PODIUM PRESENTATIONS

Tuesday 19th September 2017

Sports Trauma and Arthroscopy with free papers

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EFFECTS OF ANTERIOR CRUCIATE RECONSTRUCTION SURGERY AND NON-CONCURRENT STRENGTH AND ENDURANCE REHABILITATION ON OBJECTIVE FUNCTIONAL, MUSCULOSKELETAL AND NEUROMUSCULAR PERFORMANCE: A PROSPECTIVE, RANDOM-ALLOCATION CONTROLLED STUDY

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Background: Traditionally, ACL rehabilitation is offered in a concurrent format, whereby strength and cardio-vascular endurance are performed in the same session. However, evidence from healthy populations, suggests that strength might be compromised by cardio-vascular endurance conditioning performed in close proximity. Therefore, there is potential to improve post-operative function by sequencing exercise into a non-concurrent format.
Method: Eighty two patients (69 males, 13 females, age: 35.4 ± 8.6 yr; time from injury to surgery 9.4 ± 6.9 months [mean ± SD]) to undergo ACL reconstruction were allocated to groups (2:2:1). A group following a concurrent (CON) ACL rehabilitation programme acted as the control versus a group following a non-concurrent (NCON) ACL rehabilitation programme. An additional control group (Limited testing CON) matched the CON group. Primary outcome was HOP; secondary outcomes were (ATFD, PF, RFD, EMD and SMP) relating to knee extensors and flexors of the injured and non-injured legs. Assessment occasions were pre-surgery, and at 6, 12, 24 and 48 weeks post-surgery. These were reduced to pre-operative and at 48 weeks post-operative for the Limited testing CON group.
Results: ANOVAs with repeated-measures showed significant group, by leg, by test occasion interactions for HOP and secondary outcomes for the knee extensors. Similar responses were noted for the knee flexors of the injured and non-injured legs ($F(2.1, 248)$ GG = 4.5 to 6.6; $p < 0.01$) and confirmed increased clinical effectiveness of non-concurrent conditioning (range ~4.7% - 15.3% (10.8%) compared to control between 12 and 48 weeks). Patterns of improvements for the NCON group over time were represented by a relative effect size range of 1.92 to 2.89. Improvement patterns were not significantly different between control groups.
Conclusion: The patterning and extent of changes amongst these performance scores offer support for the efficacy of using NCON strength and endurance conditioning to enhance post-surgery rehabilitation.
Conflict of Interest: None declared

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THE CHANGING FACE OF SERIOUS BICYCLE INJURIES FROM A UK REGIONAL TRAUMA CENTRE; 2000 - 2016

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Background: Cycling has increased in popularity over the past 16 years in the UK. Whilst the number of killed or seriously injured (KSI) road users in Northern Ireland (NI) has decreased over this period, the proportion of KSI cyclists has increased steadily. We performed an epidemiological study of serious cycling-related injuries in a UK regional trauma centre and look at associated sporting, cultural and infrastructural changes.
Method: Prospectively collected data was analysed retrospectively from the NI Fractures Outcomes Research Database (FORD, NI) for all significant cycling-related injuries presenting or referred to our regional trauma centre between 2000 and 2016.

Results: Over 16 years we captured 734 patients with serious cycling injuries with a mean age of 38.7: 85.6% were male. Upper limb injuries predominate (47%), followed by lower limb (21%), spinal trauma (17%), hip fractures (10%), and pelvic trauma (5%). 10% were multiply injured patients. 29/735 fractures were open. 50/72 of femoral injuries were neck fractures. 18 patients admitted to Intensive Care Unit, with total bed days= 259.75; mean 18.6 days. Mean inpatient hospital stay was 8.7 days. Emergency surgery was carried out in 75.4% of patients. During our study the incidence of lower limb (R^2=0.037) and pelvic injuries (R^2=0.049) remained static, whilst upper limb (R^2=0.690) and spinal injuries (R^2=0.603) have increased. We show sporadic spikes in injury, following key sporting events and local infrastructural changes, however any causal link is difficult to demonstrate.
Conclusion(s): Over the study period cycling has become a popular mode of transport in NI and UK. The percentage of KSI cyclists has dramatically increased. We demonstrate the preponderance for male patients with higher energy injuries and note an increased incidence of upper limb and spinal injuries. Whilst the popularity of cycling increases, this correlates with incidence of serious cycle-related injuries.
Implications: This may have implications on healthcare provision, and regional government strategies for cycling infrastructure in NI.
Conflict of Interest: None declared

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HOW DO HIP KINETIC AND KINEMATIC CHANGES COMPARE TO THOSE AT THE KNEE DURING SOCCER MATCH PLAY CUTTING & WHAT IS THEIR INFLUENCE ON THE ACL?

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Background: In soccer match-play conditions it is unclear how hip and knee kinetic and kinematic magnitudes and timings alter and what their relationship to potential ACL injury risk is.
Methods: An eight camera gait analysis system (120Hz) synchronised with a force platform (960Hz), using 3D inverse dynamics enabled measures of absolute internal/external rotational moments (Mz), valgus/varus moments (My) and anterior/posterior joint forces (IJFx), valgus/varus joint forces (IJFy) & valgus/varus angles (Av) throughout stance phase of randomly cued straight ahead running (SA) and sidestep cutting at 30 and 60 degrees using the dominant lower limb. 14 injury-free professional footballers undertook the manoeuvres using standardised studded boots on a FIFA approved surface at standardised velocity. A univariate repeated measures ANOVA quantified differences.
Results: No significant difference in IJFx at the hip and knee were identified for all maneuvers.
My & Mz significantly increased in the hip and knee for cutting compared to SA. Peak cutting hip My were 2.5 times greater than at the knee but Mz was approximately 3 times smaller. At 13-25% of stance during cutting hip Mz peak magnitudes and peak acceleration of My coincided with knee flexion 20-30 degrees when the ACL is at risk of injury. Av hip angles occurred only in cutting and significantly increased compared to SA. At the knee there was no significant difference.
Conclusion(s): The cutting tasks showed greater hip My than at the knee. Cutting tasks required greater hip Av and was placed in a valgus position throughout stance. Early in cutting, hip Mz peaks, valgus positioning and peak acceleration of My coincide with knee flexion 20-30 degrees when the ACL is at risk of injury.
Implications: The early stance phase of cutting is associated with hip kinematic and kinetic changes that can influence ACL injury and can be targeted in injury training prevention.
Conflict of Interest: None declared

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SHOULDER INSTABILITY IN ELITE ACADEMY RUGBY PLAYERS -THE SIGNIFICANCE OF SHOULDER LAXITY

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Background: An original piece of research “Shoulder Instability in Professional Rugby Players-The Significance of Shoulder Laxity” by Cheng *et al.* (2012) suggested that excessive shoulder laxity increases the risk of shoulder instability and dislocation in the English Premiership´s Elite Professional rugby union player population. This study will determine if there is an association between shoulder laxity and players with a history of sustaining a shoulder dislocation/ instability injury injuries within the full time Under-18 Welsh Elite Academy rugby union population.
Methods:
Design: Retrospective cohort study.
Setting: Clinical sports medicine research at professional rugby clubs.
Participants: Twenty-six male full time Under-18 Welsh Elite Academy Rugby Union players (mean age 17.3 years from three of the Welsh Regional Academies were recruited from a population of forty-two full time Under-18 Welsh Elite Academy rugby union players.
Main Outcome Measures: Anterior shoulder joint laxity was measured in one uninjured shoulder of all participants using dynamic ultra sound imaging.
Results: There was no significant difference between players identified with a history of shoulder injuries (anterior: mean 1.8 ± 1.838 mm) and those identified with no history of shoulder injuries (anterior: mean 1.0 ± 0.736 mm) ($P > 0.05$).
Conclusions: The study´s findings revealed that no statistically significant association between shoulder laxity and a U-18 Elite Academy rugby player´s history of sustaining a shoulder dislocation/ instability injury could be found.
Implications: The use of ultrasound as an objective tool of joint laxity may have the potential to challenge other first line screening tools at Elite Academy rugby level in regards to injury prevention, but more vigorous research is still required.
Conflict of Interest: None declared

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INCIDENCE OF SYNDESMOTIC MAL-REDUCTION DETECTED BY POSTOPERATIVE CT SCAN

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Background: Syndesmotic injury is a common injury that could be missed or mal-reduced. Mal-reduction directly affects functional outcomes and accelerates ankle arthrosis. The disruption is a triplaner deformity with lateral diastases, anteroposterior translation, and fibular rotation and barely to be isolated. Computerised tomography (CT) scanning is superior to plain radiography in detecting postoperative syndesmotic integrity, especially in identifying rotation of the fibula. No clear consensus in literature has been reached on the best way to assess integrity. The aim of our study was to measure the incidence of syndesmotic malreduction in three planes using 6 different measures on a CT scan and to assess changes in the incidence according to the methods and definition used.
Methods: 60 patients with syndesmotic injury with bilateral CT scan postoperative were retrospectively studied and disruption in the 3 planes was assessed using 6 different measures. Changes in the incidence were assessed by changing the definition.
Results: Malreduction incidence is 36.6 to 51.6%. The most common deformity was lateral followed by anteroposterior translation then rotation. The most sensitive measure is Tibiofibular overlap followed by Anterior Tibiofibular Interval then fibular angle. Large variability in the incidence of malreduction in our study and among other studies is due to inconsistent measurement methods and definitions of malreduction.
Conclusion(s): Postoperative CT scanning is highly valuable in detecting the integrity and accuracy of reduction, which is still a challenge to achieve and diagnose. The measurement methods and the definition of mal-reduction need to be standardized, clinical reliability of different methods need to be further studied and indications for revision still need to be investigated and identified.
Conflict of Interest: None declared

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DOES STRUCTURAL INTEGRITY FOLLOWING ROTATOR CUFF REPAIR AFFECT FUNCTIONAL OUTCOME AND PAIN SCORES: A META-ANALYSIS

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Aim: To assess whether the integrity of rotator cuff repairs at follow up has an impact on functional outcomes as well as pain scores after surgery.
Methods: Systematic review and Meta-analyses performed for Level-I, II and III studies that presented functional outcome scores and radiological assessment of integrity following rotator cuff repair. Extracted data included patient demographics, functional outcome scores (Constant, UCLA, ASES, Pain VAS) as well as assessment of repair integrity on radiological investigations. Meta-analysis was performed using weighted means and a random effects model.
Results: Twelve studies were included in the final analysis. Average re-tear rate for the 800 included patients was 22% at mean follow up of 27.5 months after surgery. Patients with intact repairs had a significantly higher Constant Score (8.61 points $p< 0.00001$), UCLA score (2.96 points $p< 0.0001$) and ASES score (9.49 points $p< 0.0006$). Patients with intact repairs also reported lower pain VAS scores by 0.62 points ($p< 0.0004$).
Conclusion(s): Our results show better functional outcome and pain scores in patients with intact rotator cuffs at follow up when compared to those that have re-torn. This difference is equivalent to the published Minimal Clinically Important Difference for the ASES but not Constant scores. This review has also highlighted that shoulder strength in patients with intact cuff repairs is likely to be greater than in patients with a failed repair.
Implications: A significant amount of work has gone into developing ways of improving outcomes following rotator cuff repair. The most common complication of cuff repair is a re-tear, with rates as high as 68% being quoted in the literature. This review reports a possible clinical difference that has not been shown in previous meta-analyses and will be of benefit when dealing with re-tears in a clinical setting.
Conflict of Interest: None declared

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SHORT-TERM OUTCOMES OF ENDOPROSTHETIC REPLACEMENT FOR MASSIVE PROXIMAL HUMERAL BONE LOSS

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Background: The rate of total shoulder replacement has risen dramatically throughout the last decades, subsequent to expanding indications and its outcomes in controlling pain, improving function and life quality. Proximal humeral bone defects are considered one of the predominant difficulties in reconstructive surgeries, which may be due to primary causes such as post-tumour resection, post resection of osteomyelitis and highly comminuted fractures, or prior to failed previous shoulder replacement. Controversy still exists regarding the ideal reconstructive procedure. In our centre, we prospectively report the short-term outcomes of proximal humeral reconstruction with modular endoprosthesis.
Methods: 23 shoulder reconstructions were performed for 21 patients in same centre by single surgeon (11 males and 10 females). The indications for reconstruction showed great discrepancies: 10 patients presented with one of the aforementioned primary causes and 13 revised their primary prosthesis due to multi-failure factors. Prostheses were evaluated radiologically. The outcomes were assessed using DASH score, pain experience, limitations and patient satisfaction
Results: The mean follow-up period was 41.4 months with minimum of 6 months. Minor differences have been noticed in follow-up between preoperative and postoperative scoring because of complexity of the cases. The mean DASH score has improved from 78.5±15 to 66±19. Average pain intensity decreased from 6±3.6 to 4.3±3. Patients´ satisfaction was found to be an average of 6±2. Major postoperative complications included dislocation in 6 patients ,which has been managed by linked

prosthesis, deep infection, and recurrent notching in one patient. Traumatic Periprosthetic fracture occurred in 2 patients which, has been managed. No radiological loosening was detected throughout the follow-up.
Conclusion: Proximal humeral endoprosthetic replacement yields satisfactory results for complicated patients of massive proximal humeral deficiency. Long term follow-up is required to assess survivorship of the prosthesis.
Conflict of Interest: Zimmer-Biomet support the study zimmer-Biomet consultant

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MODIFIED LARS LIGAMENT TECHNIQUE FOR HORIZONTAL STABILITY IN ACROMIOCLAVICULAR SEPARATION

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Introduction: Acromoclavicular joint (ACJ) injuries are common, with high grade separations requiring surgical stabilisation. There are a number of described techniques for ACJ reconstruction, with insufficient evidence as to which provides greatest stability and outcome. Horizontal instability has been shown to have a closer association with pain and functional impairment than vertical instability. We evaluate whether a modification of the LARS technique provides improved vertical and horizontal stability compared with the traditionally described technique.
Methods: In this human cadaveric study we examined the vertical and horizontal stability of the ACJ in the following scenarios: 1) Intact acromioclavicular and coracoclavicular ligaments, 2) complete division of the acromioclavicular (AC) and coracoclavicular (CC) ligaments, 3) anatomical reconstruction using LARS ligament in a “U-shaped” configuration, 4) anatomical reconstruction using LARS ligament in a “figure-of-eight” configuration. Translational distance was measured under 70N of direct load. Ten cycles of loading at 20N was undertaken prior to measurements to account for creep.
Results: The native specimen showed mean vertical amplitude of 2.97mm and a mean horizontal amplitude of 4.72mm. Following complete division of the AC and CC ligaments the mean vertical amplitude was 13.35mm and the mean horizontal amplitude was 36.38mm. The mean vertical amplitude was similar between the “U-shaped “and “figure-of-eight” LARS configurations at 10.2mm and 9.8mm respectively. The “figure-of-eight” configuration showed improved horizontal stability with mean amplitude of 5.3mm compared to 18.64mm using the “U-shaped” configuration. There was no failure of any reconstruction during testing.
Conclusion: This study suggests that anatomic LARS ligament reconstruction of the CC ligaments re-establishes vertical stability of the ACJ. The modified LARS ligament technique using a figure-of-eight configuration confers greater horizontal stability than the traditional LARS technique.
Conflict of Interest: None declared

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SURGICAL MANAGEMENT OF THORACOLUMBAR KYPHOSIS IN PATIENTS WITH MUCOPOLYSACCHARIDOSIS: RESULTS OF A SYSTEMATIC REVIEW

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Background: Improvements in the medical treatment of mucopolysaccharidoses (MPS) have increased lifespan for many patients, but with no effect on thoracolumbar kyphosis. The aim of this systematic review was to determine indications and outcomes for surgical treatment of thoracolumbar kyphosis in patients with MPS.
Methods: In accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines, a PubMed database search was conducted using relevant keywords to identify articles describing MPS patients with thoracolumbar kyphosis treated surgically. Information was collected regarding demographics, indications for surgery, surgical details and outcomes.

Results: 16 articles describing 58 patients were included for review. Median age at surgery was 7 years (range 2.4 - 65 years) and median follow-up was 3.7 years (range 7 weeks - 10.3 years). The most common reported surgical indication was progression of deformity in 39/58 patients (67%). Pre-operative neurological compromise was reported in 7/58 (12%) patients (all with MPS IV or MPS VI) and resolved completely post-operatively in all paediatric patients. Three paediatric patients had died prior to final follow-up. Post-operative paraplegia was reported in 2/51 patients who were neurologically intact pre-operatively. Additional significant peri-operative medical complications were reported in 9 patients.
Conclusions: Thoracolumbar spinal surgery is most commonly performed in MPS I but in some cases may be unnecessary. Pre-operative neurological compromise associated with thoracolumbar kyphosis was reported only in MPS IV and VI, where it was associated with factors other than the degree of kyphosis. Peri-operative complications are common, may be catastrophic and relate to the complexity of the MPS condition.
Implications: Spinal surgery in MPS remains high-risk, despite modern medical therapy. The indications for thoracolumbar kyphosis surgery in other conditions of short stature cannot be extrapolated to MPS patients. Future studies must include quality of life and functional assessments.
Conflict of Interest: None declared

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AN AUDIT OF CORTICOSTEROID PRESCRIBING IN SURGICALLY MANAGED METASTATIC SPINAL CORD COMPRESSION

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Background: Metastatic spinal cord compression (MSCC) leads to irreversible neurological damage and is a medical emergency. 70% of skeletal metastasis occur within the spine and up to 5% of all cancer patients develop MSCC. Corticosteroids provide short term benefit for pain and neurological function and NICE guidelines recommend all MSCC patients receive corticosteroids (unless contraindicated). Our surgical unit treats many MSCC patients and hence we evaluated our corticosteroid prescribing for this patient group.
Methods: We reviewed clinical notes for all patients who underwent surgery for MSCC between 1st January 2015 and 31st October 2016. We audited corticosteroid prescribing against the MSCC NICE guidelines (2008, cg75). Audit standards included (1) corticosteroids 16mg prescribed as soon as MSCC is suspected (unless contraindicated) and continued until surgery. (2) corticosteroid dose reduced gradually post-surgery over 5-7 days and stopped. We also noted if a proton-pump inhibitor (PPI) was prescribed for gastric protection.
Results: During the 22-month study period, 77 patients with MSCC were operated on. Of these, 66 (86%) had corticosteroids started promptly for MSCC and continued until surgery. Nine patients were started on corticosteroids following surgery and two patients received no corticosteroids. 25 patients (32%) had their corticosteroid dose reduced in line with NICE guidelines and 52 patients (68%) did not. All patients prescribed corticosteroids were also prescribed a PPI.
Conclusion: Most patients with MSCC received corticosteroids promptly. However, two-thirds of patients had their steroid doses reduced too quickly or not quickly enough, which put patients at risk of sub-optimal treatment and numerous pharmacological side-effects.
Implications: Improved corticosteroid prescribing practices are necessary for patients with MSCC, most notably with regards to reducing regimes post-surgery. Training for corticosteroid steroid prescribing in MSCC patients will be given to doctors within our department and support from ward pharmacists will be sought to ensure guideline adherence.
Conflict of Interest: None declared

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NERVE TRANSFER SURGERY AS A SALVAGE OPTION FOR SEVERE RECALCITRANT MOTOR RADICULOPATHY

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Background: Although compressive cervical spine pathology falls within the remit of the spine surgeon, we have utilised upper limb nerve transfers as a salvage option in a subset of these patients to restore upper limb function where spine surgery has either failed, or deemed inappropriate.
Methods: In this study, we present our experience in seven patients all of whom had motor dysfunction resulting from cervical spine pathology. Four had degenerative cervical root compression, one had a cervical cord tumour, one had a unifacet dislocation, and one resulted from an iatrogenic root injury following spine surgery. Six patients had previous cervical spine decompression and one was deemed unsuitable for decompression due to longstanding loss of motor function.
Results: A selection of established nerve transfers were used, tailored to each patient´s neurological deficit. The mean follow up was 15 months. All 7 patients had evidence of reinnervation and restored function within the targeted muscles. There were no significant complications.
Conclusion(s): In cervical spine patients with longstanding upper limb paralysis without recovery following decompressive surgery, as well as those not offered surgery due to a low likelihood of recovery, targeted upper limb nerve transfers may offer an option to provide innervation to specific muscles and restore upper limb function.
Implications: Many of these patients have incomplete denervation, which allows the possibility of performing late nerve transfers beyond the typically accepted timeframe in acute nerve injury.
Conflict of Interest: None declared

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ROLE OF ROUTINE BLOOD TESTS IN PREDICTING CLINICAL OUTCOMES IN OSTEOSARCOMA PATIENTS

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Background: Osteosarcoma is the most common primary bone tumour. It is important to identify patients who will or will not respond to standard therapy at an early stage. This retrospective cohort study aimed to investigate the usefulness of simple routine blood tests (CRP, alkaline phosphatase, albumin and ESR) in predicting survival in patients with osteosarcoma.
Methods: Between January 1998 and February 2015, we treated 134 patients with a histological diagnosis of primary osteosarcoma in a single centre. Patient demographic data such as age, sex, tumour site, grade, metastases at presentation and blood tests prior to biopsy and any therapy (CRP, ESR, alkaline phosphatase and albumin levels), were obtained from the databases of our hospital. 37 patients were excluded due to lack of pre-treatment laboratory data (CRP, ESR, alkaline phosphatase or albumin). Kaplan-Meier survival was used to estimate the overall survival in patients grouped according to high/low values of serum CRP, alkaline phosphatase, albumin and ESR at presentation. A multivariate analysis was performed using a Cox proportional hazard model with the significant factors identified in the univariate analysis as variables. A value of $p < 0.05$ was considered to be significant in all statistical analyses.
Results: There were 52 males and 45 females. Univariate analysis showed that high pre-operative CRP ($p< 0.001$), raised pre-operative ESR ($p=0.007$), elevated pre-operative alkaline phosphatase levels ($p=0.032$) and older age ($p< 0.001$) were poor prognostic factors. Multivariate analysis showed that pre-operative CRP and ESR levels to be independent predictors of survival ($p=0.04$ and $p=0.049$ respectively). Kaplan Meier survival was significantly lower in patients with elevated serum CRP ($p< 0.001$), alkaline phosphatase ($p=0.025$) and ESR ($p=0.002$). Hypoalbuminemia did not correlate with overall survival.
Conclusion: We recommend doing these readily available blood tests routinely in patients with a suspected osteosarcoma as reliable prognostic indicators of poor overall survival
Conflict of Interest: None declared

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DOES THE MODIFIED GLASGOW PROGNOSTIC SCORE AID IN THE MANAGEMENT OF PATIENTS UNDERGOING SURGERY FOR A SOFT TISSUE SARCOMA?

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Background: The modified Glasgow Prognostic Score (mGPS) is a validated prognostic indicator in various carcinomas as demonstrated by several meta-analyses. The mGPS includes pre-operative CRP and albumin values and calculates a score from 0 to 2 that correlates with overall outcome. Scores of 2 are associated with poorer outcomes. To date this correlation has not been proven in the sarcoma patient group. Our aim was to assess if the mGPS is reliable as a prognostic indicator for patients witha soft tissue sarcoma (STS).
Methods: All patients with a STS diagnosis presenting during years 2010-2014 were included. We identified patients using our prospectively collected MSK oncology database. We performed a retrospective case note review examining demographics, preoperative blood results and outcomes (no recurrence, local recurrence, metastatic disease and death).
Results: 94 patients were included. 56% were female and 53% were over 50 years. 91% of tumours were high grade (Trojani 2/3) and 73% were >5cm. 45 patients had an mGPS score of 0, 16 had a mGPS of 1 and 33 had an mGPS of 2. On univariate analysis, an mGPS of 0 or 2 was statically significant with regards to outcome (p=0.012 and p=0.005 respectively). We also found a statistically significant association between CRP, albumin, tumour size and neutrophil count to the development of metastasis and death.
Conclusions: We have demonstrated that pre-treatment mGPS is an important factor in predicting oncological outcome. A score of 0 relates to an improved prognosis whilst a score of 2 relates to an increased risk of developing metastases and death. mGPS as a prognostic indicator was not affected by either the tumour size or grade.
Implications: We believe that a pre-operative mGPS should be calculated to help predict oncological outcome and in turn influence management. Further work is being undertaken with a larger cohort.
Conflict of Interest: None declared

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FUNCTIONAL OUTCOME AND GAIT AFTER LISFRANC FRACTURE DISLOCATIONS TREATED WITH PERCUTANEOUS REDUCTION AND INTERNAL FIXATION

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Background: Lisfranc fracture dislocation is considered a life-changing injury leading to severe impairment. The purpose of this study was to analyse functional disability and gait after percutaneous reduction and internal fixation.
Methods: 22 patients with a minimum follow up of 12 months were included. We achieved percutaneous reduction in all and internal fixation was performed using cannulated screws. Functional outcome was evaluated using Foot and Ankle Disability Index (FADI). Gait analysis and GRF were measured.
Results: The average age at operation was 48 years (17-67). Mean follow up was 20 months (13-60). The average Foot & Ankle Disability Index at final follow up was 79 (66-94). No loss of reduction or metal breakage was noted. Walking on uneven surface, going down stairs, heavy work and pain first thing in the morning were the components of Index that showed poor recovery while most of the patients had no/mild difficulty with rest of the activities. None of the patients had pain at rest. Only three out of 22 patients found it extremely hard to return to recreational activities. Gait analysis showed a prolonged push-off (p=0.22) and significantly prolonged pre-swing phase (p=0.015) of the affected limb. Although ground reaction forces were higher in stance phase on normal side these differences did not reach significance. These findings can be explained by the stiffness of the midfoot that these patients have after the Lisfranc injury. During the pre-swing phase the plantar flexor muscles begin to contract concentrically to support the push-off of the limb towards the toe-off phase. As the midfoot is stiff this phase consumes more time for the affected limb.
Conclusion(s): Satisfactory close reduction can be achieved in all types of Lisfranc fracture-dislocations. Percutaneous fixation of medial column with screws provides a stable construct. However the gait remains altered with prolonged pre-swing phase.
Conflict of Interest: None declared

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DO TRAUMA COURSES CHANGE PRACTICE? A QUALITATIVE REVIEW OF COURSES IN EAST, CENTRAL AND SOUTHERN AFRICA

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Background: Trauma courses have been shown to improve clinical knowledge and patient outcomes. However, little is known about the individual drivers of change in practice amongst course participants in their home clinic environment.
Methods: Front-line healthcare workers participated in a two-day Primary Trauma Care (PTC) course. Immediately after the course participants completed an evaluation survey on intended change in the management of trauma patients. Six months after the course participants completed a survey on actual changes that had occurred.
Results: A total of 451 participants were sampled, with 321 responding at 6 months, from 40 courses across East, Central and Southern Africa. The most commonly reported intended change was the adoption of an ABCDE/systematic approach (53%). Six months after the course 92.7% of respondents reported that they had made changes in their management with adoption of an ABCDE/systematic approach (50.0%) remaining most common. 77% of participants reported an improvement in departmental trauma management, 26% reported an increase in staffing, 29% an increase in equipment and 68% of participants had gone on to train other healthcare workers on PTC.
Conclusion(s): The findings suggest that PTC courses not only improve individual management of trauma patients but also have unanticipated beneficial effects for participants' host institutions with regards to staffing, equipment and training.
Implications: This study demonstrates the strengths of evaluating the qualitative benefits of trauma management courses. Further research is needed to determine how course participants' self-reported improvements in trauma management translate into improvements in actual clinical care and patient outcomes and to further investigate the drivers behind behavioural change within the clinical setting.
Conflict of Interest: None declared

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INTRAMEDULLARY FIBULAR FIXATION IS A VERSATILE TOOL IN THE OPERATIVE MANAGEMENT OF FRACTURES OF THE DISTAL TIBIA AND FIBULA

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Background: Intramedullary fixation of the fibula has been proposed as a minimally invasive alternative to traditional plate fixation in ankle fractures. After four years of using fibular intramedullary devices in our unit we aimed to review our practice.
Methods: We retrospectively searched our electronic operation database for operations in which fibular nails were used, from their first use in our unit in 2012 through to the end of 2016. Electronic operative and clinic notes were reviewed. We gathered basic demographic information and classified fractures according to the AO/OTA system, and studied pre- and post-operative radiographs for evidence of malunion.
Results: Eighteen cases were identified. Median age at surgery was 66 (Range 23 to 83 years). Seven patients smoked, one was diabetic. Fibular nails were used in six in AO type 44 and twelve in AO type 42 and 43 fractures. Five were open. Fibular nails were used alongside tibial IM nails, tibial bridging plates, percutaneous tibial fixation and a tibial circular frame and were chosen because of concerns about poor soft tissues or wounds over the lateral side. Twelve cases had syndesmotic fixation. Median follow-up was five months (range 0-48 months). One nail was removed to compress a tibial fracture. All fractures united with no progressive malunion. One prominent distal locking screw was removed and one superficial wound infection required oral antibiotics.
Conclusion: We have expanded the use of this device beyond the technique described originally. We have used it across a range of fractures about the distal tibia and fibula in patients with poor soft tissues or where there is high risk of post-operative infection. Fibular nails should not replace traditional plate fixation for simple fractures in healthy patients, but are a useful tool to have available in challenging situations.
Conflict of Interest: None declared

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THE CLINICAL AND COST EFFECTIVENESS OF A VIRTUAL FRACTURE CLINIC SERVICE: AN INTERRUPTED TIME SERIES ANALYSIS AND BEFORE-AND-AFTER COMPARISON

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Background: To assess the clinical and cost-effectiveness of a virtual fracture clinic (VFC) model, and supplement the literature regarding this service as recommended by NICE and the BOA.
Methods: This was a retrospective study including all patients (17,116) referred to fracture clinics in a London District General Hospital from May 2013-April 2016, using hospital-level data. We used interrupted time series analysis with segmented regression, and direct before-and-after comparison, to study the impact of the VFC introduced in December 2014 on six clinical parameters and local CCG spend.
Results: There were statistically significant reductions in numbers of new patients seen face-to-face per month (140.4±9.61 versus 461.6±14.14,*P*< 0.0001), days to first fracture clinic review (5.22±0.16 versus 10.27±0.35,*P*< 0.0001), monthly face-to-face discharges at first appointment (33.47±3.66 versus 129.2±7.36,*P*< 0.0001) and monthly face-to-face DNA numbers (14.82±1.48 versus 60.47±2.68,< 0.0001). In addition there was a statistically significant increase in the number of patients assessed within 72-hours (46.4%[3873 of 8345] versus 5.1%[447 of 8771],*P*< 0.0001). There was a non-significant increase in consultation time of 1 minute 9 seconds (14 minutes 53 seconds ±106 seconds versus 13 minutes 44 seconds ±128 seconds, *P*=0.0735). VFC saved the local CCG £67,385.67 in the first year and is set to save £129,885.67 annually thereafter.
Conclusions: We have demonstrated the VFC appears both clinically and cost effective, with improvements across several key performance parameters and substantial financial savings for CCGs. To our knowledge this is the largest study addressing the clinical practice implications of VFCs in England, using robust methodology to adjust for pre-existing trends.
Implications: This study demonstrates the clinical and financial impact to patients, NHS commissioners and health providers from one of Englands longest running virtual fracture clinics.
Conflict of Interest: None declared

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MANAGEMENT OF UNDISPLACED INTRACAPSULAR FRACTURES IN A REGIONAL TRAUMA CENTRE

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Background: Optimal management for undisplaced intracapsular hip fractures remains controversial. The aim was to review the demographics and outcomes of patients with this injury treated in the Royal Victoria Hospital (regional trauma centre) over 15 years.
Method: A Fracture Outcomes Research Database search was performed to identify all undisplaced intracapsular hip fractures treated with arthroplasty, fixation techniques or non-operatively from January 2000 to December 2015. All had pre-operative demographic data collected (ASA or comorbidity score, age, mini-mental score, functional score, mobility, and residence) and telephone follow-up to 1 year (mortality, functional score, mobility, and residence).
Results: FORD identified 948 patients, including 491 (52%) with hemiarthroplasty, 380 (40%) with fixation (359 sliding hip screws (SHS) and 21 other internal fixation (IF) techniques), 15 with total hip replacement (THR), and 62 with initial non-operative treatment. Patients with fixation (SHS or IF) had better preoperative demographics and outcomes than hemiarthroplasty patients in all measures apart from prior home residence. For all operated groups, the most common American Society of Anaesthesiologists (ASA) grade was ASA 3, representing 316 hemiarthroplasty, 173 SHS, 14 IF, and 7 THR patients. Among ASA 3 patients, fixation patients had significantly better 30-day mortality (2.7% versus 7.9%, p< 0.05) but were significantly younger than the hemiarthroplasty group (78 versus 81 years, p< 0.001). Both groups were otherwise demographically and functionally similar at admission and 1 year (including 1-year mortality).
Conclusions: Hemiarthroplasty patients had worse outcomes but represented a more frail cohort. Among ASA 3 patients, fixation patients were younger than hemiarthroplasty patients and had better 30-day survival but were otherwise similar preoperatively and at 1 year.

Implications: While hemiarthroplasty has been used for more frail patients, 30-day survival for fixation techniques are more favourable. Early perioperative risks should be considered in individual patients´ decision-making.
Conflict of Interest: None declared

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FROM CT SCAN OF A BONE TO 3D PRINTED MODEL, USING OPEN SOURCE SOFTWARE AND A DESKTOP PRINTER. LESSONS LEARNED AND BENEFITS GAINED

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Although commercial 3D models of bones can be made from a patient's CT scan, this is usually reserved for special cases such as neurosurgical skull reconstruction or planning correction of malunion of bones in the extremity. I present a low cost and speedy alternative utilising open source (free) software and a desktop printer. The software used to convert from DICOM to STL is 3DSlicer which works on Windows, Mac or Linux. The virtual model can be tidied with Meshmixer. The software used for “slicing” to produce GCODE for a printer, is Cura which also works on Windows, Mac or Linux. The 3D prints are made using an Ultimaker desktop printer. By using free software and an affordable printer, 3D prints can be made within a few hours of the patient having a CT scan. Models can be made prior to the fixation of acute fractures. I have used bone models, created using the above technique, in more than 50 cases to plan surgery and to inform patients. I would like to share the methodology so that others can use 3D models in their practice.
Conflict of Interest: The printer was loaned to me free of charge by Ultimaker. I have no financial interest in the company and have no other financial gain from making 3D models

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STANDARDISED VIRTUAL FRACTURE CLINIC MANAGEMENT OF RADIOGRAPHICALLY STABLE WEBER B ANKLE FRACTURES IS SAFE, COST EFFECTIVE AND REPRODUCIBLE

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Background: Mesenchymal Stromal/Stem Cells (MSCs) have been identified in the synovium. MSC proliferation is associated with synovial hyperplasia in response to Joint Surface Injury (JSI). Uncontrolled Yap activity, a key Hippo pathway transcription co-factor, causes tissue overgrowth due to modulation of stem cell proliferation. We hypothesised that YAP plays a role in the proliferation of MSCs and resulting synovial hyperplasia following JSI.
Methods: A time point analysis of Yap expression was performed using the JSI model in C57Bl/6 mice, using immunostaining and qPCR. Synovial samples from patients with normal, osteoarthritic and trauma joints were similarly analysed. Gdf5-Cre;Yap1fl/fl;Tom mice were created to determine the effect YAP1 knockout in Gdf5 lineage cells on synovial hyperplasia after JSI.
Results: In mice, on immunochemistry, Yap was highly expressed in injured knee joint synovium compared to uninjured controls. Yap mRNA levels at 2 ($p< 0.05$) and 8 days ($p< 0.001$) after injury were increased on qRT-PCR. Conditional Yap1 knockout in Gdf5 progeny cells prevented hyperplasia of the synovial lining (SL) after JSI. Cellularity was significantly decreased in the SL but not in the sub-lining of injured Yap1 knockout- compared to control mice. The percentage of cells in the synovium that were Tom+ increased in response to JSI in control and haplo-insufficient mice but not in YAP1 knockout mice ($p< 0.05$). In patients, Yap expression was upregulated in the activated synovium, including a subset of CD55 positive fibroblast-like synoviocytes in the SL. Cells staining positive for the proliferation marker Ki67 typically expressed nuclear (active) YAP.
Conclusion(s): YAP is highly expressed in the activated synovium. Knockout of Yap in Gdf5 progeny prevents SL hyperplasia following cartilage injury in vivo.
Implications: Modulation of YAP in MSCs in the synovium after JSI provides a system to study whether synovial hyperplasia after trauma is beneficial or not in re-establishing joint homeostasis and osteoarthritis prevention.
Conflict of Interest: None declared

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THE AIM TRIAL EXTENDED FOLLOW-UP: THREE YEAR OUTCOMES FROM AN EQUIVALENCE RANDOMIZED CLINICAL TRIAL COMPARING CLOSE CONTACT CASTING WITH INTERNAL FIXATION SURGERY FOR UNSTABLE MALLEOLAR FRACTURES IN PATIENTS OVER 60 YEARS

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Background: The AIM Trial previously reported (2016). Close contact casting (CCC), was compared with open reduction and internal fixation (ORIF) surgery for the initial treatment of unstable malleolar fracture in older adults. There was equivalence in ankle function at the primary endpoint of 6 months. No differences were found in secondary outcomes (below). A greater number of participants with malunion with CCC led to concerns about the potential for later deterioration. The follow-up was extended to investigate whether equivalence would be maintained.
Methods: The AIM Trial was a pragmatic, multi-centre, equivalence, randomized controlled trial incorporating health economic evaluation. 620 participants aged 60 and over (mean: 71) were randomized to ORIF or CCC. Recruitment was from 24 hospitals. The primary outcome was the Olerud and Molander Ankle Score (OMAS). Secondary outcomes were: quality of life, pain, health-related quality of life (EQ-5D-3L), and additional operating room procedures, specialist consultations or investigations for the index ankle. Longer term follow-up was via postal questionnaire at between 3 and 9 years post intervention. Consistent with the published protocol, the primary analysis was per protocol with an equivalence margin pre-set at +/- 6 OMAS points. Current Controlled Trials ISRCTN04180738
Results: Follow-up assessments at 3 to 9 years (mean: 3.4) post intervention were completed by 450/620 (73%) participants, 90/620 did not respond or did not agree to participate, 35/620 had died, and 45/620 had withdrawn. OMAS mean difference between CCC and ORIF was -1.20 [95%CI: -5.50, 3.00]. Analyses of secondary outcomes, moderators and mediators of outcomes will be presented.
Conclusion: Equivalence in functional outcome between CCC and ORIF is maintained at 3 years.
Implications: These results provide compelling additional evidence to support surgeons and patients when offering or selecting CCC as an alternative to surgery in older adults with an unstable ankle fracture.
Conflict of Interest: None declared

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PATELLA FRACTURES: SALVAGE KNEE REPLACEMENT IS RARELY REQUIRED

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Background: Patella fractures represent approximately 1% of skeletal fractures. The actual incidence of post-traumatic osteoarthritis (PTOA) leading to total knee arthroplasty (TKA) is not well documented and yet frequently discussed in medico-legal circles. Our aim was to document in a defined patient population the incidence of PTOA requiring TKA in patients who have previously undergone surgery for patella fracture. The secondary outcome was the need for further surgery.
Methods: We looked at all operatively managed patella fractures between 1995 and 2010. After exclusion of patella tendon avulsions and inferior pole fractures that were managed with tendon repair, a total of 264 fractures were included. The mean duration of follow up was 12.5 years (range 5-20 years).
Results: 52% of patients (135 fractures) required further surgery. 93% (n=126, 48% of total) required removal of metalwork for prominence or infection, the other 7% (n=9, 3% of total) were due to stiffness and failed fixation. Twenty-three (9%) fractures developed symptomatic osteoarthritis but only three patients required TKA (1%). The baseline characteristics for symptomatic PTOA did not differ to those that sustained patella fractures, including mechanism, fracture pattern, infection and age. Patellectomy was performed in one case for chronic knee pain at 16 months post injury and TKAs were at 22, 54 and 122 months post injury.
Conclusion(s): The overall incidence of TKA after patella fractures was minimal at 1%.

Implications: Although intraarticular fractures are commonly associated with degenerative radiographic changes, patients can be informed that the incidence of symptomatic OA severe enough to require TKA is very low.
Conflict of Interest: None declared

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OUTCOME OF SURGICAL FIXATION OF COMPLEX RIBS FRACTURES IN A UK MAJOR TRAUMA CENTRE

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Background: We aimed this study to assess the outcome of patients undergoing internal fixation of complex rib fractures in our unit.
Methods: We analysed prospectively collected data of consecutive patients undergoing operative fixation of rib fractures from March 2014 to May 2016. The primary outcome was hospital length of stay (LOS). The secondary outcomes included duration of ITU LOS, mechanical ventilation, respiratory complication and mortality.
Results: Overall, 102 patients (66 male, 36 female, mean age 61 years) underwent rib fracture fixation during the study period. Road traffic accidents were the source of trauma in 39 (38.2%), fall from height in 38 (37.3%) and fall downstairs in 21 (27.5%) patients. The average number of rib fractures per patient were 7 (3-19 ribs) and 55 (54%) patients had radiologically reported flail chest. Thirty-eight (37.3%) patients had isolated chest trauma but 64 (62.3%) had additional major injuries. 53 (52%) of patients required ITU admission with mean ITU stay of 4.7 days (1-34) days. The mean length of hospital stay was 13.6 days (3-51 days). Patients with additional major injuries stayed significantly longer than those with isolated chest trauma (10 days versus 15.8 days, p=0.01). Sixty-Five (63.7%) patients underwent surgery within 48 hours of the injury while 37 (36.3%) patients had their surgery after 48 hours. Both groups had comparable additional injuries (p=0.50). Surgery within 48hrs resulted in significantly fewer ITU admissions (p=0.06), shorter ITU stay (p=0.01), fewer chest infections (p=0.001), reduced duration of mechanical ventilation (p=0.03) and tracheostomies (p=0.02) and; shorter hospital length of stay (11.5 days versus 17.3 days, p=0.008). One patient (1.5%) died in first group and two (5.4%) in the second group (p=0.29).
Conclusion(s): Surgical stabilisation of multiple rib fractures is safe and improves outcomes. Early fixation is recommended to reduce the need for ITU stay and mechanical ventilation.
Implications: Improving outcome of major trauma patients.
Conflict of Interest: None declared

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SUBCUTICULAR SUTURES REDUCE THE RISK OF WOUND COMPLICATION AFTER HIP FRACTURE SURGERY - A PROSPECTIVE RANDOMISED TRIAL

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Background: There are approximately 75,000 neck of femur fractures treated in the NHS every year. The reported incidence of wound complications is around 10%. A recent meta -nalysis published in BMJ showed increased risk of wound complication when clips are used for closure of skin, but none of the studies were large enough to reach statistical significance.
Methods: We screened and recruited all eligible patients admitted with acute hip fracture undergoing hemi-arthoplasty or dynamic hip screw. A statistical analysis showed that at least 250 patients would be needed in each limb of the study. All patients over 18 with full mental capacity and undergoing either a DHS or Hemiarthroplasty were invited to take part, and rest were excluded. The randomisation was done by using the sealed envelopes. The wound review was done on post op days 2, 5, 7, 10 & 14. A new scoring method was developed to be able to assess the wound problems.
Results: We recruited 560 patients of which 32 were excluded leaving 528 patients in the study. There were 259 Hemiarthroplasty and 269 DHS. Average age of was 79.6 yrs, including 364 females

and 164 males. There were 278 patients in the clips group and 250 patients in the suture group. The average score was 1.20 for group B and 0.71 group B.
Conclusion(s): The final review of our study showed that the wounds closed with sub cut monocryl had fewer wound healing issues (average score 0.71) compared to the wounds closed with clips (average score 1.20). The sub group analysis revealed bruising and oozing were the possible responsible factors in the wounds closed with clips.
Implications: The results showed fewer wound complications associated with use of sutures in our cohort, and reduced morbidity.
Conflict of Interest: None declared

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IMPACT OF A VIRTUAL FRACTURE CLINIC MODEL AT A MAJOR TRAUMA CENTRE

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Background: In traditional fracture clinic (TFC) models, all new fracture patients were reviewed in person after being seen in the Emergency Department (ED). We aimed to determine the impact of a virtual fracture clinic (VFC) model, involving consultant review of x-rays and ED documentation prior to any clinic appointment.
Methods: All patients reviewed at the VFC from April to July 2016 were compared to a retrospective cohort of patients seen through the TFC over the same period in 2015. Demographics, injury sustained, management and number of clinic appointments until final review were noted. In parallel, patients from each cohort completed a telephone questionnaire, rating information given and overall care on a Likert scale (0-10).
Results: 1,128 patients were reviewed in the VFC study period and 1,200 patients in the TFC period. Patient demographics and injuries sustained were similar between the two cohorts, with distal radial fractures, soft tissue knee injuries and ankle fractures being the most common. Following case review at the VFC, 418(37%) did not require an outpatient clinic appointment. The median number of outpatient clinic appointments reduced from 3(range 1-10) for the TFC to 2(range 0-5) for the VFC, p=0.02. From the patient questionnaires, no difference in satisfaction with overall care was seen between VFC and TFC models (median Likert scores: 7/10 versus 7/10, p=0.88). The majority of patients reviewed through the VFC were satisfied with information given about their injury (88%) and treatment for their (86%).
Conclusion(s): We have successfully introduced a VFC model at a major trauma centre. This has reduced the number of new fracture clinic appointments by one third without compromising overall quality of patient care.
Implications: The VFC model can improve the efficiency of the fracture clinic pathway and relieve the pressure on outpatient fracture clinic services.
Conflict of Interest: None declared

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THE EFFECT OF A DEDICATED HIP FRACTURE UNIT ON THE OUTCOME OF PROXIMAL FEMORAL FRACTURES

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Background: Proximal femoral fractures are common, and are associated with significant morbidity and mortality. In the context of a Major Trauma Centre, optimising care for patients with fragility associated proximal femoral fractures is complicated by the conflicting needs of major trauma patients. The objective of this study was to evaluate the effect of a dedicated hip fracture unit (HFU) on clinical outcomes.
Methods: This was a retrospective and prospective study carried out at Brighton and Sussex University Hospitals Trust. Patients presenting from 1 April 2011 to 16 September 2016 were included. Data pertaining to length of stay, mortality, re-operation and best practice tariff attainment were collected. Formerly, proximal femoral fractures and major trauma were treated at the same hospital.

From 1st July 2015, a dedicated HFU was commenced at a separate hospital site. Fragility related proximal femoral fractures are now transferred directly by ambulance to the HFU, and are managed on a specific orthopaedic ward. Importantly, a daily consultant-led theatre list is now dedicated to operating on these patients.
Results: In total, 2,178 patients pre-HFU and 673 patients with HFU were included. Baseline demographics and admission rates did not significantly differ between these two groups. Among patients treated in the HFU, a 49% relative reduction in 30-day mortality rate was observed, while the mean time to surgical intervention from initial admission was reduced by 6.50%. Mean length of stay was 19.1 days (95% CI; 18.4-19.7) pre-HFU, and 17.5 days (95% CI; 16.6-18.5) with HFU.
Conclusion(s): In the context of a Level 1 Major Trauma Centre, a dedicated HFU can optimise length of stay and improve 30-day mortality outcomes.
Implications: The management of fragility-related proximal femoral fractures in dedicated units enhances the efficiency of care provision, improving patient outcomes and reducing the cost associated with hospital stay.
Conflict of Interest: None declared

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A NOVEL USE OF QR CODE STICKERS AFTER ORTHOPAEDIC CAST APPLICATION

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Background: We have developed a novel solution to ensure that information and contact details are always available to a patient while they are in a cast. An information sticker is applied to the outside of the cast containing both phone numbers and a Quick Response (QR) code. When scanned with a smartphone, the code loads the plaster team´s webpage from the hospital website. This contains information and videos about cast care, complications and enhancing recovery.
Methods: A sticker was designed and applied to all synthetic casts fitted within our fracture clinic plaster room. On cast removal, patients were asked to complete a questionnaire concerning the sticker. 101 patients were surveyed between November 2015 and February 2016. The questionnaire contained 10 binary questions.
Results: On return to clinic, 97% had the sticker still on their cast. 9% of all patients used the contact details on the cast to seek advice. Of the 56% of patients with a smartphone, 33% scanned the QR code and 95% deemed the information useful. Overall 85% of patients were reassured by the presence of the contact information and QR code on their cast.
Conclusion(s): The use of the QR code for advice about cast problems has not been previously documented. Our results show that this is an effective tool in the proactive management of cast problems and patient reassurance. Following the success of this trial we are now rolling out the sticker across our trust, for application to all casts and backslabs applied in minor injury units, theatres and the A&E departments.
Implications: The authors are developing a portfolio of QR-accessible orthopaedically relevant information for patients. We recognise the potential for the QR code to have multiple uses across different medical specialities for improving patient access to relevant information about their care.
Conflict of Interest: None declared

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ONLINE SPINAL REFERRAL PATHWAY IN A REGIONAL REFERRAL CENTRE

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Background: As a regional spinal referral centre, a quality referral pathway is required to achieve excellent patient outcomes. An audit of the existing referral pathway in February 2016, which was by phone-call to an on-call core trainee grade doctor, demonstrated poor recording of referral information on a proforma intended for general trauma. Documentation of discussion with senior spinal colleagues and communication of management plan to the referring team was frequently absent.
Methods: An electronic referral pathway was introduced in August 2016. This was accessible via Trust intranet sites. Four separate referral forms (trauma, tumour, infection and

radiculopathy/myelopathy) were designed. Telephone referrals were still accepted by senior trainees for unstable fractures, developing neurology or Cauda-equina syndrome. New electronic referrals were reviewed and actioned once daily by Consultant Spinal Surgeons.
Results: A second audit of spinal referrals in September 2016 was performed. Over 220 referrals were audited with an average of 32 per week. Completeness of referral information increased from 56% to 100%. Documentation of communicated management plan increased from 61% to 100%. This plan was communicated to the referrer within 24 hours of referral in 88% of cases. A significant number of referrals required no spinal service intervention or follow-up, including referrals from units with a General Trauma & Orthopaedic (T&O) service on-site.
Conclusion(s): The introduction of an electronic referral pathway has demonstrated a significant improvement in the quality of referral information and documentation of management plan. Patient care has been improved by streamlining the referral process and ensuring timely response by a senior trainee or consultant.
Implications: The electronic referral pathway has now been accepted by the Unit. The improvement in quality of referral information and ease in documenting advice means that this electronic pathway may be applicable to other T&O referral pathways in the Unit, for example, complex pelvic fractures
Conflict of Interest: None declared

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THE FIRST REVIEW OF NHS LITIGATION AUTHORITY RISK SUMMARIES FOR CLAIMS AGAINST ORTHOPAEDIC SURGERY TO IMPROVE PATIENT CARE - A COLLABORATION BETWEEN GETTING IT RIGHT FIRST TIME (GIRFT), NHS IMPROVEMENT AND THE NHS LITIGATION AUTHORITY

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Background: The NHSLA reported a rise in the cost of the indemnity of the NHS to £56.4billion. In 2015-16 Orthopaedics was second only to Obstetrics and Gynaecology when reviewing claim volume and fourth in cost of claims per specialty. The aim of this work is to determine the lessons that can be learned from medical negligence claims to improve patient care.
Methods: The NHSLA database was reviewed for risk summaries of claims attributed to orthopaedic surgery from April 2010 until April 2013. This was the only period when the NHSLA panel law firms produced this resource. They evaluated risk management factors and suggested improvements in patient care. From these reports reviewers identified recommendation for improvement in practice and categorised these into common themes using an agreed protocol.
Results: Risk summaries of 631 claims against Trauma and Orthopaedic Surgery were reviewed. The estimated total cost of claims against the specialty during this period was £582 million. The most common themes for quality improvement were the ´education/training´ 154 (24%), ´guidelines/policy/protocol´ 106 (17%) ´communication/consent/information´ 71 (11%), ´documentation´ 38 (6%) and ´imaging´ 32 (5%).
Conclusion(s): This study has provided the most detailed review in the literature of claims against this specialty, utilising both legal and medical experts. Litigation in Trauma and Orthopaedic Surgery is without doubt a serious concern for the sustainability of the specialty. Claims data must be used as a resource to improve patient care as well as reduce claim volume and cost.
Implications: The data in this study will be used by ´GIRFT´ to create specific clinical guidance for the profession. Claim volume will be reduced by targeting communication, consent, education during and after training, improving policy both locally and nationally, increasing the number of cases performed in training and implementing regional networks to ensure the right patient is seen at the right time by the right clinician.
Conflict of Interest: None declared

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VIRTUAL TOTAL HIP ARTHROPLASTY FOLLOW UP: 5 YEAR DATA IN A BUSY DISTRICT GENERAL HOSPITAL

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Background: To prevent the need for complex revision and patient suffering, follow up of elective hip arthroplasty patients has been advocated to identify those with asymptomatic loosening. Regular clinic follow up does however have both time and financial implications.
Methods: In our institution, patients are followed up face to face at 6 weeks post op and are then placed into virtual follow up; at 1 year they are sent a patient questionnaire assessing patient outcomes based on a modified Harris hip score. The same questionnaire together is sent along with an x-ray request at 5 years and every 5 years thereafter. The results are then assessed by an arthroplasty surgeon, who recalls any patient with cause for concern. Using a locally compiled database we identified all patients reviewed between 2011- 2015 in this ´virtual follow up´ environment. We reviewed the numbers recalled, rationale behind the recall prior to established and the outcome of their review.
Results: In the 5-year period of follow up reviewed a total of 3,140 primary total hip replacement patients were eligible to be reviewed in the virtual programme. 2,415 (77%) completed the process. As a result of the consultant review, 10 were recalled to clinic; 8 for x-ray changes and one for a poor patient satisfaction score. 5 (50%) patients recalled went on to undergo revision surgery.
As a result of the virtual review process 2405 clinic appointments were avoided, equivalent to over 400 hours in clinic.
Conclusions and implications: A virtual arthroplasty clinic not only significantly reduces the number of patients attending regular follow up clinics but also helps to identify patients who develop asymptomatic x-ray changes. The evidence suggests this is safe practice, with no revisions taking place within our hospital as a result of missed complications on virtual review.
Conflict of Interest: None declared

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MANIPULATIONS IN TRAUMA THEATRE: A WASTED RESOURCE?

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Background: Emergency Departments (EDs) are under increasing pressure to achieve waiting-time targets. Locally this has resulted in the near abandonment of the management of injuries that require manipulation under anaesthesia (MUAs) in the ED. We hypothesised that MUAs being performed in our trauma theatre is an increasing burden and poor use of resources.
Methods: We performed a retrospective audit of operating lists in our institution from 2013-2016. We collected clinical details for each procedure and were provided with cost estimates by our finance department. We used the NICE guidelines on management of non-complex fractures and the Royal College of Emergency Medicine guidelines on safe sedation in the ED as our audit standards.
Results: We collected data on 1,372 cases performed over a three-month representative period (August to October) in consecutive years from 2013 to 2016. MUAs were 13% of the total trauma theatre workload, with an annual increase in case volume noted. Average theatre time was 57 minutes. Delay to procedure ranged from 8 to 120 hours. Cost of overnight stay or day case admission, combined with theatre utilisation, was approximately £1,000 per patient. Conversely, the cost of an MUA performed in the ED was estimated at £150. Given that we currently undertake around 15 manipulations in theatre a month, this costs the trust an additional £153,000 a year.
Conclusion(s): This audit identifies that MUAs of uncomplicated orthopaedic injuries undertaken in trauma theatre results in significant financial costs. If all uncomplicated MUAs were performed in the ED, it would reduce hospital admissions and delay to treatment, and improve theatre use.
Implications: We have highlighted these findings to our institution and are working on solutions to enable increased provision of safe sedation in the ED.
Conflict of Interest: None declared

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ADOPTING AND SUSTAINING A VIRTUAL FRACTURE CLINIC MODEL: A QUALITY IMPROVEMENT APPROACH

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Background: Virtual Fracture Clinics (VFCs) can supplement or replace face-to-face consultations in the management of selected musculoskeletal injuries. This approach has recently been reported as a safe, cost-effective and efficient care model in city and tertiary hospital settings. The aims of this project were: 1) to develop a Quality Improvement framework for widespread adoption of VFCs; 2) to apply this framework in three Plan-Do-Study-Act cycles; and 3) to measure changes in consultation type before and after the introduction of a VFC model.
Methodology: We undertook Process Mapping, Driver Diagrams and Stakeholder Analysis to create a bespoke VFC pathway to assist local implementation. We employed Whole Systems Measures applicable to VFCs to consider how robust and specific data collection can progress this care model. We recorded the numbers of face-to-face and ´virtual´ patient ineractions before, during and after this study.
Results: Several Quality Improvement approaches enabled integration of a VFC pathway alongside a pre-existing fracture requiring few additional resources and no more clinicians. Three Plan-Do-Study-Act cycles led to a change in practice over a 21-month period. Our target for uptake of new patients seen in VFCs within 6 months of starting was set at 50%. It increased from 0% to 56.1% soon after introduction, and plateaued at an average of 56.4% in the six months before the end of the study period.
Conclusions: The reported Quality Improvement framework enabled the contextualisation, measurement and analysis of a novel VFC model. Planning, frequent monitoring, and gathering feedback from a multidisciplinary team of varying seniority were the important factors in the transition. VFCs increased overall outpatient orthopaedic capacity. Further studies could validate this framework in the other district and tertiary hospitals.
Conflict of Interest: None declared

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REDUCING THE NUMBER OF ARTHROSCOPIES IN KNEE OSTEOARTHRITIS: THE PERSONALISED KNEE IMPROVEMENT PROGRAMME (P-KIP)

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Background: The number of knee arthroscopies performed for knee osteoarthritis has remained high, despite “do not use” guidance from NICE. We previously identified and published barriers to implementation of this guidance and subsequently developed a targeted and evidence-based conservative intervention. This intervention, aimed at secondary care, offers an alternative to arthroscopy that is acceptable to both orthopaedic surgeons and patients. Here, we report the early findings from the Personalised Knee Improvement Programme (P-KIP).
Methods: P-KIP encourages self-management through a group education session followed by individually tailored one-to-one dietician and physiotherapy sessions. Virtual clinic follow up is conducted three to six months after completion of the programme. A pilot service began in August 2014, and now accepts 250 referrals a year. The number of arthroscopies saved, measured by referrers reporting alternative treatment options and from hospital level coding data, is the primary outcome measure. Interupted time series analysis using autoregressive integrated moving average (ARIMA) modelling of coding data was conducted. Additionally, the Oxford Knee Score (OKS) and EuroQol 5-Dimensions (EQ-5D) are collected at baseline and at virtual clinic follow up.
Results: Time series analysis demonstrates that the programme is saving 15 arthrocopies a month (95% confidence interval 9-21; p< 0.001). This eqates to over 150 arthroscopies a year, and is consistent with referrer data from the programme.
Fifty-four out of a possible 68 patients (79%) have complete follow up, with a median improvement in OKS from 26 to 34, and in EQ-5D from 76 to 84.

Conclusion(s): Preliminary results suggest that P-KIP reduces the number of arthroscopies performed, and provides a high-quality service that improves patients´ knee outcomes and general health.
Implications: As arthroscopies are expensive, P-KIP has the potential to deliver large efficiency savings and relieve pressure on operative lists while providing outstanding patient care.
Conflict of Interest: None declared

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DEVELOPING A NEW NHS HYBRID BASIC ADMIN/CLINICAL UN-REGISTERED BAND 3 ROLE OF 'DOCTORS' ASSISTANT' AND EVALUATION OF THE ROLE'S IMPACT ON THE WORKLOAD OF DOCTORS IN TRAINING

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Background: Foundation doctors and surgeons in training spend 50% of their time on administrative work, limiting educational opportunities, and morale is low.
Methods: We report a six-month pilot of appointing/developing six Doctors´ Assistants (3 on each site) at pay Band 3 (£18,000pa mid-point + on-costs) from our existing HealthCare Assistants.
We designed a recruitment package, two-week induction, communications strategy, rota, uniform, weekly tutorial programme and task list including phlebotomy, cannulation, coding, documentation and discharge summarising. The evaluation had quantitative and qualitative elements. Happiness scores, diary cards and task-time studies for both doctors and Doctors´ Assistants were undertaken. Transcripts of interviews and group staff discussions were analysed by theme.
Results: The doctors´ happiness scores, workload and likelihood of attending teaching/operating sessions consistently improved when a Doctors´ Assistant was present. Audited discharge summaries drafted by Doctors´ Assistants scored highly for accuracy providing reassurance for stakeholders. Qualitative assessment demonstrated pride, support and feedback. Three themes identified as vital for success were: retaining line management within Education, communication with stakeholders and defining role boundaries (e.g. no contact with medication to reduce perceived risk). For elective wards, 8am-6pm Monday-Sunday worked better than long shifts. Multiple junior doctors´ contract ´exception reports´ detailed excessive work and helped develop the business case for continued Trust funding.
Conclusions: A new NHS role of ´Doctors´ Assistant´ can be highly effective, cost-effective and safe. With HealthCare Assistant experience, a two-week induction is sufficient. Non-Registered staff can reduce the burden on doctors seven days/week. Communication to all stakeholders must reinforce that these are support staff (neither Practitioners nor Registered) and that all work is delegated and checked.
Implications: The ´Doctors´ Assistants´ role should be introduced immediately at all NHS sites where doctors in training are overloaded. Our two-week induction and weekly tutorial could form the basis for an Apprenticeship.
Conflict of Interest: The Senior author is a Council member of the Royal College of Surgeons, but this work has been performed in their NHS workplace. Health Education England provided £80,000 to the Trust to cover Doctors' Assistants salaries for the six-month pilot. There are no other conflicts of interest

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DAY ZERO MOBILISATION OF HIP AND KNEE REPLACEMENTS

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Background: In the current climate of limited resources and increasing demands on bed utilization there is a focus to initiate same day mobilization and rehabilitation following joint replacement surgery.
Objectives: Twilight physiotherapy shifts were introduced to encourage patients to stand upright and mobilise on the day of surgery.

Methods: Prospective data was collected to include all patients undergoing primary and revision hip and knee replacements. Patients were made aware of the new protocol prior to undergoing surgery and encouraged to stand and walk weight bearing on the evening of the procedure. Data was collected to include time taken to achieve physiotherapy goals, length of stay, patient satisfaction, readmission rates and complications.
Results: From 2014 to September 2015, prior to implementation of changes, only 15.2% (of total of 799) patients were mobilized on day of surgery. In those patients, physiotherapy goals were achieved in 2.92 days (compared to 3.66 days if mobilized on day one). Patients were discharged on 3.43 days as compared to average patient discharge achieved after 4.07 days.
Following implementation of the twilight shift, 48.35 % (of total of 515) patients were mobilized on day of surgery. Patients who stood on day of surgery achieved their physiotherapy goals on average 0.62 days sooner than those mobilised the following day and were discharged from the ward 0.68 days earlier. We did not notice any increase in complications or increase in readmission rates.
Limitations included type of anaesthetic, medical reasons, patients returning late to the ward, lack of physio staffing to fully cover the shift, complexity of procedure and operating list overrunning. Delay in discharge was due to oozing wound, medical reasons, awaiting investigations and issues surrounding transport.
Conclusions: Day zero mobilization is safe, improves patient satisfaction and facilitates early discharge.
Conflict of Interest: None declared

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A NEW CLINICAL PATHWAY FOR ACUTE TRAUMATIC SHOULDER DISLOCATIONS IN A TEACHING HOSPITAL SETTING: QUALITY IMPROVEMENT PROJECT

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Background: Evidence indicates that acute first time shoulder dislocations have been historically managed quite variably. Furthermore, specific groups have improved outcomes with acute investigation and treatment. We evaluate the quality improvement effect of the introduction of our newly introduced pathway for first-time traumatic shoulder dislocations.
Methods: We have developed a pathway for first time traumatic shoulder dislocations in our hospital, adopting principles from the BESS (British Elbow and Shoulder Society) guidelines. Patients are either seen in a general or upper limb specific fracture clinic or a physiotherapist-led soft tissue shoulder clinic run in parallel with the upper limb clinic. From here our guidelines signpost a specific pattern of referral and investigation. Two changes were MR Arthrograms for all patients age 18-25 and ultrasound for all patients over 40 years eligible for surgery. All patients attending our hospital with a first-time shoulder dislocation in 2013 were retrospectively reviewed for investigations performed and referral patterns. Intervention in the form of surgeon education and clinic posters was performed in September 2016 and the same data was prospectively collected until January 2017.
Results: Before intervention, 6% of patients age 18-25 with first time traumatic shoulder dislocation underwent an MR arthrogram; after intervention 100% of eligible patients were correctly referred. Before intervention 39% of eligible patients over 40 years old were referred for ultrasound; 62% of these scans were positive for rotator cuff tears. After intervention 92% of eligible patients underwent ultrasound; 83% of these demonstrated cuff tears and these patients have had informed consultations regarding early surgery.
Conclusion(s): Our intervention has changed referral patterns in a manner which evidence suggests will improve long term outcomes. Long term follow up of this cohort will confirm this.
Implications: This intervention has improved the quality of our service and is applicable in other centres.
Conflict of Interest: None declared

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THE FINANCIAL IMPLICATIONS OF BLOOD GROUP & SAVE ANALYSIS ON PATIENTS REQUIRING PRIMARY TOTAL KNEE ARTHROPLASTY SURGERY

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Background: Current practice for an elective primary total knee arthroplasty (TKA) procedures includes blood-group analysis at pre-operative anaesthetic assessment clinic (POAC) and duplicated on the day of surgery. Little is known about the financial consequences of blood-group analysis for orthopaedic TKA procedures. Our study aims to evaluate the current transfusion rate and financial implication of routine pre-operative "Group-and-Save" (G&S) analysis in patients undergoing primary elective TKA surgery.
Methods: Retrospective review of the NJR database of 350 patients undergoing primary TKA surgery at our unit, between January 2014 and January 2016. We collected qualitative data from knee arthroplasty surgeons in the south-west to evaluate consensus on current G&S practice.
Results: 350 TKA procedures were performed, 332 notes were obtainable. 0.9% (n=3) patients required a post-operative blood transfusion. The mean decline in haemoglobin following surgery was 17g/L at day 1 post-op. 97.9% (n=325) of patients had duplicate G&S samples taken at POAC and on day of surgery. 75% of south-west knee arthroplasty surgeons (n=23) consider G&S is unnecessary for TKA surgery and would accept discontinuing routine G&S testing. The national cost of a G&S is estimated to be £30. In 2015, we performed 289 TKA procedures. We estimate the total cost of G&S testing for TKA surgery is £17,340/year.
Conclusion(s): The incidence of post-operative blood transfusion for TKA is extremely low. A 0.9% transfusion rate was not related to a TKA-related surgical complication, nor were transfusions clinically indicated according to National Blood Transfusion Guidelines (2013). Despite this, we routinely perform duplicate G&S investigations for all patients requiring TKA as per pre-assessment guidelines.
Implications: This practice has a significant cost to our trust, and imposes added demand on pathology services. In view of these findings we aim to propose a change to pre-operative G&S protocols for TKA surgery with associated cost and resource saving benefits.
Conflict of Interest: None declared

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THE DETERIORATION IN HEALTH RELATED QUALITY OF LIFE (HRQOL) OF PATIENTS ON THE WAITING LIST FOR TOTAL KNEE REPLACEMENT

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Background: Total Knee Replacement (TKR) is successful treatment for patients suffering from end-stage osteoarthritis (OA) of the knee. The demand for this procedure has increased over the years, with subsequence lengthening of the waiting time before surgery. Studies have shown that patients' quality of life and function will decline when they have been waiting for over 6 months. However, conditions of patients who are required to wait longer remains unknown. The aim of this study was to evaluate patients´ deterioration over an extended period of time on the waiting list.
Methods: A prospective study of 142 patients on the waiting list for total knee replacement were recruited. There were 49 male and 93 female with a mean age of 67 years. The outcome measurement includes the Western Ontario and McMaster university Osteoarthritis Index (WOMAC), Self-Rated Questionnaire SF36 and Health Related Quality of Life (HRQoL) 15D questionnaire. Assessments were conducted bi-yearly for a minimal of 2 years.
Results: Patients with severe OA of the knee already show significant poor HRQoL and functional ability at the time listed for TKR. While on the waiting list, there were significant progressive increases in pain and disability ($p=0.035$) within the first year. Patients with 2 or more years of waiting showed the worse HRQoL ($p< 0.05$). However, significant difference was not achieved when comparing their first and second year characteristics.
Implications: Increasing disability and worsening HRQoL were shown in patients waiting for TKR. This appears to peak at one year and then plateau. Patient learn to adapt to their functional decline if they have to wait for more than 1 year. The optimal waiting time should be within 1 year to limit patient functional deterioration.
Conflict of Interest: None declared

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FIVE- TO TWELVE-YEAR OUTCOMES OF MEDIAL OPENING-WEDGE HIGH TIBIAL OSTEOTOMY WITH RIGID PLATE FIXATION IN COMBINATION WITH AN ARTIFICIAL BONE SUBSTITUTE

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Background: High tibial osteotomy (HTO) is an established procedure to optimize lower limb alignment for medial compartmental osteoarthritis of the knee and spontaneous osteonecrosis of the knee. This study evaluated the effect of rigid plate fixation with an artificial bone substitute on mid- to long-term outcomes after opening-wedge high tibial osteotomy (HTO).
Methods: Medial opening-wedge HTO using TomoFix and wedged bone substitutes was performed in 88 patients (mean age 67.3 years, range 40-82 years; 108 knees). Minimum follow-up was 5 years, with a mean follow-up duration of 6.6 years (5 to 12 years). Clinical outcomes were evaluated using the Knee Society knee score and function score. Lower limb alignment was assessed by measuring femoro-tibial angle in an anteroposterior weight-bearing radiograph of the knee.
Results: The knee score and function score improved from 50.9±10.5 and 56.9±14.4 before surgery to 88.1±11.8 and 88.4±15.6 at final follow-up, respectively ($p < 0.05$ vs preop.). To evaluate the effect of age, clinical outcomes were compared between two different age groups (≥70 years vs. < 70 years). There were no significant differences between two age groups. The mean standing femoro-tibial angle was corrected significantly from 181.7±2.8° preoperatively to 169.6±2.5° at 1 year post-operative follow-up ($p < 0.05$ vs preop.) and 169.3±3.2° at final follow-up (N.S. vs. 1 year).
Conclusion(s): Opening-wedge HTO using a rigid plate fixation system in combination with an artificial bone substitute is a reliable procedure that provides excellent results.
Implications: Although treatment with osteotomy seems challenging for older patients, the present results strongly suggest that there is no significant effect of age on mid- to long-term clinical and radiographic outcomes.
Conflict of Interest: None declared

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MULTIVARIATE AND UNIVARIATE ANALYSIS OF WEEKEND PHENOMENON FOR ELECTIVE LOWER LIMB JOINT REPLACEMENTS

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Background: The ´weekend phenomenon´ has been a topic discussed nationwide surrounding the perceived difference in medical care provided at the weekend compared to a weekday. It remains incompletely understood and highly variable between different clinical settings. Our aim was to use statistical modelling to measure relevant potential factors concerning this phenomenon in the context of primary elective hip and knee arthroplasty.
Methods: By cross-matching the electronic medical records(EMR) against National Joint Registry submission data, we reviewed a cohort of 352 elective orthopaedic patients who underwent a primary hip or knee arthroplasty between 1 April 2016 and 23 August 2016 at a university teaching hospital. Elective operating was carried out six days a week Monday to Saturday. We used post-operative length of stay (LOS) as our primary outcome measure, with patient variables (Age, ASA classification) and time-relative variables (time to post-operative physiotherapy and radiography) also extracted from EMR. Anonymised data was processed using logistic regression statistical modelling.
Results: There was no statistical correlation between post-operative LOS and day of the week. Significant positive correlations were observed between post - operative LOS and age ($p < 0.0001$), time to first post-operative physiotherapy($p = 0.0014$), time to first post-operative radiography ($P=0.0011$) and ASA classification($P = 0.0073$).
Conclusions: Increasing age, ASA classification, time to post-operative radiography and time to first post-operative physiotherapy are significantly associated with increasing post-operative LOS. There is no evidence of a ´weekend phenomenon´ in our institution.
Implications: At a local level, we did not identify any factors that would require additional weekend medical staffing. These results support the local and national move to increase multidisciplinary peri operative care and an effective enhanced recovery program that includes a focus on reducing time to

first post-operative physiotherapy and radiography. The statistical techniques can be used to critically look at the factors influencing service delivery throughout healthcare
Conflict of Interest: None declared

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HIP AND KNEE ARTHROPLASTY IN A TEMPORARY OPERATING THEATRE IS ASSOCIATED WITH A SIGNIFICANT INCREASE IN DEEP PERIPROSTHETIC INFECTION

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Background: Infection following total hip or knee arthroplasty is a serious complication. We noted an increase in post-operative infection in cases carried out in a temporary operating theatre. We therefore compared those cases performed in standard and temporary operating theatres and examined the deep periprosthetic infection rates.
Patients and methods: A total of 1,233 primary hip and knee arthroplasties were performed between August 2012 and June 2013. 44% were performed in temporary theatres. The two groups were matched for age, sex, BMI and ASA grade.
Results: The deep infection rate for standard operating theatres was 0/684 (0%); for temporary theatres, it was 8/539 (1.5%); p=0.001.
Conclusion: Use of a temporary operating theatre for primary hip and knee arthroplasty was associated with an unacceptable increase in deep infection. We do not advocate the use of these theatres for primary joint arthroplasty.
Conflict of Interest: The senior author receives royalties from De Puy We receive institutional and educational support from De Puy, Zimmer Biomet and B Braun

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REVIEW OF PRELIMINARY INVESTIGATIONS IN SUSPECTED SEPTIC ARTHRITIS OF THE NATIVE KNEE; *ACCURACY OF MICROSCOPY AND GRAM-STAIN*

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Background: Gram stain analysis of joint fluid is often perceived as the ´gold standard´ primary investigation for suspected septic arthritis, with management decisions based upon the initial inflammatory markers and fluid microscopy. We assessed initial biochemical investigations and synovial fluid microscopy results in comparison with definitive culture results to assess the accuracy of these initial investigations.
Methods: We retrospectively reviewed knee joint aspirate samples processed within our microbiology laboratory between 1 October 2015 and 1October 2016. A total of 115 patients were identified. 57 were excluded due to being in non-native knees, samples taken at the time of revision or aspirate samples performed by GPs/rheumatologists for other differentials. The 58 patients with native knee aspirate results were reviewed alongside their biochemical investigations and notes reviewed for outcome and management.
Results: Of the 58 samples, 9 patients had organism-positive cultures. 3 Staphylococcal, 3 Streptococcal, 1 Pseudomonas, 1 Haemophilus, 1 Pseudomonas and 1 viral.
On Microscopy only, 1 patient had positive gram stain suggestive of the presence of an organism. Gram staining has a poor sensitivity of 11.1%.WCC has a poor specificity of 26.53%, sensitivity 88.89% for septic arthritis. CRP had a similarly poor specificity of 8.16% but an improved sensitivity of 100%, its negative predictive value was 100%. The presence of +++ polymorphs on gram stain was the most useful of preliminary investigations with a sensitivity of 77.78% and specificity of 82.98%, its positive predictive value is 46.67%.
Conclusion(s): Initial investigations for suspected septic arthritis are inaccurate and should not be used in isolation for the diagnosis/exclusion of septic arthritis. Management decisions should be based on clinical assessment with the interpretation of these investigations to be a secondary aid.
Implications: A review process of definitive cultures after aspiration should be implemented to ensure that patients are not discharged incorrectly based on preliminary investigations.
Conflict of Interest: None declared

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UPPER TIBIAL MRI VASCULAR MARKS AND THEIR RELATIONSHIP TO EARLY OSTEOARTHRITIS

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Background: A previously undescribed pattern of vascular marks in water bright upper tibial MRI scans was observed. We studied the frequency, depth and distribution of the marks.
Plain x-rays of the same knees were available and we compared the incidence of early osteoarthritis of the knee with the vascular marks.
Method: 56 patients with an antero-posterior knee x-ray and an axial PD_SPAIR MRI scan of the same knee within one year were included. Their mean age was 53.1 years (range 22- 85) with 27 males and 29 females. The medial and lateral compartments of each knee were scored for OA using the Kellgren-Lawrence classification. Marks on the MRI scans were counted by layer and quadrant position. The axial scans were 3mm thick slices spaced 0.3mm apart. The upper slice was taken as the first slice showing only cancellous bone.
Results: The marks which appeared to be venous vascular channels were present in the first subchondral slice, peaked between 6-10 mm and were absent by 16 mm depth. There were more marks antero-laterally than postero-medially. There was no association with age, left or right knee, BMI or weight. There was a strong inverse correlation between the number of marks and the grade of osteoarthritis both medially ($p=0.001$) and laterally ($p=0.002$).
Conclusions: We demonstrate previously undescribed subchondral venous vascular channels on MRI scans of the upper tibia. They are present in healthy bone but are lost in early osteoarthritis. The clear inverse correlation of the marks with the presence and severity of knee osteoarthritis offers a new means of early diagnosis of knee OA and an insight into the pathology of early OA.
Implications: We suggest that the onset of osteoarthritis is closely associated with vascular changes. This is important in understanding the aetiology of osteoarthritis.
Conflict of Interest: None declared

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VITAMIN D DEFICIENCY PREVALENCE ACROSS DIFFERENT ETHNO-RACIAL GROUPS: CROSS SECTIONAL ANALYSIS FROM A LARGE INNER CITY COHORT

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Background: Vitamin D deficiency is a common condition worldwide with an estimated 1 billion people affected. There is evidence to suggest hypovitaminosis varies by ethnicity but this relationship is not well understood and has not been investigated in the United Kingdom (UK) population.
Methods: A cross-sectional analysis of routinely collected data in a central London hospital was undertaken. Ethnic groups were subdivided into three categories: Caucasian, African/Afro-Caribbean and Asian. Inpatient and outpatient encounters routinely capture body height and weight. The set of observations closest to the vitamin D sample date were used. Descriptive analyses were undertaken, with parametric and non-parametric tests used to determine if variation across groups was statistically significant. A multivariable logistic regression including age, gender and average body mass index (BMI), was used to assess the relationship between vitamin D deficiency and ethnicity.
Results: Data were available for 5,830 patients. The mean age of the cohort was 52 years (SD 18) and 67% were female. The index BMI was 29.8 (SD 7.6). The Caucasian population had a higher mean age (ANOVA $p< 0.001$). The African descent population had the highest mean BMI (29.9, Kruskal-Wallis $p< 0.001$). Vitamin D deficiency was detected in 29.0% of patients and a raised BMI was a significant independent predictor. In the multivariate regression model, the African descent and Asian populations were more likely to be vitamin D deficient (odds ratios 1.37 (95% CI 1.21 to 1.55) and 1.38 (95% CI 1.15 to 1.67) respectively).
Conclusion(s): Ethnicity and body weight are statistically significant independent predictors of vitamin D. Our data quantify the risk of vitamin D deficiency in the UK African and Asian populations with an almost 40% increased risk of deficiency compared to the Caucasian population.
Implications: These findings may lead to focused testing and vitamin D supplementation in specific patient groups.
Conflict of Interest: None declared

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40-YEAR-EXPERIENCE IN ENDOPROSTHETIC RECONSTRUCTION OF PROXIMAL HUMERUS: COMPARISON OF DIFFERENT OPTIONS OF PROSTHESES AND SOFT TISSUE RECONSTRUCTIONS

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Background: There are various options for reconstruction of the prosthetic shoulder joint and adjacent soft tissue after proximal humeral tumor resection.
Methods: We have studied 288 patients from 1976 to 2016 to assess the clinical and functional outcomes of different types of shoulder prosthetic and soft tissue reconstructions. 151 were males and the mean follow-up was 93 months (0-443). Indications for surgery were mainly chemo-sensitive primary malignant bone tumours such as Osteosarcoma and Ewing´s sarcoma (43%). Different types of endoprostheses were used including custom made endoprostheses with hemiarthroplasty (66%), modular prostheses with hemiarthroplasty (19%), constrained shoulder replacements of Bailey-walker type (4%), total shoulder replacements with reverse geometry (1%) and extendable prostheses (10%). Soft-tissue reconstruction around the shoulder was performed using Mersilene mesh (34%) or Trevira tube (18%) or simple closure (25%). Mean length of resection was 145 mm (50-280).
Results: The survival of implants at 10 years, 20 years and 30 years was 85%, 76% and 73% respectively. Overall survival of patients was 57% at 10 years, 55% at 20 years, and 51% at 30 years. Local recurrence occurred in 7% of patients. Complications occurred in 112 patients (39%) which the most common being asymptomatic subluxation (19%). Complications requiring surgical treatment occurred in 45 patients (16%) such as infection (4%), symptomatic subluxation (4%), aseptic loosening (2%), etc. The survival of implants was similar in the different implant and soft tissue reconstruction types. Adjuvant radiotherapy was identified as the adverse factor affecting implant survival. Complications were significantly more common after using an extendable prosthesis. Average MSTS functional score was 77%. Extendable prostheses had significantly poorer functional outcomes compared to the other type of implants.
Conclusion(s): Endoprosthetic replacement of the proximal humerus is a reliable surgical reconstruction with excellent long term clinical and functional outcomes.
Conflict of Interest: None declared

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EXCISION, IRRADIATION, REIMPLANTATION VERSUS ALLOGRAFT RECONSTRUCTION FOLLOWING SEGMENTAL RESECTION OF TIBIAL SARCOMAS: IS A VASCULARISED FIBULA GRAFT NECESSARY?

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Background: Biological reconstruction in limb salvage surgery following segmental resection of the tibia is challenging.
Methods: Retrospective search of a prospective oncology database. All patients with a biological reconstruction following resection of a tibial sarcoma included. Reconstructions were categorised into two groups:
Group 1 - excision, extracorporeal irradiation and reimplantation;
Group 2 - allograft reconstruction. Within each group, an intramedullary fibula autograft was used to augment the reconstruction.
Results: Indications; osteosarcoma (11), Ewing´s sarcoma (5), adamantinoma (6), giant cell tumour of bone (1) and pleomorphic sarcoma (1).
Group 1 included 17 patients, 11 male and six female. Median age was 13 years (range 7-25 years). Nine patients received a vascularised fibula graft, eight a non-vascularised fibula graft. Limb salvage rate was 94% (16). Median time to union with a vascularised fibula was 132 weeks (range 58 - 320) and with a non-vascularised fibula was 94 weeks (range 22 - 216). Complication rates in the patients receiving vascularised fibula grafts included fracture 44% (4), infection 67% (6), revision surgery 89% (8). Complication rates in the patients receiving non-vascularised fibula grafts included fracture 13% (1), infection 38% (3), revision surgery 25% (2).
Group 2 included seven patients, two males and five females. Median age at diagnosis was 18 years (range 7 -43). All patients received an intramedullary, non-vascularised fibula graft. Limb salvage rate

was 100% (7). Median time to union was 23 weeks (range 14 - 26). Complications included fracture 33% (3), infection 11% (1) and revision surgery 22% (2).
Conclusion(s): The use of a tibial allograft, augmented with a non-vascularised, intramedullary fibula autograft, provides a reliable method of limb salvage surgery in patients following segmental tibial resection. Significant complications are seen with excision, irradiation and reimplantation.
Implications: Strategies for limb salvage surgery in tibial sarcoma treatment should be directed by this evidence.
Conflict of Interest: None declared

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IMPACT OF PRE-OPERATIVE MSSA SCREENING AND DECOLONISATION ON PERIPROSTHETIC JOINT INFECTION FOLLOWING PRIMARY HIP AND KNEE ARTHROPLASTY

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Aims: Periprosthetic joint infection (PJI) is a catastrophic and potentially life threatening complication following arthroplasty. In addition to the resulting impact on patient morbidity and mortality, PJI is associated with significant financial cost, which is estimated at up to £20,000 per case. Methicillin sensitive staphylococcus aureus (MSSA) is a common isolate in PJI and colonisation is a proven risk factor for subsequent infection. The aims of this study were:
1) to determine if MSSA screening and decolonisation reduced MSSA PJI rate in primary joint replacement; and
2) to determine the cost effectiveness of such a screening program at a high-volume arthroplasty centre.
Methods: Pre-operative screening for MSSA was introduced in 2010. All MSSA-positive patients attending for elective arthroplasty were prescribed Octenisan body wash and nasal bactroban for use 5 days prior to procedure.
Results: Between 2007 and 2014, 12,911 primary arthroplasties (5,918 hip, 6,993 knee) were performed. There were 3,593 in the pre-screening group and 9,318 in the post-screening group. The pre-screening PJI MSSA rate was 0.75%, and this reduced to 0.25% post screening introduction ($p< 0.0001$). Overall PJI rate fell from 1.92% to 1.41% ($p = 0.03$). The screening program was most effective in MSSA prevention in total hip arthroplasty (3% to 1.5%, $p=0.002$) and significant in multivariate analysis. The cost of the screening program was £88,953 with 47 predicted PJI prevented. The estimated cost of treating these prevented infections is >£1.1 million.
Conclusion: The MSSA screening and eradication protocol used in our institution was effective at reducing rates of MSSA PJI and associated with a lower overall rate of PJI. Furthermore, it resulted in significant savings when compared to the cost of prevented infections.
Conflict of Interest: None declared

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SYNOVASURE: HOW USEFUL IS IT IN THE DIAGNOSIS OF PERIPROSTHETIC JOINT INFECTION? EXPERIENCE IN A HIGH VOLUME ARTHROPLASTY UNIT

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Background: Identification of periprosthetic joint infection (PJI) is challenging, with no single test providing a definitive diagnosis. Alpha defensin is part of the innate immune response with levels elevated in PJI. The Synovasure test measures alpha defensin in synovial fluid, with claimed high sensitivity and specificity. We carried out independent assessment of Synovasure in our unit.
Methods: Patients with painful hip and knee replacements underwent routine workup for PJI, including clinical and radiological assessment, routine inflammatory blood tests and synovial fluid culture. A Synovasure test was undertaken concurrently.
Results: 26 cases were analysed, 24 from knees and 2 from hips. 19 Synovasure results were negative, 6 were positive and 1 was excluded due to an insufficient specimen volume. 3 patients had

diabetes and 3 had rheumatoid arthritis. 17 Synovasure results were thought to reflect infection status as predicted by routine workup, 4 were equivocal whilst 4 opposed the impression generated by the other tests. In these latter 4 cases, 3 were of exclusionary value, where infection was suspected but Synovasure was negative. The final case was a rheumatoid arthritis patient on steroids with culture negative PJI and a positive Synovasure test. She underwent 2-stage revision and remains well at 2 years. No patient with a negative Synovasure test developed subsequent infection. Patients with positive Synovasure test underwent 2 stage or 2-in-1 stage revisions. Synovasure´s overall sensitivity was 100% and specificity was 95% in our series.
Conclusions: The current cost of Synovasure may not be justified for all suspected PJI cases because meticulous traditional workup is often sufficient. It may be very useful, however, when traditional investigations are contradicting, contamination is suspected or in rheumatoid/autoimmune disease - where inflammatory markers are chronically elevated.
Implications: Synovasure provides additional information with high specificity and sensitivity in the management of PJI in selected cases.
Conflict of Interest: None declared

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OUTCOMES OF THE DISTAL RADIUS INTERNAL FIXATION TRIAL (DRIFT)

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Aim: To compare the clinical and cost effectiveness of Kirschner wire fixation with locking plate fixation for patients with a dorsally displaced fracture of the distal radius.
Methods: A multicentre two arm parallel group assessor blind randomised controlled trial. DASH and PRWE captured functional outcome, EQ5D captured information on general health. Cost to the participant and to the NHS was documented in a bespoke resource usage questionnaires. The patient´s experience and perspective was captured in a Patient Diary completed over the first 3 months post-surgery and by a Patient Satisfaction survey focusing on surgery, follow-up care, speed of recovery, pain and overall movement.
Results: 170 patients with low impact distal radius fractures were recruited to DRIFT over a period of 3 years. There was no significant difference in the functional outcome as measured by the DASH of the two treatment groups at 3,6,12 months post-surgery. The diaries of 92 individuals (49 ´plate´: 43 ´K-wires) were reviewed. In general the participants in the ´plate´ treatment group (76%) were more satisfied than those in the ´K-wires´ treatment group (61%). Heath economic analysis shows volar plate fixation is less costly in the treatment costs to the health service, the patients and society.
Conclusion(s): Our research supports the use of plates at least from a patient´s perspective. Patients treated with a plate show a better (though not significant) functional outcome at 3 mth, 6 mth and 12 mths post-surgery. This does tie in with the greater amount of patients treated with a volar locking plate being ´very satisfied´ with the overall movement of their wrist at the end of 3 mths post-surgery. It is also possible that there is not such a cost saving as reported in DRAFFT for the use of K-wires, as we found them in our study to prove more expensive.
Conflict of Interest: None declared

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LONG-TERM RESULTS OF FDP TO FDP HEMI-TENDON TRANSFER FOR DELAYED REPAIR OF THE FLEXOR DIGITORUM PROFUNDUS IN ZONES I AND II OF THE FINGER : A MULTICENTER RETROSPECTIVE STUDY

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Background: Many reconstructive techniques of FDP are described to treat irreparable ruptures. These, however, require multiple surgical interventions and have insufficient bio-mechanical characteristics. In order to manage these challenges, a hemi-tendon transfer of a hetero digital-FDP in

the Zones I and II of the long fingers has been developed. The objective of the study was to evaluate the results of this intervention.
Methods: In this multicenter retrospective study, reconstruction of FDP to FDP hemi-tendon transfer has been analyzed for 23 patients. Inclusion criteria were: rupture of deep flexor tendon of a long finger not amenable to primary repair, or rupture after tenolysis; the presence of an intact deep-flexor hetero-digital tendon; patients aged less than 80 years; a minimum setback of a year; and an initial wound in area I and II of the flexor. Outcomes assessed were: the average total active flexion and the average total active mobility preoperatively and at final review. Secondary outcomes were: the pulpo-palmar distance or postoperative evaluation by Strickland.
Results: 23 patients were included and analyzed by photography and videos. The average age was 32.1 years (4-67) and the remainders were 4.8 years (1-9). In 20 cases, primo-surgery was performed and the most often operated fingers were II and V (10 and 9 cases respectively). The average total active flexion was 130, 5 (+/- 43.5) preoperatively and 231, 3 (+/- 56.4) ($p < 0.05$) at final review. The average total active mobility was 127, 8 (+/- 42) preoperatively and 229, 3 (56 +/- 4) ($p < 0.05$) at final review.
Conclusion(s): The results of this series confirm that FDP to FDP hemi-transfer tendon is a reliable, effective and reproducible technique.
Implications: This technique allows restoration of satisfactory function in a one-stage surgery and is a favorable alternative to previous techniques described.
Conflict of Interest: None declared

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ANATOMICAL DIFFERENCE BETWEEN HAND AND FOOT WEB-SPACE RECONSTRUCTION

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Background: This study focused on the difference between web-space anatomy of hand and foot and provided the recommended guideline of flap design for hand and foot web-space reconstruction.
Methods: Web-spaces between 2,3,4,5 fingers and toes were measured and correlated with surgical landmarks.All parameters were compared and analyzed by paired t-test including web-length ratio(defined as distance between tip of web to metacarpophalangeal (MCP) joint compared with proximal phalangeal distance), web-width ratio (defined as width of web-space in maximum abduction compared with distance between tip of adjacent MCP joint), slope angle(defined as angle between the most dorsal part of web-space and the horizontal line,measured in sagital plane) and abduction angle of web-space (defined as the angle between the mid-axis of adjacent fingers or toes in the maximum abduction position, measured in the coronal plane).
Results: A total of 108 web-spaces in hand and foot were measured in 18 adults. Average hand and foot web-length ratios were 0.52 and 0.77,respectively. Average web-width ratios between hand and foot were 0.80 and 0.71. Mean slope angles of hand and foot web-space were 25.33 and 31.50 degrees respectively. And average abduction angles in hand and foot web-space were 19.26 degrees and 5.95 degrees. All these parameters mentioned above were compared between hand and foot by paired t-test and found statistically different ($p< 0.05$).
Conclusion(s): Because the foot had thicker web-space, more slope angle and less abduction angle compared with hand web-space, our conclusion was that hand web-space needs short and wide flap design. On the contrary, foot web-space needs a longer and narrower flap for web reconstruction.
Implications: We recommend that flap for hand web-space reconstruction should be at least 50% of the length of the finger proximal phalange and 80% width of distance between tip of adjacent MCP joints. For foot web-space reconstruction, we recommend 80% length of proximal phalange and 50% width of distance between tip of adjacent MCP joints.
Conflict of Interest: None declared

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DETERMINANTS OF OUTCOME OF BONE GRAFT SURGERY FOR SCAPHOID FRACTURE NONUNION: A MULTICENTRE RETROSPECTIVE STUDY

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Background: Scaphoid fracture nonunion occurs in young adults and treatment with bone graft surgery is not always successful. Factors affecting the outcome of bone graft surgery are disputed.
Methods: Data was collected retrospectively on 785 nonunions treated with bone grafting at 18 centres throughout the UK. All had undergone surgery before October 2014. Data collection from the medical records was during October-December 2016. Cases were excluded if: age at surgery less than 16 years; surgery performed less than 3 months of the acute fracture; less than 3 months radiological follow-up. Outcome of treatment was categorized as “united”, “uncertain if united” and “not united”.
Results: Smoking significantly influenced the union rate of 94 proximal pole (non-smokers = 71%, smokers = 44%, p< 0.05) but not 228 waist (non-smokers = 73%, smokers = 66%, p>0.5) nonunions. Type of bone graft did not affect the union rate of the 282 waist nonunions (iliac crest = 69%; non-vascular distal radius = 75% and vascularised distal radius = 70%: P=0.35), but did influence the union rate of the 98 proximal pole nonunions (iliac crest = 58%; non-vascular distal radius = 58% and vascularised distal radius = 82%: P=0.004).
Time interval between fracture and non-union surgery did not affect the union rate of 121 proximal pole nonunions (3-6 months = 56%; 6-12 months = 76%; 1-2 years = 69%; 2+years = 54%: P=0.5), but did influence the union rate of 303 nonunions of the waist (3-6 months = 80%; 6-12 months = 82%; 1-2 years = 65%; 2+years = 55%: P=0.02).
Conclusion(s): Smoking status and type of bone graft influence the outcome of bone graft surgery for proximal nonunions. The time interval between the acute fracture and the nonunion surgery influences the outcome of surgery for nonunions of the waist.
Conflict of Interest: None declared

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FUNCTIONAL OUTCOME OF FIXATION OF COMPLEX INTRA-ARTICULAR DISTAL RADIUS FRACTURES WITH A VARIABLE ANGLE DISTAL RADIUS VOLAR RIM PLATE

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Background: Marginal intra-articular distal radius fractures pose a significant challenge to the treating surgeon. We aim to evaluate the outcome of these complex fractures using a volar approach and the DePuy Synthes variable angle 2.4mm distal radius rim plate. This plate is pre-contoured to the volar rim for placement distal to the watershed line allowing purchase of the rim fragment of the lunate facet. Its low profile and smooth edges are designed to minimise flexor tendon irritation.
Methods: We reported a consecutive series of far distal AO-23B3 and AO-23C3 fractures treated using this plate in a tertiary hand centre between November 2011 and May 2014. Range of motion, grip strength and complications were assessed at the final clinic review at six months. Disabilities of the arm, shoulder and hand (DASH) score and patient evaluation measure (PEM) were assessed at twelve months.
Results: Twenty-seven patients were treated with this implant. This plate was used in isolation in seventeen cases and in combination in ten patients. DASH and PEM scores twelve months after surgery were 17.6 and 27% respectively. Visual analogue scores were satisfactory. Post-operative ROM was variable and grip strength was of 71% of the uninjured side. There was no tendon rupture but tendon irritation was noted in two patients. The plate was removed in four patients. Loss of reduction occurred in one case and neurological complications in two cases.
Conclusion(s): This implant is specifically designed for the management of far distal complex intra-articular fractures of the distal radius. It provided accurate reduction and stable fixation, outcomes were satisfactory in this small series of cases.
Implications: This variable angle distal radius volar rim plate will be used for complex distal intra-articular fractures due to its good outcome and low complication rate. However, a six month follow up is recommended.
Conflict of Interest: None declared

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EFFECTIVENESS OF STATIC PROGRESSIVE SPLINT ON FINGER CONTRACTURE OF THE PROXIMAL INTERPHALANGEAL JOINT

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Introduction: Development of proximal interphalangeal joint (PIPJ) contracture is relatively common following trauma. Corrective splintage is a valid conservative management. However, different splintage may yield different results. The aim of this study is to evaluate the effectiveness and compliance between a belly gutter splint and a locally designed static progression splint (SPS).
Methods: 16 fingers with flexion contracture were randomized into 2 groups (Group 1 SPS and Group 2 Belly gutter splint) The primary outcome measurement was the change of extension lag in passive range of motion (PROM). Secondary outcome measurements include the total active range of motion (TAROM), pinch grip, power grip and patient satisfaction. Measurements were taken initially and at 10 weeks post intervention. Patient compliance and splint complication were also recorded and evaluated.
Results: Significant improvement was shown in both groups. Medians (interquartile range) of extension lag in PROM of the belly gutter splint group changed from 25 (7.5) to 10 (8.8) [$p < 0.05$]; while the SPS group changed from 20 (8.75) to 5(8.8) [$p < 0.05$]. Secondary outcomes showed improvement in terms of power grip, pinch grip, TAROM and patient satisfaction ($p < 0.05$). Contrasting the change in all outcome measurements, no significant difference ($p > 0.05$) was observed between groups. Both groups wore the splints daily, however, no significant difference ($p > 0.05$) in terms of the mean wearing time was seen. Impingement was an issue with the belly gutter splint.
Implications: This study shows that both splints were effecting in treating PIPJ flexion contracture. Both groups showed similar compliance. However, SPS was shown to be better than a belly gutter splint in terms of operational efficacy and less documented impingement.
Conflict of Interest: None declared

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DENERVATION OF THE SCAPHOTRAPEZIOTRAPEZOID (STT) JOINT - A SAFE AND LESS INVASIVE NOVEL SURGICAL TECHNIQUE

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Background: Scaphotrapeziotrapezoid (STT) joint arthritis is the second most common form of wrist osteoarthritis (OA) and a frequent condition that hand surgeons have to deal with. Failing conservative measures, the surgical options, as with all forms of arthritis, traditionally include resection arthroplasty, arthrodesis or implant arthroplasty. In this article, we present a novel surgical technique of STT denervation as a valuable safe surgical option to treat STT arthritis, supported by a preliminary report of 9 cases.
Methods: Surgical technique explained. Retrospective analysis of 9 cases and their preliminary outcome.
Results: Nine patients underwent STT denervation. Age range was between 41 to 82 years and a mean follow-up of 12 months. Three of them also had concurrent 1st CMC joint osteoarthritis and therefore this joint was also denervated. Visual Analogue Score improvement in pain was 5.3 (pre-op 7.9 to post-op 2.6) at one year. Eight patients were extremely pleased with the results and only one patient had minimal improvement of symptoms but didn´t want any further surgery. We had no complications.
Conclusion(s): Joint denervation is an accepted safe surgical option to treat refractory painful arthritis. Potential complications such as development of a Charcot´s joint or loss of proprioception are controversial. Handling of the nerves, especially the LABCN which is the most superficial of them, is extremely important to prevent hypersensitive scar or painful neuroma. We accept the limitations of this study, being retrospective and having very small numbers but considering our excellent patient feedback, we would like this novel technique of STT denervation to be considered as a safe and less invasive surgical treatment modality for painful STT arthritis.
Implications: STT denervation does not preclude further surgery. Its recovery period is much shorter than traditional techniques, allowing patients to resume their activities much sooner.

Conflict of Interest: None declared

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COLLAGENASE *CLOSTREDIUM HISTOLYTICUM* INJECTION IN THE TREATMENT OF DUPUYTREN'S CONTRACTURE, CONCURRENT FINGERS TREATMENT, EARLY COMPLICATIONS AND THREE YEARS & SIX MONTHS FOLLOW UP WITH PATIENT REPORTED OUTCOME MEASURES

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Background: This is a prospective double blind, placebo controlled trial. Collagenase Clostridium Histolyticum was effective and well tolerated used in well palpable cords of Dupuytren's Contracture. Concurrent fingers treatment with early complications have been reported. Patients´ reported outcome measures have been obtained.
Methods: 143 fingers were treated in 125 patients. Deformity of more than 30° at metacarpo phalangeal joints and more than 20° at proximal interphalangeal joints with well palpable cord were selected in this study. Finger straightening procedure was undertaken at 24-72 hours post injection. Patients were prospectively evaluated for early complications, extent of correction, residual deformity and recurrence rate at 3 years and 6 months follow up. Concurrent fingers were treated without serious side effects.
Results: Full correction was achieved in 130 fingers (91%). Residual flexion deformity noted in mainly in PIPJ with flexion 80° or more. At 3 ½ years follow up, the recurrence rate was noted in Metacarpophalangeal Joints in 4(3%)fingers and Proximal Inter Phalangeal Joints in 12(9%) fingers. Patient reported outcome measures have been collected and expressed high degree of satisfaction
Conclusion(s): Most local complications resolved within two weeks of the injection. Isolated MPJ deformity is more likely to be corrected fully. Isolated Proximal Interphalangeal Joints and combined Proximal Interplalangeal Joints and Metacarpo Phalangeal Joints contractures are mostly end up in residual flexion. Concurrent finger treatment was uneventful.
Conflict of Interest: None declared

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SCAPHOID FRACTURE GEOMETRICS: AN ASSESSMENT OF LOCATION AND ORIENTATION

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Background: The location and orientation of scaphoid fractures are important to guide management. There has been little research to accurately calculate scaphoid fracture geometrics.
Methods: 3D meshes of uninjured scaphoids were created from CT scans. The scapho-lunate plane (SLP) and true scaphoid central axis (SA) were calculated. Scaphoid fractures over a 3-year period were subjected to the study. Scaphoid fractures planes identified on at least 2 orthogonal views using plain radiographs were modelled on a 3D scaphoid. The location of the fracture, as a percentage along the scaphoid from the proximal pole, and the orientation, as the angle the fracture plane intersects the axis or scapholunate plane, were calculated. 379 fractures proceeded to have a 3D assessment.
Results: The mean point of intersection of fracture planes with the SA was 50.17% along the scaphoid. Older patients are slightly more likely to have more proximal fractures ($P < 0.01$). Males are significantly more at risk of more proximal scaphoid fractures than females ($P < 0.001$). More proximal fractures increases the risk of progressing to non-union ($p=0.018$). The mean angle between the SA and fracture plane was 83.45 degrees. The mean angle between the SLP and fracture plane was 95.86 degrees. There was no link between fracture angles when compared with age, sex and union status. Scaphoid fractures at the poles of the scaphoid result in smaller angles between the fracture plane and SLP($p < 0.005$).
Conclusions: This study clarifies links between patient factors and scaphoid fracture geometrics. Older patients and males are more likely to sustain more proximal scaphoid fractures. More proximal

fractures have a higher risk of progressing to non-union. Not all fractures are perpendicular to the scaphoid axis, particularly fractures which were at the scaphoid poles.
Implications: This may have implications when planning scaphoid fixation and further studies should be performed to explore intra-operative displacement of scaphoid fractures.
Conflict of Interest: None declared

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A RETROSPECTIVE STUDY ANALYSING SURGICALLY TREATED DIGITAL MUCOUS CYSTS (DMC) WITH COMPARISON OF PRACTICE BETWEEN ORTHOPAEDIC AND PLASTIC SURGEONS

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Background: To evaluate practice and recurrence rates of surgically treated DMC in a single centre where DMC excision is performed by plastic and orthopaedic surgeons; comparing practice to the suggested operative-triad outlined by Shin and Jupiter(1).
Method: A retrospective review of all patients with surgically treated DMC, under the care of plastics or orthopaedic surgery, from April 2012-April 2016. Data was collected from online operation notes, outpatient follow-up letters and histology reports and included: patient demographics; documentation of:osteophyte debridement, synovectomy; closure: direct, local flap, secondary intention; follow-up period, recurrence, other complications.
Results: A total of 136 cases have been included. 73 (53.7%) were treated by plastic surgeons and 63 (46.3%) by orthopaedic surgeons. There were 14(10.3%) documented recurrences; average plastic surgery recurrence rates:13.7% and orthopaedic surgery: 6.4%. All three of the suggested triad were documented as performed in 4(2.9%) cases - with a 100% cure rate. Debridement of osteophytes was documented in 39 (28.7%) cases; synovectomy was documented in 13 (9.6%) cases.114 (83.8%) cases underwent direct closure and 16 (11.8%) local flaps. Samples sent to histology for plastic surgery: 84.9%; orthopaedic surgery; 36.5%. Orthopaedics had a shorter average follow up period of 3.6 weeks compared to the plastics follow up of 8.6 weeks. Average complication rates for plastic surgeons: 23.3%; and orthopaedic surgeons:19%.
Conclusions: The study has shown discrepancies in practice and outcomes between plastic and orthopaedic surgeons with regard to follow up, histology samples and elements of the Shin and Jupiters triad that are performed.
Implications: Discussions regarding the introduction of a universal proforma to be used by both plastic and orthopaedic surgeons - and a trial of ensuring that all surgeons perform the triad of osteophyte debridement, synovectomy and skin excision where possible - will promote treatment consistency and pave the way for further research into the optimal technique for digital mucous cyst excision.
Conflict of Interest: None declared

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RESPONSE OF PRECISION PINCH GRIP FORCE TO UNEXPECTED DOWNWARD LOAD FORCE AS A CLINICAL EVALUATION TOOL IN CARPAL TUNNEL SYNDROME

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Background: Carpal tunnel syndrome (CTS) is a common compression neuropathy of the median nerve. In CTS, precision pinch grip force (when picking up an object between the thumb and index finger) is impaired. This study intended to evaluate how precision pinch grip adapts to sudden increases in downward load force in CTS, before and after surgical decompression. This could provide insight into functional recovery after decompression and reveal novel grip measures to assess CTS severity in the future.
Methods: This prospective follow-up, cohort study received ethical approval and was registered with ClinicalTrials.gov (NCT02830828). Patients presenting with CTS underwent routine clinical evaluation

and neurophysiology testing. Patients picked up, held stable, and replaced a hand-held force-torque device that continuously measured precision pinch grip force. This recorded a “hold” force. A 200g weight attached to the device by a 4cm string then dropped to produce a sudden increase in downward load force, whilst “catch” force was measured. Patients were followed up at 6 and 12 months post-carpal tunnel decompression.
Results: Thirty-five patients underwent pinch grip testing; 9 male, 26 female; mean age 57.1 years. At presentation, mean “hold” grip force was 8.1N (SD 3.4N), mean “catch” force was 12.3N (SD 5.0N) and were significantly different ($p < 0.005$). Nineteen patients underwent surgical decompression. Eleven completed 6 month follow-up. Six months post decompression, a significant increase in the difference between “hold” force and “catch” force ($p< 0.05$) was demonstrated.
Conclusion(s): Carpal tunnel decompression allows better modulation of precision pinch grip control six months post-operatively and may be due to recovery in sensory-motor function.
Implications: Measuring precision pinch grip force using a sudden increase in downward load force shows promise as an assessment tool in CTS recovery.
Conflict of Interest: None declared

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COMPARISON OF INTERFRAGMENTARY COMPRESSION PRODUCED BY CONICAL TAPERED SCREW AND 3MM HEADLESS COMPRESSION SCREW IN SCAPHOID FRACTURE

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Background: Conical tapered screws (Acutrak series screws) and 3mm Synthes headless compression screws (3mm HCS) are commonly used for internal fixation of scaphoid fractures. There is conflicting evidence regarding the interfragmentary compression abilities of conical tapered screws and 3 mm HCS. There has been no meta-analysis to compare interfragmentary compression produced by the above screws. The aim of the study was to conduct a meta-analysis of in-vitro biomechanical studies on interfragmentary compression produced by conical tapered screws (Acutrak series screws) and 3mm Synthes headless compression screws.
Methods: A computerised search of Pubmed, Embase and OVID database was undertaken to identify studies investigating biomechanical features of headless compression screws. Inclusion criteria were biomechanical studies comparing conical tapered screw with 3 mm Synthes headless compression screw in human cadaver or polyurethane foam, published in English language between 1995 and August 2016. As there was moderate heterogeneity of the studies used for comparison, random effects model was selected for meta-analysis. We estimated the weighted mean difference of ultimate failure load (load at mechanical failure) with 95% confidence intervals.
Results: Overall, five studies were included in the study. Three studies were on human cadaver and two studies were on polyurethane foam. There were 86 cases in the study with 43 cases each in conical tapered screw group and 3mm HCS group. Conical tapered screw produced significantly higher interfragmentary compression compared to 3mm HCS ($p < 0.0001$). There was no evidence of publication bias.
Conclusion(s): Meta-analysis of biomechanical studies shows that it is preferable to use a conical tapered screw because it provides higher interfragmentary compression compared to 3mm HCS.
Implications: However, one must remember that this is biomechanical analysis and further clinical studies should investigate any difference in functional outcome and fracture union between the above implants.
Conflict of Interest: None declared

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MEASUREMENT OF WIRE DEFLECTION ON LOADING MAY INDICATE UNION IN ILIZAROV CONSTRUCTS; AN IN VITRO MODEL

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Background: No entirely reliable method exists for assessing union during Ilizarov treatment. Premature removal results in treatment failure, hence, alternative methods warrant investigation. Wire deflection might provide an indication of fracture site deformation on weight-bearing, indicating progress towards union. This study aimed to test a method for assessing wire deflection within an Ilizarov frame. A clinically acceptable method for assessing wire deflection has not been previously described.
Methods: Tests were performed on clinical grade, all tensioned wire, 4 ring Ilizarov constructs stabilising a simulated bone, with and without an unstable defect. Models were sequentially loaded to 700N using an Instron testing machine. A digital depth gauge attached to the superior ring and measured wire displacement at the ring closest to the fracture. Tests were repeated three times at untensioned, 90kg and 130kg of tension on both unstable and stable constructs. Overall extension of the construct was automatically recorded by the Instron machine and used as comparison to assess accuracy.
Results: Both unstable and stable bone models produced highly repeatable load deformation curves (R^2=0.983 and 0.997). In the unstable model, wires tensioned at 882N and 1274N produced mean maximum deflections of 2.41mm and 2.69mm compared with 0.050mm and 0.046mm in the intact bone model (significant p< 0.0001). Results from the depth gauge measurement method had strong positive correlation with overall machine extension (r= 0.999).
Conclusion(s): A measurable difference in wire deflection between stable and unstable situations exists using this method, which appears repeatable and accurate with clear correlation between displacement and load.
Implications: This approach might be clinically applicable and further clinical testing is required. If bone union is directly correlated to wire deflection it will assist in decision making for frame removal, leading to lower complication rates and decreasing need for radiology and clinic visits.
Conflict of Interest: None declared

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SMOKING CESSATION ADVICE IN LIMB RECONSTRUCTION: AN OPPORTUNITY NOT TO BE MISSED

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Background: The adverse health effects of smoking are well known, including its effects on the musculoskeletal system. Limb reconstruction using external fixators is a high intensity process with high levels of patient contact time, complications and cost. The aim of this study was to examine smoking patterns in this group and in particular to assess trends in smoking cession.
Methods: Data was collected from 41 patients all undergoing treatment using circular frame external fixation, for a variety of pathologies, most commonly acute tibial trauma. A patient-reported questionnaire was used. Data was collected over a six-month period.
Results: In our population 56.1% of patients were smokers. During the study 47.8% patients stopped smoking and a further 39.1% decreased their smoking behaviour. 78.3% of patients could recall being given smoking cessation advice. In our group, 87% of patients were unaware of the effects of smoking on bone healing. Once made aware during discussion of proposed treatment, 73.9% stated that it was, in part, this knowledge that prompted them to positively change their smoking habits.
Conclusion(s): The results of this study show that advice regarding smoking cessation during limb reconstruction treatment can potentially have a positive impact on patients smoking habits. The effect of smoking should be linked to the patient pathology and discussed during the consent process.

Implications: Taking the time with the patient for this simple free intervention can have a positive impact on patient health, and potentially on the outcome of their current treatment, and is an opportunity not to be missed.
Conflict of Interest: None declared

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PATTERNS OF ACUTE REFERRALS FOR LIMB RECONSTRUCTION, AND RECOMMENDATIONS

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Background: Care of complex and open fractures may provide better results if undertaken in larger units, typically Major Trauma Centres (MTCs) or Orthoplastic units. Some ´complex injuries´ may still be admitted to units lacking specialist services, potentially delaying definitive treatment. The aim of this study was to analyse the referral pattern for acute inpatient transfer in an adult limb reconstruction unit in 2016.
Methods: A retrospective review was conducted of prospectively collected data from an electronic database. All referrals and patient health records were evaluated for baseline demographic data, diagnosis, time from injury to referral, initial treatment, time to transfer, details of definitive surgery, and delays in repatriation.
Results: There were 91 referrals, of which 84 were considered appropriate for inpatient transfer. 74 were for fresh complex fractures, including 22 pilon fractures and 23 bicondylar fractures of the tibia. Median delay to request transfers for acute trauma was 3 days (0d-19d), delay from referral to transfer was 8.5 days (1d-31d) and delay from date of injury to definitive surgery was 13 days (1d-52d). 9 patients with Grade 3 open fractures and had primary debridement at the referring institution with a delay to definitive orthoplastic surgery of 9 days (5d-20d). Only 17 of 61 per-articular fractures had spanning external fixation at the referring institution. Delay to repatriation was 8 days (0d-72d).
Conclusion(s): This study demonstrates organisational failures in acute orthopaedic care: open fractures not being primarily treated in orthoplastic centres or MTCs, delays in transfers due to bed-blocks, and significant delays in repatriation. It also demonstrates scope for improvement in clinical practice, and in particular, the need to reinforce the advantages of spanning external fixation of periarticular fractures.
Implications: Our data can only serve to highlight continuing problems in delivery of health care, despite widely publicised recent national guidelines.
Conflict of Interest: None declared

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MEDIAL OPEN WEDGE HIGH TIBIAL OSTEOTOMY: FIX THE KNEE, IMPAIR THE ANKLE?

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Background: Medial open wedge high tibial osteotomy (MOWHTO) is a commonly performed procedure for symptomatic medial compartment osteoarthritis (OA). However, little is known about its effects on ipsilateral ankle or hindfoot. Hence, our primary aim was to evaluate the effects of MOWHTO on the ankle and/or hindfoot. Our secondary aim was to report the radiological and survivorship outcomes after navigated MOWHTO.
Methods: Forty-eight knees (43 patients) undergoing navigated MOWHTO were included in the study. Pre and postoperative (6-12 weeks) hip knee ankle (HKA) angle, medial proximal tibial angle (MPTA), and ankle joint line obliquity (AJLO) were evaluated on standing lower limb alignment x-rays. Patients were asked about newly developed postoperative ankle or hindfoot symptoms.
Results: The mean (± standard deviation) age at surgery was 45.2 ± 7.1 years. The mean change in AJLO was 8.3° (Range: -4.5° to 18.7°) after surgery. Response about presence/absence of ankle or hindfoot symptoms was obtained from 32 out of 42 eligible patients (response rate: 76%). Unexplained ankle/hindfoot symptoms were seen in 22% (7/32) cases after MOWHTO. Patients with a change in AJLO of ≥10° were significantly more likely to be symptomatic (p=0.03). The mean pre- and postoperative HKA angles were 5.9° varus (Range: 0.6° to 14.8° varus) and 2.9° valgus (Range: 2.7°

varus to 8.1° valgus) respectively. 8% (4/48) of the knees had undergone some form of knee arthroplasty at a mean follow- up of 59 months.
Conclusion(s): a) MOWHTO alters ankle alignment which may predispose to symptomatic conditions of the ankle/hindfoot. b) Navigated MOWHTO provided reliable results with a survivorship of 92% at midterm.
Implications: Based on these results, we are now undertaking a prospective study where all patients undergoing MOWHTO will undergo pre and postoperative evaluation using the AOFAS ankle-hindfoot score to assess the effects of MOWHTO.
Conflict of Interest: S. Shah, A. Papadopoulos, J. Roberts- None declared. F. Picard- a) License and royalties with Aesculap/ BBraun (none with implant products), Brainlab (CMU), Oxford University Press; b)Research support from BBraun (none to implant products); c) Financial or material support from Zimmer, Stryker, BBraun.

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BALLISTIC TRAUMA: TEN YEAR EXPERIENCE FROM GAZA

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Background: Ballistic trauma and terrorist acts can result in some of the most challenging, severe mangled extremity injuries that trauma surgeons must address. Ballistic trauma is associated with significant soft tissues injuries including skin, muscle, bone and neurovascular injuries. With both high and low-energy ballistic injury occurring in Gaza in the last 10 years we treated more than 1,000 cases for reconstruction and different procedures.
Methods: We have experience working in Gaza for more than 10 years and have seen that ballistic injuries can be different for traditional and recent war zone injuries. With our regular missions 4 times a year, we run regular teaching on and having continuity of care from local surgeons and digital communication. We provided input for more than 1,000 patients on our recorded data. This is based at al-Shifa and Khan Yonis Hospitals with staff of 400 doctors and 600 nurses. Local doctors are unfortunately becoming world-leading experts in disaster medicine, but in such circumstances a supportive presence from outside combined with regular recent advances in warzone injuries can add more to management of complex cases.
Results: To present our experience in Gaza in the last 10 years and feature input from other volatile war zone injuries.
Conclusion(s): Our experience can add some experience regarding warzone injuries and can increase our knowledge for feature reconstruction.
Conflict of Interest: None declared

Childrens free papers

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THERE IS A DRAMATIC INCREASE IN PAEDIATRIC PELVIC PYOMYOSITIS IN THE UNITED KINGDOM

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Introduction: Pyomyositis is a primary bacterial infection of skeletal muscle. It is a tropical disease. There has been an increased incidence in temperate countries. We present the largest series of paediatric pelvic pyomyositis in temperate countries and analyse the factors influencing long term prognosis.
Materials and method: 41 patients diagnosed with primary paediatric pelvic pyomyositis between 1998 and 2016, with a mean age of 7.5 years were included in this retrospective study. Demographic, clinical, radiological and follow-up data were reviewed. Statistical analysis was performed to analyse the impact of age, early diagnosis and treatment on the final outcome.
Results: There was an increased occurrence of primary paediatric pelvic pyomyositis in the last 18 months (17 cases). 85% of cases fulfilled Kocher´s criteria for septic hip arthritis. The mean time to diagnosis was 2.8±0.8 days. The most common muscle affected was obturator internus (65.85%) and multifocal involvement is common (46.34%). Early diagnosis and antibiotic treatment within 7 days

from the time of onset of symptoms was the only factor that influenced functional outcome and the occurrence of complications ($p < 0.001$).
Discussion: Pyomyositis mimics septic arthritis and is not restricted to tropical countries in its incidence. Clinical examination and inflammatory markers have low sensitivity and specificity. MRI scanning can diagnose pyomyositis in early stages. The time period from occurrence of symptoms to antibiotic treatment influences final functional outcome.
Conclusion: There is an increased occurrence of this tropical disease in temperate countries. We recommend an ultrasound in all cases of suspected septic arthritis, followed by a MRI scan if there is no effusion. We also recommend early institution of antibiotics in these cases.
Implication: Pyomyositis is increasing in incidence in temperate countries with a presentation similar to septic arthritis.
Conflict of Interest: None declared

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SINGLE EVENT MULTILEVEL SURGERY IS A SAFE STRATEGY FOR MANAGING UPPER LIMB NEUROMUSCULAR CONDITIONS

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Background: The use of Single event multilevel surgery (SEMLS) in the management of lower limb deformity secondary to neuromuscular disease is a well established practice. It reduces hospital admission episodes and combines rehabilitation into a single period, which is preferable for patients and families. This technique also allows for intraoperative assessment of the effect of each operative step. We present our evidence of the safety and feasibility of this process applied to the upper limb.
Methods: Retrospective analysis of prospectively collected data from a single surgeon (MFN) across two centres. One district general hospital and one paediatric-only centre. All patients had neuromuscular dysfunction of the upper limb. All patients who underwent correction at 2 or more levels were included. Review of all clinic letters at most recent follow up was undertaken. Statistical analysis was performed in Microsoft Excel.
Results: 42 patients were included and a total of 248 procedures were undertaken, with on average 5 procedures per patient and a comparable spread of bony and soft tissue procedures between the two sites. The majority of patients (23/31) were discharged home within 24 hours of surgery. There were two complications in a single, older patient involving failure of fixation. Overall patient satisfaction is excellent.
Conclusion(s): This intervention gives good patient satisfaction in the short term. Complication rate is low in a challenging patient group.
Implications: There are no safety concerns regarding performing this intervention in a non-paediatric centre. It can improve function and patient quality of life in a range of conditions.
Conflict of Interest: None declared

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THE EFFECT OF SELECTIVE DORSAL RHIZOTOMY ON SAGITTAL PLANE STATIC ANALYSIS IN THE LOWER LIMBS OF CHILDREN WITH CEREBRAL PALSY. SHOULD SDR BE COMBINED WITH EARLY SOFT TISSUE LENGTHENING SURGERY?

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Background: Selective Dorsal Rhizotomy in ambulant children with cerebral palsy has become increasingly popular in the UK recently. Whilst most units are using similar criteria for the selection of suitable cases, controversy remains regarding the timing of soft tissue surgery. Some units recommend early surgery (during the same hospital visit); others opt to wait in anticipation of improvement in sagittal plane movements, before making a decision several years later.

Methods: We have studied the pre-operative and up to 2 year post operative sagittal plane data of 72 children who have undergone SDR in our institute. This includes static & 3D instrumented gait analysis. The median age was 6 years. There included 1 GMFCS I, 21 GMFCS II & 50 GMFCS III children. Soft tissue surgery by way of hamstring lengthening was performed if a significant knee flexion contracture was present, and calf lengthening if ankle dorsiflexion with the knee extended was to less than zero.
Results: 19 children had early soft tissue release; 53 did not. Of the 53 children who did not have soft tissue release, whilst some sagittal plane improvements were noted at 6 & 12 months, they returned to their pre-operative ranges at 2 year follow-up. Of the 19 children who had soft tissue releases, their sagittal plane ranges remained significantly improved at two years (pre-op mean PA 56.9, 2 years post op 36.9, pre-op mean DFKE -7.8, 2 years post op 3.3 degrees).
Conclusion(s): Sagittal plane analysis reveals improvements in both the operative and non-operative groups, however at 2 years the non operative group reverted to their pre-SDR ranges. The ranges remained improved in the operative group.
Implications: This data supports the view that consideration should be given to early soft tissue releases in children undergoing SDR if they have significant knee or ankle contracture.
Conflict of Interest: None declared

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ISOLATED ASYMMETRICAL SKIN CREASES AND THEIR ASSOCIATION WITH PATHOLOGICAL DEVELOPMENTAL DYSPLASIA OF THE HIP: A 21-YEAR OBSERVATIONAL LONGITUDINAL STUDY

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Background: The study aim was to clarify the true association between pathological DDH and ASC (asymmetrical skin creases).
Methods: Between 1st January 1995 and 31st December 2015, all paediatric referrals with suspected hip instability were assessed in a one-stop DDH clinic. All patients had clinical and sonographic assessment, with results prospectively recorded onto a database.
Results: Over this 21-year period, 103 cases were referred with ASC. Seventy were female and 33 male. The age distribution at initial assessment was bimodal, with peaks at 3 and 9 months. Eighty-three cases (81%) were referred with ASC, but the hip joints were normal on both clinical examination and sonography. Eighteen cases (17%) were referred with ASC but had an additional risk factor. This group also had normal hips on both clinical examination and sonography. Of the 103 cases, only two had pathological DDH. Both were female and aged 3 and 10 months respectively. They had ASC, but in addition had unilateral limitation of hip abduction, a Galeazzi positive sign and a leg length discrepancy. Radiological assessment diagnosed unilateral irreducible hip dislocations in both cases. Statistical analysis calculated an overall sensitivity for ASC of 100% and a PPV of 1.94%.
Conclusion(s): Public Health England NIPE guidelines state that ASC are a 'screen positive sign' and should be referred for expert assessment of the hip joints to exclude DDH. This study confirms the opinions of experts and systemic reviews that isolated ASC is an unreliable clinical sign in the diagnosis of pathological DDH.
Implications: If the hip joint is clinically normal it is highly unlikely that there will be an association with pathological DDH. Routine radiological and sonographic imaging of the hip joints is unnecessary if there is no limitation of hip abduction and normal leg lengths (negative Galleazzi). National guidelines should reflect this.
Conflict of Interest: None declared

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GAIT ANALYSIS PRE AND POST TIBIALIS ANTERIOR TENDON TRANSFER FOR PONSETI TREATED CLUBFOOT DEFORMITY

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Background: This study aimed to objectively define gait derangements and changes before and after Tibialis Anterior Tendon Transfer surgery (TATT) in a group of patients treated using the Ponseti method.
Methods: 21 feet in 13 patients with Ponseti treated clubfoot who showed supination in swing on clinical examination underwent gait analysis before, and approximately 12 months after, Tibialis Anterior Tendon transfer. 3-4 weekly casts were applied prior to the surgery, which was performed by transfer of the complete TA tendon to the the lateral cuneiform. A parental satisfaction questionnaire was also completed.
Results: In all but one patient, increased supination in swing phase was confirmed on pre-operative gait analysis, with EMG evidence of poor Tibialis Anterior modulation through-out the gait cycle. Post-operatively all patients showed improved positioning at initial contact, with heel strike and an absence of supination, and a decrease in swing phase supination.
In all patients, knees were overly flexed at initial contact, some continuing through stance phase; there was no change seen postoperatively. All parents reported marked improvements in gait and activity level post-operatively.
Conclusion(s): Gait analysis can be useful to confirm the need for tibialis anterior tendon transfer. Improved post-operative gait patterns seen by parents and clinicians can be related to objective improvements seen during gait analysis, confirming the benefit of tibialis anterior tendon transfer in appropriate patients.
Implications: TATT results in improved gait parameters when used for dynamic supination after clubfoot treatment.
Conflict of Interest: None declared

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MANIPULATION AND REDUCTION OF PAEDIATRIC FOREARM FRACTURES USING ESKETAMINE IN THE EMERGENCY DEPARTMENT - A 5 YEAR STUDY

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Background: Forearm fractures are the most common paediatric injury. Previous work has identified safe and effective treatment of these in A+E using a variety of sedation methods. We reviewed outcomes of forearm fractures reduced in A+E over a 5-year period following the dissemination of training using esketamine.
Methods: A retrospective analysis was undertaken of forearm fractures between January 2012 to December 2016 that were treated with manipulation in A+E using esketamine sedation. Pre and post manipulation radiographs, final radiographs and clinic letters were reviewed.
Results: 151 patients (103 male, 48 female) were included with an average age of 8.5 [1 to 15]. 3 were lost to final follow up. 11 (7%) fractures were not accepted after initial post manipulation radiographs and required a formal general anaesthetic on the next available trauma list. At one week follow up, a further 5 (3%) fractures displaced, requiring operative management. No further displacement occurred after this. The median angulation difference between pre and post manipulation was 18.0 degrees [95% CI 16.6-19.4, $p < 0.0001$]. 100% of patients who slipped at one week had a cast index greater than 0.8 [average 0.86, 95% CI 0.80-0.92]. An estimated saving of £63,000 per annum was calculated using this technique compared to needing a formal general anaesthetic. A successful reduction had been achieved in 90% (133/148) of patients and at final review (mean 32 days [range 5 to 155]) all patients had clinical and radiological union.
Conclusion: With adequate and appropriate training, the majority of simple radius and ulna fractures can be safely reduced and definitively managed using esketamine sedation in A+E.
Implications: Our technique has significant benefits for resource and finance management whilst maintaining optimum patient care. These results are similar to those undergoing manipulation under general anaesthetic; as such, we recommend its use.
Conflict of Interest: None declared

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CONGENITAL ABSENCE OF THE FIBULA: OUTCOME OF AMPUTATION OR EXTENSION PROSTHESIS IN THE MANAGEMENT OF SEVERE LOWER LIMB DEFORMITY

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Background: This study compares outcomes in patients with complete congenital fibula absence (associated with severe lower limb deformity) treated with an amputation protocol to those using an extension prosthesis.
Method: 32 patients were identified. 9 patients (2M: 7F, median age at presentation of 22yrs) utilized an extension prosthesis. 23 patients (16M: 7F, median age at presentation of 10 months) underwent 25 amputations during childhood: only two underwent tibial kyphus correction to facilitate prosthetic wear. Mobility was assessed using the SIGAM and K scores. Quality of life was assessed using the PedsQL inventory questionnaire; pain by a verbal severity score. Patients undergoing amputation were further subdivided by age, below and above 2yrs at the time of surgery.
Results: 19 Syme and one Boyd amputation in 19 patients were performed early (mean age 15 months). 4 Syme and one trans-tibial amputation in 4 patients took place in older children (mean age 6.6 years). K Scores were significantly higher (mean 4 versus 2) and pain scores lower in the amputation group allowing high impact activity compared to community ambulation with an extension prosthesis. The SIGAM and PedsQL scores were all better in the amputation group, but not significantly so. There was no significant difference in the scores based on the time of amputation.
Conclusion: Complete fibula absence can present with significant lower limb deformity. Parental counselling regarding management is paramount in achieving the optimum functional outcome. Childhood amputation for severe limb length inequality and foot deformity in congenital fibula absence offers excellent short-term functional outcome with prosthetic support. The tibial kyphus deformity does not need routine correction and facilitates prosthetic suspension. Accommodative extension prostheses do offer reasonable long-term function but outcome scores are lower.
Conflict of Interest: None declared

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EVALUATION OF THE 6-8 WEEK GP CHECK FOR DEVELOPMENTAL DYSPLASIA OF THE HIP

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Background: The national screening programme for developmental dysplasia of ths hip has run since 1969. It includes a clinical examination in the community at 6-8 weeks. The aim of this study was to assess the value of this GP 6-8 week hip examination.
Methods: In a 15-year prospective observational longitudinal cohort study, every infant referred by the GP with suspected pathological developmental dysplasia of the hip (DDH) had their hip joints clinically and sonographically examined in a specialist hip screening clinic. Graf Type IV and dislocated hips were classified as pathological. Screening failures were defined as those who had not been identified by the 6-8 week check and presented with late instability. Secondary univariate and multivariable analyses were performed to determine which clinical findings are predictive of instability.
Results: 60,320 infants underwent the 6-8 week GP check. Of 176 referrals, 5 had pathological hips. 13 screening failures presented between the ages of 17 and 80 weeks. The 6-8 week check has a sensitivity of 28% and a specificity of 99.7%. Clicky hips, asymmetric skin creases, and leg length inequality were not predictive of pathological hips. A multivariable model showed a positive Ortolani test to be the sole independent predictor of instability at 6-8 weeks.
Conclusion(s): This is the first attempt to test the validity of the 6-8 week GP clinical hip check. A low rate of hip pathology was identified. The high rate of false negatives raises questions about the value of screening at this age. At 6-8 weeks, clinical signs of hip instability are unreliable as hips become irreducible and stiff.
Implications: We advocate the reintroduction of the 8-month check, including an assessment for limited hip abduction, which may improve the detection rate of those missed by initial screening.
Conflict of Interest: None declared

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INVESTIGATING TIPTOE WALKING IN CHILDREN: IS MRI A HELP OR A HINDRANCE?

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Background: Tiptoe walking is a common and usually benign, self-limiting condition. MRI is used to identify underlying neuroaxial causes of persistent toe walking. Despite this being a common investigative modality, there is no evidence in the literature to delineate how common pathological findings are on MRI for tiptoe walking and what the indications are. Our aim was to describe the occurrence of abnormal findings on MRI for tiptoe walking, and to identify clinical findings that may have associations with particular underlying pathology.
Methods: We reviewed 150 patients having MRI to investigate the cause of tiptoe walking. We examined the notes and the MRI request forms to identify the signs, symptoms and background medical history that prompted the investigation. The corresponding MRI reports were noted and subsequent treatments were recorded.
Results: Of the 150 patients reviewed, 47 had an abnormality identified. Of those, 31 did not require intervention, although 16 required further investigations or referrals to other specialties before re-assurance. 12 patients (8% total) had a new diagnosis of cerebral palsy. Increased tone had 72% sensitivity and 86% specificity for CP. 3 patients had cord tethering requiring surgical intervention, and one MRI identified an incidental Chiari malformation needing surgical decompression. Of the three patients requiring surgical intervention, two had urinary/bowel incontinence and 2 had developing neurology.
Conclusions: MRI in persistent tiptoe walking is an important investigation that identifies pathology in a third of patients, with 11% having life-changing pathology. Evolving neurology and change in bowel or bladder function are red flags for requesting an urgent scan.
Implications: Parents and carers need to be counselled that a significant number of scans will identify abnormalities that are not related to the presenting problem.
Conflict of Interest: None declared

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THE PAEDIATRIC ORTHOPAEDIC TRAUMA SNAPSHOT (POTS) STUDY

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Background: The primary objective of this study was to identify the case mix of paediatric orthopaedic trauma cases treated operatively over a typical week in the National Health Service in the United Kingdom. A secondary objective was to perform a clinical audit of surgical management of supracondylar humeral fractures against national guidelines (BOA BOAST guideline 11).
Methods: Three hundred and eighty-one collaborators in 125 hospitals in the United Kingdom collected data prospectively on all children requiring surgical intervention for acute orthopaedic trauma between 0800 on 6 July 2016 and 0800 on 13 July 2016.
Results: 772 acute orthopaedic trauma cases were treated surgically during the study period (473 boys and 277 girls). Mean age was 8.6 years. 658 cases were referred from the ED. The top three most common diagnoses were both bone forearm fractures (n = 229), distal radius fracture (n = 182), and supracondylar humeral fracture (n = 87). The primary surgeon was a consultant orthopaedic surgeon in 244 cases, a registrar in 292 cases, a staff grade surgeon in 130 cases, and 55 cases were operated on by fellows.
Regarding supracondylar fractures, crossed configuration Kirschner wires were used in 67% of cases. Of these, 69% required 2 wires and 18% required 3 wires. 1.6mm wires were used in 46% of cases, and 39% utilised 2.0mm wires. Twelve cases (14%) underwent surgery after 2000.
Conclusions: For supracondylar fractures in children, only 39% of cases utilised the nationally recommended 2.0mm Kirschner wires, whilst 14% of cases were performed after 2000, which is not recommended by the BOAST 11. Adoption of some elements of the national guideline relating to the surgical management of supracondylar humeral fractures remains low.
Implications: This national study involving 125 hospitals in the UK provides an insightful snapshot of surgical activity for acute paediatric trauma included areas of improvement.
Conflict of Interest: None declared

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OSTEONECROSIS FOLLOWING TREATMENT FOR CHILDHOOD ACUTE LYMPHOBLASTIC LEUKAEMIA: THE SOUTHAMPTON CHILDREN'S HOSPITAL (SCH) EXPERIENCE

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Background: Acute lymphoblastic leukaemia (ALL) is the commonest childhood cancer. As 5-year survival exceeds 90%, focus on the side effects of chemotherapy is essential. Osteonecrosis is one of the most common sequelae, presenting considerable management dilemmas to oncologists and orthopaedic surgeons. A paucity of evidence exists to guide treatment. We sought to determine the incidence of osteonecrosis, characterise cases and review treatment methods at our institution.
Methods: A retrospective review of all children diagnosed and treated for ALL between 1 January 2003 and 31 December 2013 was undertaken using the Southampton Paediatric Oncology (SPO) database. Clinic letters and radiography were scrutinised and cross-referenced to the database.
Results: Of 235 children treated for ALL, 13 (5.5%) had MRI-confirmed osteonecrosis; 3 of whom were identified from letters and imaging but not recorded on the SPO database. 20.4% (48/235) children suffered musculoskeletal symptoms necessitating radiological investigation (osteonecrosis cases comprised 27.1% (13/48)). Older age at ALL diagnosis was associated with significantly increased risk of osteonecrosis ($p< 0.001$, OR 1.35 95% CI 1.17-1.57), which was diagnosed at a median of 12 months (8-31, 10^{th}-90^{th} centiles) following chemotherapy commencement.
7/13 children suffered multi-level osteonecrosis. Osteonecrosis affected the hips (8/13) and knees (7/13) most commonly. 6/13 received conservative treatment only, whilst 7 underwent ≥1 surgical intervention. Joint arthroplasty was undertaken in 9 joints of 4 children at a mean age of 18.25 years. All 4 patients who underwent hip arthroplasty previously received core decompression, with a mean time of 27.75 (range 18-33) months between treatments.
Conclusion(s): Osteonecrosis is devastating for a significant proportion of children with ALL. Our results suggest risk stratification for development of osteonecrosis by age and anatomical location is possible. Treatment is varied with little evidence base.
Implications: Improved understanding of the natural history is essential to facilitate early diagnosis. Long-term follow-up of treatments will improve the evidence for management of this challenging disease entity.
Conflict of Interest: None declared

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COMPLICATIONS FOLLOWING FASSIER-DUVAL RODDING OF FEMUR AND TIBIA IN CHILDREN

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Background: The Fassier-Duval (FD) rod, which offers a single-entry design and allows elongation for growth,has been widely adopted in paediatric deformity correction over the past decade, although evidence is limited in literature regarding the associated complications from its use.
Methods: All FD roddings carried out in a Scottish tertiary referral centre were identified. The electronic records and radiographs of each procedure were reviewed. The follow-up duration, indications for surgery, complications arisen and further operations were recorded.
Results: 21 procedures in 11 patients were identified between 2009-2016. The mean age at operation was 6 years and 2 months. The median follow-up period was 3 years and 9 months. The main underlying pathology was osteogenesis imperfecta (71.4%, n=15). The main indication of surgery was deformity correction (61.9%, n=13). 11 (52.4%) FD roddings were for femur and the remainder were for tibia. The commonest complication was proximal migration (n=6, 28.6%). In our cohort, we did not have negative telescoping or non-union. Two procedures (9.5%) were complicated by deep infections which were successfully treated. There were 3 further operations (14.3%), including one revision to a locked intramedullary nail for fracture and one below knee amputation for recurrent pseudarthrosis. We compared our results with those from Birke and co (J PaediatrOrthop 2011) from Australia. Our results are comparable and with a longer follow-up period.
Conclusion(s): Although FD rodding allows children to maintain their mobility and prevent fractures, there are significant complications associated with its use.

Implications: We hope in the future other centres can publish their results to allow improvements in surgical practice and implant design.
Conflict of Interest: None declared

Hip free papers

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THE CHOICE BETWEEN HIP PROSTHETIC BEARING SURFACES IN TOTAL HIP REPLACEMENT: A COST-EFFECTIVENESS MODEL USING UK AND SWEDISH HIP JOINT REGISTRIES DATA

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Background: Prosthetic implants used in primary total hip replacements have a range of bearing surface combinations (metal-on-polyethylene, ceramic-on-polyethylene, ceramic-on-ceramic, metal-on-metal); head sizes (small < 36mm, large 36mm+); and fixation techniques (cemented, uncemented, hybrid, reverse hybrid), which influence prosthesis survival, patient quality of life, and healthcare costs. This study compared the lifetime cost-effectiveness of prosthetic implants to determine the optimal choice for patients of different age and gender profiles.
Methods: In an economic decision Markov model, the probability that patients required one or more revision surgeries was estimated from analyses of UK and Swedish hip joint registries, for men and women aged < 55, 55-64, 65-74, 75-84, and ≥85 years. Implant and follow-up healthcare costs were estimated from hospital procurement prices, national tariffs, and the literature, which also provided quality-adjusted life year estimates. We derived incremental net monetary benefits and cost-effectiveness acceptability curves.
Results: Small head cemented ceramic-on-polyethylene implants were optimal for men aged 65-74 years; small head cemented metal-on-polyethylene implants for men aged over 75 years, and women aged 65 to 84 years; and large head cemented metal-on-polyethylene implants for women aged over 85 years; all showed over 60% probability of being cost-effective. For younger patients, revision risk estimates were imprecise and optimal choices were more varied and uncertain. Cemented implants, regardless of bearing surface combination or head size, were optimal for patients aged over 55 years.
Conclusions: The older the patient, the higher the probability that cemented small head metal-on-polyethylene implants are optimal, with large heads for women aged over 85 years. Cemented ceramic-on-polyethylene implants are often good alternatives. Optimal choices for patients under 65 years are uncertain.
Implications: Our findings can influence NICE guidance, clinical practice, and hospital procurement decisions; and support the case for further research into revision risks.
Funding: NIHR Research for Patient Benefit programme PB-PG-0613-31032.
Conflict of Interest: None declared

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MOLECULAR AND EPIGENETIC CROSSTALK OF NETWORKS ACTIVATING INFLAMMASOME IN PATIENTS WITH ASEPTIC LOOSENING AFTER TOTAL HIP ARTHROPLASTY

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Background: Aseptic loosening following total hip arthroplasty occur as a result of the innate immune response, leading to failure. Chronic local inflammation is triggered by implant derived wear debris, which ignite recruitment of immune cells including macrophages and osteoclasts, resulting in inflammasome activation and osteoclastogenesis. Inflammasome is a multiprotein complex that senses debris through receptors, such as Toll - like receptors, to generate active IL-1ß, a central

cytokine in inflammatory response. Little information is available on the regulation of inflammasome response at the post-transcriptional or pre-translational level in patients with THA failure and periprosthetic osteolysis.
Methods: To get insights on the molecular mechanisms underlying aseptic loosening, we investigated the expression levels of specific miRNAs and genes that encode factors of the inflammasome, as well as cytokines involved in osteolysis in 15 patients, using qRTPCR arrays and classic RTqPCR for verification.
Results: We observed, downregulation of miR302a3p and upregulation of its targets NF-κB and TNFa, which induce osteoblast differentiation and osteolysis, whereas miR1013p downregulation causes increased osteoclastogenesis through FOS upregulation. Interestingly, downregulation of miR513b5p and miR181a3p directly affected the inflammasome by upregulating IL-1ß. In addition, downregulation of miR19a3p and miR1813p suggests increased inflammatory response via stimulation of NF-κB, through TLR2 and TLR4, respectively, an observation which implies positive feedback of inflammasome activation. Finally, miR130a3p was found upregulated having a suppressive impact on genes encoding bone morphogenic proteins like GDF3 and BMP7 which were downregulated. The observed overexpression of the inflammatory cytokines IL-1ß and CXCL2 as well as of essential transcription factors like NF-κB, FOS and JUN coincides with the induction of osteolysis and aseptic loosening.
Conclusions/Implications: This is the first report of specific miRNA networks that are differentially expressed and regulate pathways which are intricately interconnected with local inflammation and aseptic loosening and could serve as prognostic markers.
Conflict of Interest: None declared

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DOES TIME TO SURGERY AFFECT 30 DAY MORTALITY FOR HIP FRACTURE PATIENTS? AN ANALYSIS OF THE NATIONAL HIP FRACTURE DATABASE

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Background: Hip fracture is a common injury with a high associated mortality. Many recommendations regarding timing of operative intervention exist for patients with such injuries. The Best Practice Tariff was introduced in England and Wales in 2010, offering financial incentives for surgery undertaken within 36 hours of admission. The England and Wales National Institute for Health and Clinical Excellence (NICE) Guidance states that surgery should be performed on the day or day after admission. Due to lack of clear evidence, this recommendation is based on Humanitarian grounds. NICE have called for further research into the effect of surgical timing on mortality.
Methods: We utilised data from the National Hip Fracture database prospectively collected between 2007 and 2015, comprising 413,063 hip fractures. Using 11 variables, both Cox and Logistic regression analysis was used to establish the effect on mortality of each 12 hour interval from admission to surgery.
Results: For each 12 hour time frame from admission to surgery a trend for improved 30 day survival was demonstrated the earlier the surgery was performed. However, this did not reach significance until beyond 48 hours (Hazard ratio of 1.12, 95% CI: 1.04-1.20). Surgery after 48 hours suffered significantly higher chance of mortality compared to surgery done within 12 hours.
Conclusion(s): This is the largest analysis undertaken to date. Lowest mortality rates are found within the 0-12- hour window. After 48 hours there is a significant increased risk of mortality compared to the 0-12-hour time frame. Expeditious surgery within 48 hours can be justified both on humanitarian and survivorship grounds.
Implications: Hip fracture surgery performed within 48 hours is associated with reduced mortality when compared to that beyond this time. This is in agreement with Blue Book recommendations and extends the currently recommended NICE and Best Practice Tariff targets of 36 hours.
Conflict of Interest: None declared

ULTRASONIC CEMENT REMOVAL IN CEMENT-IN-CEMENT THR REVISION: DOES OSCAR AFFECT THE STRENGTH OF THE FINAL CEMENT-CEMENT BOND?

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Background: Numerous studies have evidenced cement-in-cement techniques as reliable in revision arthroplasty. The original cement mantle is commonly reshaped to aid accurate placement of the new stem. Ultrasonic devices selectively remove cement, preserve host bone and have lower cortical perforation rates than other techniques. As far as the authors are aware, their impact on final cement-cement bonds has not been investigated. This study assessed the impact of cement removal using OSCAR (Orthosonics System for Cemented Arthroplasty Revision, ORTHOSONICS) on final cement-cement bonds.
Method: Twenty-four specimens were manufactured by pouring cement (Simplex P Bone Cement, Stryker) into stainless-steel moulds with a central rod polished to Stryker Exeter V40 specifications. After cement curing, rods were removed and eight specimens allocated to each of three internal surface preparation groups: 1) burr; 2) OSCAR; 3) no treatment. Internal holes were re-cemented, then each specimen was cut into 5mm discs. Shear testing of discs was completed by a technician blinded to original grouping, recording ultimate shear strengths.
Results: The mean shear strength for OSCAR-prepared specimens (17 MPa, 99% CI 14.9 to 18.6, SD=4.0) was significantly lower than that measured for the control (23 MPa, 99% CI 22.5 to 23.7, SD=1.4) and burr (23 MPa, 99% CI 22.1 to 23.7, SD=1.9) groups ($P< 0.001$, one-way ANOVA with Tukey's post-hoc analysis). There was no significant difference between control and burr groups ($P>0.05$).
Conclusions: Results show that cement removal technique impacts on final cement-cement bonds. This in-vitro study shows a significantly weaker bond when using OSCAR prior to re-cementation into an old cement mantle, compared to cement prepared with a burr or no treatment.
Implications: These results infer that care must be taken in surgical decision-making regarding cement removal techniques used during cement-in-cement revision arthroplasty, suggesting that the risks and benefits of ultrasonic cement removal need consideration.
Conflict of Interest: Stryker provided cement and mixing apparatus. None of the authors have conflicts of interest related to this study.

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FEMORAL REVISION FOR PERIPROSTHETIC FRACTURE FOLLOWING PRIMARY TOTAL HIP ARTHROPLASTY

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Background: Peri-prosthetic femoral fractures (PPF) are increasing as a cause for revision of primary THA. Our aim was to highlight the revision burden of primary THA for PPF and investigate patient and prosthesis factors using data from a large national joint registry.
Methods: All primary conventional THA from September 1999 to 31 December 2014 were analysed to identify those revised for PPF. The cumulative percent revision (CPR) of all procedures that had a femoral component revision for PPF was determined and further analyses based on patient and prosthesis characteristics were performed. The Kaplan-Meier estimates of survivorship were used to describe the time to first revision. Hazard Ratios (HR) from Cox proportional hazards models, adjusting for age and gender, were used to compare revision rates.
Results: Of the 296,532 primary THA procedures, there were 1,589 procedures with a femoral stem revised for PPF. The cumulative percent femoral revision for fracture at 14 years post-surgery was 1.3%. There was a higher rate of femoral revision for PPF in males (1mth+ HR=1.63, $p< 0.001$) and when the primary THA was performed for fractured neck of femur (NoF) (1mth+ HR=2.44, $p< 0.001$) and for osteonecrosis (HR=1.32, $p=0.034$). Cementless stems had a higher rate of femoral revision for

PPF compared to cemented in the first 3 months (p< 0.001). Polished cemented stems had a higher rate of revision than matt (HR=3.21, p< 0.001) and there was prosthesis specific variation. The Exeter V40 had a lower rate of femoral stem revision for peri-prosthetic fracture than the C-Stem and the CPT.
Conclusion(s): The rate of PPF is higher for males, patients with fractured NoF, osteonecrosis and when cemented polished stems are used.
Implications: The number of revisions for PPF increases the longer the follow up and is likely to be an increasing health burden in the future.
Conflict of Interest: None declared

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A PROSPECTIVE COMPARATIVE STUDY ON FUNCTIONAL OUTCOME OF CORE DECOMPRESSION PLUS STEM CELL THERAPY VERSUS CORE DECOMPRESSION ALONE IN TREATMENT OF A VASCULAR NECROSIS OF HIP JOINT GRADE II & III A CLINICAL FOLLOW UP FOR 2 YEARS

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Background: We evaluate the advantages of core decompression plus stem cell therapy immediately, compared to core decompression alone in treatment of vascular necrosis of grade II and III hip joint patients with persistent complaining.
Methods*:* This prospective comparative study looked at 40 patients with vascular necrosis of hip joint grade II, III. Where there was no benefit from core decompression alone, we used stem cell therapy immediately. The groups were randomized according to inclusion exclusion criteria into two groups. In group A, 20 patients were treated by core decompression with intra-articular injections of stem cell (harvested from patients peripheral blood). In group B, 20 patients were treated by core decompression alone without Stem Cell therapy. The patients were followed up for 24 months. The primary outcome measurements were according to Oxford Hip Score and Harris Hip Score.
Results: In both groups significant reductions in the mean of both Oxford Hip Score and Harris Hip Score from baseline were seen at all follow up visits for 12, 24 months. Also, there were significant statistical differences and clinical improvements at 12, 24 months for both Oxford Hip Score and Harris Hip Score in group A superior to the group B (P-value < 0.0001). No severe adverse events related to these combinations were observed.
Conclusion(s): We concluded that core decompression plus stem cell therapy depending on both Oxford Hip Score and Harris Hip Score[PW1] for 2 years follow up are superior to core decompression alone in treatment of a vascular necrosis of hip joint grade II & III.
Implications: Effectiveness as management advantages in a vascular necrosis of hip joint.
Conflict of Interest: We studied the effectiveness of combination core decompression plus intra operative intra articular injection of Stem cell under image intensifier, compared to core decompression alone in treatment of a vascular necrosis of hip joint diseases grade II, III.

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EARLY EXPERIENCE OF A DUAL MOBILITY BEARING IN TOTAL HIP ARTHROPLASTY IN A DISTRICT GENERAL HOSPITAL

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Background: The dual mobility (DM) bearing concept was introduced to reduce the risk of dislocation in total hip arthroplasty (THA). Our aim was to evaluate the early outcomes following the utilisation of DM in primary and revision THA in our unit.
Methods: Prospectively collected data on all patients undergoing a DM bearing by a single surgeon was reviewed between July 2012 and December 2015. The primary outcome assessed was dislocation, with a secondary outcome revision for any reasons. All data was gathered from patient clinical records and the digital picture archiving and communication system (PACS).

Results: 30 primary THA were undertaken and 54 revision THA in the time period described. 11 of the procedures involved a proximal femoral endoprosthesis. The mean age in the primary setting was 65 and 73 in the revision population. The main indications for using DM bearing in the primary setting were: trauma (40%), residual dysplasia (40%) and malignancy (17%). There were no dislocations in the primary THA category. Indications in the revision THA cohort included 33% for aseptic loosening, 11% for instability, 18% for ALVAL reactions, 20% for infection, 18% for fracture. 1 out of the 54 revision THAs had one large bearing dislocation requiring closed reduction. Subsequent analysis confirmed that implant alignment was satisfactory and patient compliance was the cause due to mental health concerns. To date no patient in either cohort has required revision surgery. The overall dislocation rate was 1.2%.
Conclusion(s): Our early experience with DM bearings has been positive, with no evidence of early failure or loosening. The dislocation rate overall has been low and matches the current large series in the literature. The stability provided by the DM bearing is particularly useful in the complex reconstruction setting.
Implications: DM bearings are a useful adjunct in planning for challenging reconstruction cases.
Conflict of Interest: None declared

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PREDICTING AND PREVENTING EDGE LOADING AND PROSTHETIC IMPINGEMENT IN TOTAL HIP ARTHROPLASTY

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Background: Edge loading and prosthetic impingement are associated with significant complications following total hip replacement (THR). Appropriate component placement is therefore important, and should take into account the functional movements of both the pelvis and femur. The purpose of this study was to develop a method to determine and minimize the risk of functional edge loading and prosthetic impingement of a planned THR.
Methods: Pre-operative CT scans and lateral standing and seated radiographs of 20 patients awaiting a THR were performed. The changes in pelvic and femoral positions on the lateral radiographs were measured between the standing and seated positions, and a 3D digital model was then generated to simulate the movement of a rise from a seated position for each patient. Using the Corin OPS system, the planned component orientation was optimized to avoid edge loading. The path of the prosthetic femoral neck relative to the acetabular component for this planned position was then calculated for this "sit-to-stand" movement.
Results: For every planned THR it was possible to predict the path of the femoral neck relative to the acetabular component. Where there was an apparent risk of prosthetic impingement, the orientation of the planned components could be adjusted to minimize the risk of both edge loading and impingement.
Conclusion(s): This study demonstrates a novel method to determine and visualize the potential for functional edge loading and prosthetic impingement when planning a THR.
Implications: This method could be incorporated into existing THR planning software, to make it widely available to surgeons and patients. By optimizing the component orientation, complications of THR should therefore be reduced.
Conflict of Interest: A number of the authors have a relationship with Corin Group PLC, either as employees or as providers of consultancy services.

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COST ANALYSIS ON VIRTUAL CLINIC FOLLOW UP AFTER PRIMARY JOINT ARTHROPLASTY

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Background: Virtual Clinic (VC) is seen as an effective, cost saving and productive way to manage the increasing need to review and monitor patients after primary joint replacement. The number of

procedures is increasing steadily, exceeding 160.000 procedures per year in the UK. Guidelines suggest reviewing patients in regular intervals with radiographs and patients reported outcome measures (PROMs). Face to face review following routine uncomplicated primary joint arthroplasty can cost valuable resources.
Methods: We have reviewed our experience with VC in a large teaching hospital. A single surgeon established this VC two years ago. We reviewed all clinical records, PROMs, patient satisfaction and outcomes of VC at one year follow up. Additionally, we performed a cost analysis.
Results: This study included 154 primary joints (70 total knee replacements and 84 total hip replacements) in 148 patients (89 female, 59 male). Average age at surgery was 65.3 years. 57% of patients were directly discharged following VC assessment, which included radiographs and PROMs. 39% of patients had additional face-to-face review following VC evaluation; the majority (66%) of these patients were seen for a new problem of a different joint. Evaluation of PROMs revealed results above national average. Cost analysis demonstrated an average cost saving of £ 9,030 per year and per consultant.
Conclusion(s): VC follow up after primary joint replacement is a safe and cost effective option to manage post-operative follow up visits and determine which patient require face-to-face review and who can be safely discharged. This study demonstrated cost savings of over £ 9,000 per year and per consultant surgeon.
Implications: In view of the increasing number of primary joint arthroplasty and the financial pressure on the NHS, VC offers an excellent alternative to conventional clinics.
Conflict of Interest: None declared

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PRECAUTIONS FOLLOWING PRIMARY TOTAL HIP REPLACEMENT (THR): PATIENT ADHERENCE

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Background: The incidence of post-operative dislocation after total hip replacement (THR) is influenced by surgical technique and prosthesis type. A further influence is patients ensuring their THR is not put at risk of dislocation by extreme positions or activities. To counter this, patients are given stringent post-operative functional restrictions. Historically, it is presumed that all patients comply with these post-operative restrictions, but the true level of compliance is largely unknown. We surveyed patients to ascertain their level of adherence to the post-operative restrictions after THR.
Methods: An anonymised postal questionnaire was sent to 126 patients who had undergone THR at the Manchester Orthopaedic Centre. All surgical approaches and femoral head sizes were included. The questionnaire asked about each patient's compliance with the post-operative restrictions at three different time points: whilst still an in-patient, at home following discharge, and at 6 weeks.
Results: Patient adherence during all activities immediately post op was 80%. When patients first went home this reduced to 71% and by 6 weeks, adherence was 59%.
Patients found sleeping on their back difficult with 82%, 63% and 46% adherence levels for the same timeframes. We received responses from 71% of patients with a dislocation rate for all the126 patients during the collection period of 2.2% (n=2). One hip dislocated transferring from theatre trolley to bed, the second hip dislocated following trauma 3 weeks postoperatively.
Implications: Although therapists and consultants insist on enforcing the practice of restrictions after a THR, this study highlights that a sizable of minority patients do not adhere to this advice whilst in hospital (20%), when at home (29%) and after 6 weeks (41%). Despite this, the incidence of dislocation remains very low. This survey highlights the need for an informed and considered review of the need for routine restrictions after a THR.
Conflict of Interest: None declared

VALIDATION OF REVISION DATA FOR TOTAL HIP REPLACEMENTS UNDERTAKEN AT A HIGH VOLUME ORTHOPAEDIC CENTRE USING HOSPITAL AND NATIONAL JOINT REGISTRY DATA

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Background: The National Joint Registry (NJR) is the largest arthroplasty registry in the world with over 2 million records. Data held in arthroplasty registries is fundamental for the surveillance and evaluation of joint replacements. On a national level ´*reason for revision*´ recorded in Consultant Outcome Publications on the NJR for Total Hip Replacements (THR) has not been validated. There is a need for consultants and hospitals to undertake an independent validation on their data sets.
Methods: 1.70% (160) primary THRs undertaken at a high volume orthopaedic centre between 1st January 2004 and 31st March 2015 were reported to the NJR as revised. Validation to determine the accuracy of NJR ´*reason for revision*´ data was undertaken after analysis of radiographs (x-rays, CT and MRI scans), pathology, histology, microbiology and electronic medical records.
Results: This analysis revealed discrepancies in reporting to the NJR. The key discrepancies were in the reporting of adverse soft tissue reaction to particulate debris, infection, aseptic loosening, and ´other´. Adverse soft tissue reaction to particulate debris was under reported to the NJR by 11%. The ´*reason for revision*´ data is recorded to the NJR with findings at the time of surgery. It is some weeks before histological evidence becomes available and source data is not updated. Likewise, infection was under reported to the NJR by 1.88%. Microbiology reports for infection are also not instantly available. Aseptic loosening was over reported by 5.60%, these cases were reclassified to either adverse soft tissue reaction to particulate debris or failed osseointegration. 8.75% of the revised cases were reported as ´other´, all these cases were reclassified to the most appropriate ´*reason for revision*´ category.
Conclusion: It is crucial that arthroplasty registry data is frequently validated. Accurate data recorded to the NJR is imperative to provide safe and effective improvements in orthopaedic surgery.
Conflict of Interest: None declared

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THE IMPACT OF PATIENT AND SURGICAL FACTORS ON THE RATE OF POST-OPERATIVE INFECTIONS FOLLOWING TOTAL HIP REPLACEMENT - A NEW ZEALAND JOINT REGISTRY STUDY

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Background: Infection remains a devastating complication following total hip replacement (THR). The aim of this study was to identify risk factors associated with post-operative infection following primary THR.
Methods: New Zealand Joint Registry data on 91,585 THRs performed between 2000 and 2014 was analysed. Risk factors associated with revision for deep infection at 6 and 12 months post primary surgery were identified using univariate and multivariate logistic regression models.
Results: The overall rate of revision for infection was 0.15% at six months and 0.21% at 12 months. Multivariate analysis showed statistically significant ($p < 0.05$) associations with revision for deep infection with ASA grade (odds ratio (OR) 6.13, 95% confidence interval (CI) 1.28-29.39), severe or morbid obesity (OR 2.15, CI 1.01-4.60 and OR 3.73, CI 1.49-9.39 respectively), metal on highly crosslinked polyethylene articulation (OR 2.12, CI 1.08-4.16), laminar flow ventilation (OR 1.98, CI 1.38-2.85), consultant-supervised trainee operations (OR 1.94, CI 1.22-3.08), male gender (OR 1.68, CI 1.23-2.30) and anterolateral approach (OR 1.62, CI 1.11-2.37). Procedures performed in the private sector were protective for revision for deep infection (OR 0.68, CI 0.48-0.96). Age, previous hip surgery, THR caseload, addition of antibiotics within cement, choice of parenteral antibiotic and the use of surgical helmet systems were not associated with revision for infection.
Conclusions: Patient factors including obesity and ASA had strong independent associations with risk of revision for infection following primary THR. Some surgical factors were also significant, although their impact was smaller.
Implications: The risk profile for patients undergoing THR comprises complex patient and surgical factors. Although surgical factors were less important, these may be more readily modifiable in practice.

Conflict of Interest: None declared

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***IN VITRO* STUDIES INTO BIOFILM PREVENTION USING ANTIBIOTIC-LOADED BEADS: IMPLICATIONS FOR PROSTHETIC INFECTION MANAGEMENT**

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Background: Bacterial biofilms play a key role in prosthetic infection (PI) pathogenesis. Establishment of the biofilm phenotype confers the bacteria with significant tolerance to systemic antibiotics and the host immune system meaning the twin strategy of thorough joint debridement and prosthesis removal often remain the only possible course of therapeutic intervention. Protection of the prosthesis and dead space management may be achieved through the use of antibiotic-loaded cements and beads which aim to release high localised concentrations of antibiotics to the surgical site. However, the antibacterial and antibiofilm efficacy of these materials is poorly understood. Consequently, we have performed an array of *in vitro* studies against a selection of important gram negative and gram positive pathogens involved in PIs to better understand their potential clinical benefit.
Methods: Acrylic cement and various non-acrylic materials prepared as beads loaded with antibiotics were evaluated for their capacity to both inhibit biofilm formation and kill preformed biofilms using agar diffusion assays, viable cell counts, confocal and scanning electron microscopy. Studies to model the release of antibiotics from mineral based materials permitted an understanding of antibiotic elution kinetics and the bacterial response.
Results: Agar diffusion assays demonstrated antibacterial concentrations of eluting antibiotics lasting for up to 111 days, dependent on the cement type, antibiotic and bacterial strain. Antibiotic-loaded beads attenuated early bacterial colonisation and reduced biofilm formation for multiple days post inoculation. Established biofilms were harder to clear. With beads of a pharmaceutical grade calcium sulfate (CS), antibiotic release data suggests rapid and sustained diffusion with distinct physiological reactions of the bacteria depending on distance from the bead.
Conclusions & Implications: Synthetic antibiotic-loaded CS beads have potential to reduce or eliminate biofilm formation on implant material by providing locally high concentrations over sufficient time periods to aid in the management of PIs.
Conflict of Interest: This work was funded by Biocomposites Ltd. RPH and PS are consultants for Biocomposites Ltd Ltd. SSA and JJC are employed by Biocomposites Ltd.

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CATIONIC STEROID ANTIBIOTIC-90 (CSA-90) PREVENTS MRSA INFECTION AND PROMOTES UNION IN A RAT OPEN FRACTURE MODEL

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B **Background:** Despite meticulous wound management and intravenous antibiotic prophylaxis, open fracture infection remains a challenge, and resistant organisms are emerging in many countries. We have previously shown that CSA-90, a novel broad-spectrum antimicrobial compound, has pro-osteogenic properties in vitro and in vivo. We hypothesised that CSA-90 could improve bone formation and prevent infection in MRSA-inoculated fractures.
Methods: 12 week-old male Wistar rats underwent open mid-shaft femoral fractures stabilised with a 1.1mm K-wire. All animals received 10µg BMP-2 on a collagen sponge, which was also used to deliver $1x10^4$ MRSA to the fracture site, along with 500µg CSA-90 in the treatment group (n=10). No systemic antibiotic prophylaxis was administered. All animals were monitored daily for signs of systemic sepsis and local infection. An independent, blinded veterinarian reviewed weekly radiographs and rats demonstrating osteolysis and/or declining overall health were culled at his instruction. Remaining animals were culled at 6 weeks. The primary outcome was fracture infection, incorporating survival,

microbiological, radiological, and histological measures. All studies were approved by the local animal ethics committee.
Results: Rats inoculated with MRSA that did not receive CSA-90 showed evidence of fracture infection and were euthanised within 2 weeks of surgery. No animals treated with CSA-90 were culled prior to the end-point of 6 weeks. CSA-90 treated fractures united (modified RUST score >11) and deep tissue swabs showed reduced rates of microbial contamination ($p< 0.001$ vs untreated controls). The CSA-90 treated group also demonstrated a significant increase in bone volume by microCT analysis (mean 49.76mm^3, 95% CI: 4.40-95.12mm^3, $p< 0.05$).
Conclusion(s): These results demonstrate that CSA-90 is an effective prophylactic antimicrobial agent and facilitates fracture union when administered locally to open fractures inoculated with MRSA.
Implications: The CSA class of antimicrobials may offer novel local agents for use in open fractures, providing additional prophylaxis against resistant organisms.
Conflict of Interest: None declared

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HMGB1 ACCELERATES REGENERATION OF MULTIPLE TISSUES BY TRANSITIONING STEM CELLS TO G(ALERT)

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Background: We sought to identify the factor that transitions endogenous quiescent G(0) stem cells to an ´alert´ phase, thereby enhancing regeneration in multiple tissues, including bone, muscle and blood.
Methods: Alarmins are endogenous molecules released on tissue damage. We screened candidate alarmins in-vitro and assessed the effects of local addition of the prototypical alarmin HMGB1 or its inhibitors in murine models of skeletal, muscle and haematological injury. The ability of HMGB1 to transition murine and human stem cells to G (Alert) was assessed using BrdU incorporation, FACS, measurement of cell size, ATP levels, mitochondrial DNA, and mTORC1 dependancy. The receptor through which HMGB1 promoted healing was identified using small molecule inhibitors.
Results: HMGB1 and S100A8/9 levels were elevated post fracture in both human and murine samples. Only HMGB1 pre-treatment improved the osteogenic differentiation of human mesenchymal stromal cells (MSCs) in-vitro and local administration of HMGB1 accelerated fracture healing in-vivo via the CXCL12-CXCR4 axis. Analyses of cell cycle kinetics, cell size, ATP levels, mitochondrial DNA, and mTORC1 dependancy showed this was due to HMGB1 transitioning the murine skeletal stem cell to G(Alert). This effect extended to murine muscle and haematopoietic stem cells, and human haematopoietic stem and progenitor cells, and MSCs. HMGB1 also accelerated recovery in murine models when administered at the time, or 2 weeks before skeletal, muscle or haematological injury.
Conclusion(s): Through human samples and murine models, we show that injury leads to the release of HMGB1 and administration of this alarmin accelerates healing in models of skeletal, muscle and haematological injury, even if administered 2 weeks before injury. HMGB1 leads to improved healing via the CXCL12-CXCR4 axis by transitioning various stem cells to G (Alert).
Implications: We identify the ´alerting´ factor, HMGB1, and highlight its therapeutic potential to accelerate the regeneration of multiple tissues following trauma, chemotherapy, and elective surgery.
Conflict of Interest: None declared

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ANKLE CARTILAGE IS MORE RESILIENT TO CYTOKINE-INDUCED CATABOLISM THAN KNEE CARTILAGE: A POTENTIAL TARGET FOR PREVENTION OF KNEE ARTHRITIS?

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Background: The lifetime prevalence of symptomatic osteoarthritis at the knee is 50%, hip 25% while surgically significant osteoarthritis of the ankle occurs in only 1% of our population. This variation in prevalence has been hypothesised to result from the differential responsiveness of these joints to catabolic stimuli. The aim of this study was to determine whether ankle cartilage is less susceptible to the catabolic effects of pro-inflammatory cytokines when compared to the knee.
Methods: Human cartilage explants were taken from the talar domes (n=12) and the femoral condyles (n=7) following surgical amputations. Explants were cultured in the presence of a combination of high concentration cytokines (100ng/ml TNFα, 10ng/ml OSM, 5ng/ml IL-1α) or low concentration cytokines (2ng/ml TNFα, 0.2ng/ml OSM, 0.1ng/ml IL-1α) in order to mimic the osteoarthritic environment. Cartilage breakdown was measured by DMMB assay in order to assess the percentage loss of sulphated-glycosaminoglycan (sGAG) from the explant to the media during culture. Expression levels of the pro-inflammatory molecules nitric oxide and prostaglandin E2 (PGE2) were measured using the Griess assay and a PGE2 ELISA respectively.
Results: Significantly more sGAG was lost from knee cartilage exposed to 100ng/ml TNFα (22.2% vs 13.2%, P=0.01) and 100ng/ml TNFα in combination with 5ng/ml IL-1α (27.5% vs 16.0%, P=0.02) compared to sGAG release from the ankle; low cytokine concentrations did not affect sGAG release. All high concentration cytokine treatments resulted in production of more nitrite and PGE2 compared to low concentrations; however, no significant difference was noted between joints.
Conclusion(s): Cartilage from the knee and ankle has a divergent response to stimulation by pro-inflammatory cytokines, with high concentrations of TNFα alone, or in combination with IL-1α amplifying cartilage degeneration in the knee only.
Implications: This differential response may account for the high prevalence of knee compared to ankle arthritis and provide a future pharmacological target.
Conflict of Interest: Research funding received from the British Orthopaedic Foot and Ankle Society

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YES-ASSOCIATED PROTEIN (YAP) - A TARGET FOR JOINT HOMEOSTASIS?

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Background: Mesenchymal Stromal/Stem Cells (MSCs) have been identified in the synovium. MSC proliferation is associated with synovial hyperplasia in response to Joint Surface Injury (JSI). Uncontrolled Yap activity, a key Hippo pathway transcription co-factor, causes tissue overgrowth due to modulation of stem cell proliferation.
We hypothesised that YAP plays a role in the proliferation of MSCs and resulting synovial hyperplasia following JSI.
Methods: A time point analysis of Yap expression was performed using the JSI model in C57Bl/6 mice, using immunostaining and qPCR. Synovial samples from patients with normal, osteoarthritic and trauma joints were similarly analysed. Gdf5-Cre;Yap1fl/fl;Tom mice were created to determine the effect YAP1 knockout in Gdf5 lineage cells on synovial hyperplasia after JSI.
Results: In mice, on immunochemistry, Yap was highly expressed in injured knee joint synovium compared to uninjured controls. Yap mRNA levels at 2 ($p< 0.05$) and 8 days ($p< 0.001$) after injury were increased on qRT-PCR.
Conditional Yap1 knockout in Gdf5 progeny cells prevented hyperplasia of synovial lining (SL) after JSI. Cellularity was significantly decreased in the SL but not in the sub-lining of injured Yap1 knockout-compared to control mice. The percentage of cells in synovium that were Tom+ increased in response to JSI in control and haplo-insufficient mice but not in YAP1 knockout mice ($p< 0.05$).
In patients, Yap expression was upregulated in activated synovium, including a subset of CD55 positive fibroblast-like synoviocytes in the SL. Cells staining positive for the proliferation marker Ki67 typically expressed nuclear (active) YAP.
Conclusion(s): YAP is highly expressed in activated synovium. Knockout of Yap in Gdf5 progeny prevents SL hyperplasia following cartilage injury in vivo.
Implications: Modulation of YAP in MSCs in the synovium after JSI provides a system to study whether synovial hyperplasia after trauma is beneficial or not in re-establishing joint homeostasis and osteoarthritis prevention.
Conflict of Interest: None declared

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MECHANICAL PROPERTIES OF PERIPHERAL NERVE: OVINE EXPERIMENTS IN VITRO

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Background: Understanding the biomechanical properties of the peripheral nerve is fundamental in treatment of stretch injuries and nerve repair. However, the mechanical properties and limit of elasticity of the peripheral nerve remained controversial. There is also limited literature which provides mechanical data in the neural layer responsible for mechanical strength.
Methods: In this in vitro experiment, ovine hindlimb nerves were harvested (n=12). The epineurium of the six specimens was circumferentially resected. The specimens were stretched to failure in Zwick Roell Z005 mechanical testing machine at a rate of 1mm per second (~0.5% strain per second). We then compared that to six normal control nerves. The non-linear stress-strain behaviour is representative of soft tissue viscoelastic behavior. At 20%, linear stiffness was achieved until failure, when the load drops abruptly.
Results: The strain experienced at maximum stress ranged from 29% to 52%. Our results showed that in the group with epineurium intact, the peripheral nerves were able to withstand a higher strain at maximum stress.
Conclusion(s): The lack of correlation between two sample groups for other factors show that the perineurium is responsible for providing majority of the tensile strength in peripheral nerves.
Implications: This is a novel technique of understanding mechanical properties of peripheral nerves in a pre-clinical setting. Further studies are required to quantify clinical application, incorporating nerve repair techniques.
Conflict of Interest: None declared

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DIAGNOSING ACUTE COMPARTMENT SYNDROME WITH REAL-TIME INTRAMUSCULAR PH MEASUREMENTS: THE SUPPORTING BASIC SCIENCE

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Background: Delayed diagnosis and ´missed´ acute compartment syndrome (ACS) remain significant problems resulting in permanent symptoms and subnormal function. The problem lies with current diagnostic methods that use unreliable clinical criteria and/or intra-compartmental pressure (ICP) criteria which are subject to patient variation and interpretation. Our research comparing clinical criteria combined with ICP, and continuous intramuscular pH (IMpH) measurements, to diagnose ACS, demonstrated IMpH to be far superior (95% sensitivity, 80% specificity) compared with ICP (65% sensitive, 60% specific). However, little was known about the underlying metabolic events. The aims of this study were to measure metabolites that directly influence tissue pH, comparing these with directly measured pH using a probe, and to measure adenosine triphosphate (ATP) and phosphocreatine (PC) concentrations, relating these to tissue pH and imminent cell death.
Methods: An ischaemic rat muscle model was used (25 rats). An indwelling pH probe was inserted into one block of muscle to give real-time pH readings, while at 15 minute intervals muscle biopsies were removed and SNAP frozen. Each biopsy was prepared as previously described and the concentrations of lactate, pyruvate, glucose-6-phosphate, ATP and PC were measured.
Results: Over time, lactate concentrations increased while the other metabolites all decreased. Using Sahlin´s equation ´calculated´ pH levels were compared directly with ´measured´ pH using the indwelling probe. The correlation between measured/calculated pH was 0.93 with a high measurement of agreement. ATP and PC levels reached a constant baseline level of 3 and 15mmol/kg dw respectively when tissue pH reached 6.4.
Conclusions: We can confirm that IMpH measured using an indwelling pH probe accurately measures IMpH. At pH 6.4, all high-energy phosphate molecules are exhausted at which point cell death is imminent.

Implications: This work supports our previous clinical research. Both studies suggest that IMpH will become the new gold standard for diagnosing ACS.
Conflict of Interest: None declared

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FIBONACCI'S MATHEMATICAL SEQUENCE CAN PREDICT LENGTHS OF THE PHALANGES

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Background: The motion of the tips of the fingers follow an equiangular spiral and as such it has been proposed that the length of the phalanges can be predicted by Fibonacci´s mathematical sequence (0,1,1,2,3,5…). The Fibonacci sequence is one example of a Lucus sequence where each number is the sum of the two preceding numbers. The golden number (1.61803) is the ratio between n_{-1}:n as the sequence progresses.
Methods: We reviewed 200 consecutive PA hand radiographs and measured the actual (P1, P2, P3) and functional lengths (F1, F2, F3) of the phalanges of the index (II), middle (III), ring (IV) and little (V) fingers. Exclusion criteria included patients < 18 years; fractures, OA or congenital deformities.
Results: Both actual and functional measurements of the little finger (V) follow the Fibonacci sequence while functional length of the remaining fingers (II to IV) follow the Lucus sequence 1, 1.3, 2.3. Ratios of adjacent phalangeal lengths followed no discernible pattern (1 to 1.99). P2 + P3 = P1 with a mean accuracy of within 1mm (II 0.3mm, III -0.4mm, IV -0.6mm, V -0.6mm) and standard deviations (1mm to 1.5mm). F2+ F3 = F1 with greater mean accuracy (II 0.1mm, III -0.2mm, IV -0.1mm, V 0.0mm) but slightly greater standard deviations (1.3 to 3mm).
Conclusion: The actual and functional lengths of the little finger follow the Fibonnaci sequence while functional length of the remaining fingers follow “Littlers” sequence (1, 1.3, 2.3). The sum of the actual and functional lengths of the distal and middle phalanges equals the length of the proximal phalanx with great accuracy.
Implications: Our study provides a mathematical system to predict phalangeal lengths to within a millimetre from a single measurement. This has the potential to improve deformity correction surgery, aid complex fracture fixation and improve templating prior to arthroplasty surgery.
Conflict of Interest: None declared

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GRADING KNEE OSTEOARTHRITIS FROM PLAIN FILMS: ARE WE KIDDING OURSELVES?

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Background: There are many methods of grading knee OA, including plain film radiographic scoring systems (e.g. the Ahlback and the Kellegran Lawrence score). Many scores rely on an estimation of where the **normal** joint line was, and have been criticised for a lack of reliability. Improvements in reliability by using templates of “normal” tibias have been reported. However, we have been unable to replicate this in our own institution. Therefore, we questioned if there was a “normal” or “average” tibial shape, or if normal variations in shape precluded the use of refined, accurate grading of knee osteoarthritis on plain radiographs.
Methods: Seventy-five radiographs were selected from our institution's electronic database from a one-month period. Non-rotated images that did not display pathology (judged independently by two authors) were included.
Images were electronically templated using software specifically designed for the purpose. Templates were combined using finite element analysis, which allowed the separation of pose (i.e. rotation) and tibial shape. We then plotted 95% confidence intervals around a mid point on the medial tibial plateau. This allowed us to map how variations in pose and normal variations in shape affected the height of the medial tibial plateau.

Results: The largest source of variation was tibial shape, varying from -2mm to +2mm (4mm range). Although rotated images were excluded, pose (rotation) affected the level of the tibial plateau by -1mm to +1mm.
Conclusion(s): Normal tibial variations in shape alter the height of the tibial plateau by around 4mm. This makes grading systems based on an assessment of a normal joint line prone to large degrees of error.
Implications: Accurate grading of knee osteoarthritis should take into consideration the normal variation in height of the tibial plateau, and we would recommend moving towards more rudimentary grading systems for osteoarthritis using knee radiographs.
Conflict of Interest: None declared

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THE ROLE OF SODIUM-HYDROGEN EXCHANGER REGULATORY FACTOR-1 (NHERF-1) IN OSTEOARTHRITIS

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Background: Osteoarthritis (OA) is a common disease with an unknown pathogenesis. Sodium-Hydrogen Exchanger Regulatory Factor-1 (NHERF-1), which was shown to be down-regulated in OA, has 2 main functions: as a regulator of intracellular pH (pHi) and as a tumour suppressor. We investigated these two functions by looking at the co-localization of NHERF-1 with each of Sodium Hydrogen Exchanger 3 (NHE3; a pHi regulator), Phosphatase and Tensin Homologue (PTEN) and β Catenin (tumour suppressor proteins) in human articular chondrocytes. A pilot study to determine p53 (tumour suppressor) localization was also performed.
Methods: Immunofluorescence was done on OA and non-OA human articular cartilage sections. Three co-localization experiments were performed: NHERF-1 with each of NHE3, PTEN and β Catenin. p53 localization was also performed. Sections were imaged using fluorescence and confocal microscopy to determine localization. Quantitative data on proportion of co- localization and degree of co-localization of proteins was determined from the images using ImageJ.
Results: NHERF-1 co-localizes with NHE3 and PTEN within the cytoplasm in both OA and Non-OA chondrocytes. This was unexpected, as NHERF-1 localizes to the plasma membrane in other cell types. NHERF-1 shares a similar subcellular localization with β Catenin. p53 is expressed in articular cartilage and was found in the cytoplasm of OA chondrocytes, in contrast to a peri-nuclear distribution of Non- OA chondrocytes.
Conclusion(s): Our findings show that NHERF-1 acts as more of a tumour suppressor than a pHi regulator in chondrocytes.
Implications: Down-regulation of NHERF-1 may contribute to the pathogenesis of OA.
Conflict of Interest: None declared

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DOES CORTICAL ACTIVATION HOLD THE KEY TO SHOULDER INSTABILITY?

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Introduction: Neuroimaging offers clinically relevant insights into orthopaedic conditions that are poorly understood. We investigated a group of patients with shoulder instability that is caused by muscle patterning and atraumatic structural issues.
Methods: We recruited 16 patients with shoulder instability (Polar Type II/III - Standmore Triangle) and 16 age matched controls. Both groups underwent Functional Magnetic Resonance Scanning whilst undertaking simple shoulder movements and Diffusion-weighted magnetic resonance imaging. The Oxford Instability Shoulder Score and Western Ontario Shoulder Instability Index was completed by both groups.

Results: The patient group overall had higher levels of activation within both their white and their grey matter. An area of activation unique to the patient group was identified in the motor cortex (p=< 0.001). Further, in the white matter, the neutral tracks of the patient group were different (p=< 0.013). The variation is particularly concentrated in the corpus callosum, which is the interconnection area of the premotor, supplementary motor and motor cortex.
Discussion and conclusion: The work demonstrates for the first time that the pathophysiology of these patients is very different: that there is a fundamental difference in the cortical activation of shoulder movement in these patients. We suggest that these cortical activations are evidence of a simultaneous provoking and compensatory strategies to maintain a fragile stability. This builds on other work that has identified differences in other patient groups with movement dysfunction, such as Dystonia. In such conditions, biofeedback techniques have enable cortical activations patterns to be changed as a therapeutic intervention.
Conflict of Interest: None declared

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CHARACTERIZING THE INFLUENCE OF VITAMIN K2 ON OSTEOCYTE FUNCTION

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Background: 1 in 2 postmenopausal women will have an osteoporotic fracture during their life. Postmenopausal osteoporosis and its prevention represents a major challenge for healthcare systems. Vitamin K2 has previously been implicated in reducing the incidence of postmenopausal fractures in Japan but the therapeutic mechanism is unclear. This project aimed to characterize the effect of vitamin K2 in osteocytes, the most abundant cell type in bone and an identified mediator in the pathogenesis of postmenopausal osteoporosis.
Methods: IDG-SW3 cells which are able to undergo osteoblast to osteocyte transition were treated with vitamin K2 (5mM - 80mM) or a combination of vitamin K2 and zolendronic acid in vitro and assessed for cell proliferation (MTS assay), gene expression (RT-qPCR) of key genes (OPG, RANKL, DMP1, sclerostin, VEGF) and protein secretion (IL-6 and VEGF; ELISA).
Results: The expression of OPG was increased in both osteoblasts (p=< 0.0001, 95% CI [4.074, 9.545]) and osteocytes (p=< 0.0001, 95% CI [2.563, 4.097]) with 80mM vitamin K2 treatment. There was also increased expression of DMP1 in osteocytes (p=0.0003, 95% CI [0.7179, 2.584]) with 80mM vitamin K2 treatment. There was no influence of vitamin K2 on RANKL, sclerostin or IL-6 production. There was increased secretion of VEGF in osteocytes treated with 20mM vitamin K2 plus 10mM zolendronic acid (p=0.0341, 95% CI [0.03211, 0.9472]).
Conclusion(s): Vitamin K2 may play a role in modulating signaling in osteocytes and osteoblasts towards bone formation by upregulating OPG expression, in addition to the promotion of matrix formation in osteocytes through upregulation of DMP1. Vitamin K2 may also have a role in promoting bone formation in combination with Zolendronic acid through increased osteocyte VEGF protein secretion.
Implications: Vitamin K2 has been identified as a possible therapeutic adjunct to stimulate osteogenesis. Further in vitro studies using mechanically loaded models are required to validate these results.
Conflict of Interest: None declared

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FIXATION OF ANKLE FRACTURES - A MAJOR TRAUMA CENTRE'S EXPERIENCE IN IMPROVING QUALITY

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Background: Ankle fracture mal-reduction has been shown to result in poor functional outcomes long term. We present 2 audit cycles in our pursuit to improve the quality of ankle fracture fixation in our centre.
Methods: 2 audit cycles were performed incorporating 3 audit data collections, an initial standard setting in 2013, a second audit in 2015 and a repeat audit in 2017. Between the first and second audit

was a period of education and reflection. Between the second and third audit there was a change in process in ankle fracture management supported by education. Image intensifier films were reviewed on PACS and scored based on the criteria published by Pettrone et al.
Results: In the initial audit cycle in 2013 there were 94 patients, with a mal-reduction rate of 33% on Pettrone´s criteria. In the second audit there were 68 patients, with an unchanged mal-reduction rate of 34%. In the third audit there were 207 patients, with a significant decrease in mal-reduction rate to 2.4%. The final revision rate was 1.4%. The rate of deep infection was 0.5%.
Conclusion(s): By recognising and then addressing the need to improve the quality of ankle fracture fixation we have made a significant improvement. Initial intradepartmental education was not successful, even with constant consultant presence in theatre. The results of the second audit brought about hard changes within the department, which included the appointment of a foot and ankle trauma lead and the use of treatment algorithms for certain ankle fracture types. This resulted in a significant improvement in ankle fracture reduction.
Implications: Education without system change is not successful in achieving improved outcomes. As more departments are presenting high ankle mal-reduction rates, we have illustrated a model that could be adopted in most departments and provide benefit to a large number of patients.
Conflict of Interest: None declared

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THE RESISTANCE TO FAILURE OF SPRING LIGAMENT RECONSTRUCTION

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Background: The spring ligament (SL) is increasingly recognised as the major structure that fails in tibialis posterior dysfunction. Lateral translation of the foot has been shown to be most influenced by SL integrity. We used lateral translation of the foot as a measure to assess the integrity of various methods of repair/reconstructions of the SL. To date this is the first study to demonstrate the integrity of repair of the SL.
Methods: Six pairs of fresh frozen cadavers were setup in a standardised fashion with ankle in plantargrade (mean age 59 years, BMI 25).
A 25N lateral force was applied to the medial first metatarsal head using an algometer. Lateral displacement of the foot was measured with SL intact, sectioned, following FibreWire repair, then Internal Brace reconstruction, then with selective sectioning of each limb of the Internal Brace reconstruction.
Results: In 12 specimens, overall lateral translation with SL intact was 21mm+-4.9. This increased to 39.2mm+-10.9 ($p < 0.05$) with SL sectioning, no significant improvement to 34.2mm+-9.5 with repair ($p=0.159$), before significantly returning to baseline 16.55mm+-5.1 ($p < 0.001$) with the Internal Brace. Augmenting with FDL did not influence lateral translation ($p = 0.586$).
Conclusion(s): Restoration of SL integrity is fundamental to prevent flat foot. Our study shows traditional repair models fail to provide sufficient resistance to planovalgus. Using an augmented device such as the Internal Brace provides optimal resistance to lateral translation and hence planovalgus, particularly the plantar limb of augmentation.
Implications: Flat foot reconstruction is undertaken routinely using untested various methods of reconstruction of the SL with mixed outcomes and uncertainty of the best option. Our study shows augmented repair of the SL is a viable option as it provides the best resistance to lateral translation.
Conflict of Interest: None declared

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OUTCOMES FOLLOWING SILASTIC ARTHROPLASTY OR 1ST METATARSOPHALANGEAL JOINT ARTHRODESIS FOR HALLUX RIGIDUS: A PROSPECTIVE COMPARATIVE SERIES

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Background: Both 1st MTPJ arthrodesis and silastic arthroplasty have been shown to provide good long-term outcomes for end-stage hallux rigidus. Whilst novel implants are compared against arthrodesis as the gold standard, there are currently no published studies comparing Swanson silastic

arthroplasty with arthrodesis. We present a comparison of outcomes in patients who had these procedures performed after a shared decision-making process.
Methods: Consecutive patients who received 1st MTPJ arthrodesis or silastic arthroplasty for hallux rigidus between June 2014 and November 2015 were included. Patient demographics, complications and prospectively collected pre-operative and 6-months post-operative PROMS (MOXFQ and VAS) were reviewed.
Results: 61 patients received silastic arthroplasty (52 female, mean age 63 years) and 61 patients received arthrodesis (25 female, mean age 60 years). There was 1 post-operative infection and 1 reoperation (conversion to fusion) in the silastic arthroplasty group, and 1 post-operative infection and 6 reoperations (4 removal of prominent metalwork, 2 revision fusions) in the arthrodesis group. Complete PROMS data was available for 53% of patients. There was a significant improvement in MOXFQ and VAS following both silastic arthroplasty (MOXFQ mean change 18, p=0.005; VAS mean change 24, p=0.0004) and arthrodesis (MOXFQ mean change 38, p< 0.0001; VAS mean change 44, p< 0.0001). There was a significant difference in mean improvement of both MOXFQ and VAS in favour of arthrodesis (MOXFQ p=0.0004, VAS p=0.002). Patient satisfaction scores rated better for arthrodesis than silastic arthroplasty with ratings of “Excellent” or “Good” in 87% and 73% respectively.
Conclusion(s): Both silastic arthroplasty and arthrodesis have shown a significant improvement in pain and function, with low complication rates. In these cohorts, arthrodesis showed a greater improvement than silastic arthroplasty in patient reported outcomes but was associated with a higher reoperation rate.
Implications: This local data can be utilised when counselling patients in a shared decision-making process.
Conflict of Interest: None declared

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THE DELTOID LIGAMENT: THE GATEKEEPER TO MIDFOOT COLLAPSE IN ADULT ACQUIRED FLATFOOT DISORDER

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Background: The medial ligaments are integral in stabilising the medial column. Failure of these structures causes flatfoot deformity (AAFD). The spring ligament (SLC) includes the medial capsule of the talonavicular joint and merges with the anterior-superficial component of the deltoid complex, stabilising the talonavicular joint. However, when disrupted, it does not cause deformity until the foot is cyclically loaded. We hypothesise that the next structure to fail is the tibionavicular component of the Deltoid complex(TN).
Methods: A prospective case control study used a novel MRI technique to image the TN. We scanned 20 consecutive normal feet and 20 with clinical and radiological AFFD. We assessed for pathology in the SLC, deltoid and PT. Imaging of the TN was performed using an oblique T1 and T2 sequence in the plane of the TN. All patients also had weight bearing AP and lateral radiographs. Patients were followed up, with the end point being surgery or definitive conservative management and discharge.
Results: 2 distinct groups of patients were identified:
Normal TN (11/20)
A mixture of medial ligament pathology was associated with this. All were managed conservatively and discharged from follow-up. The mean Meary´s angle was 6.8°.
Abnormal TN (9/20)
The ligament was thickened proximally, with distal attenuation and intrasubstance oedema. On sagittal sequence it had the appearance of an omega (Ω), with dorsal bulging and high signal. The mean Meary´s angle was 13.2°(p 0.013). All patients had PT dysfunction and 8 had SLC attenuation. 5 of these patients had undergone corrective surgery. None had been discharged.
Conclusions/implications: Imaging of the TN is valuable in AFFD, adding no cost or risk. Sequential failure of the medial ligaments occurs in AFFD. We have shown that deltoid is involved more often than previously reported. When the TN is attenuated, this represents a foot transitioning to a more severe, less flexible planovalgus deformity, often requiring corrective surgery.
Conflict of Interest: None declared

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THE USE OF A DORSAL LOCKING PLATE IN ARTHRODESIS OF THE FIRST METATARSOPHALANGEAL JOINT. DOES PREOPERATIVE HALLUX VALGUS INCREASE THE RATE OF NON-UNION?

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Background: Our aim was to retrospectively identify risk factors for delayed/non-union of first metatarsophalangeal joint arthrodesis using a dorsal plate with cross screw.
Methods: Case note and radiograph analysis was performed for operations between April 2014 and April 2016 with at least 6 months´ post-operative follow up. Surgery was performed through a dorsal approach using a dorsal locking plate with compression screw (Anchorage, Stryker). Blinded preoperative AP radiographs were analysed for the presence of a severe hallux valgus angle equal to or above 40 degrees. Intraobserver reliability was acceptable (95% CI: 1.6-2.3 degrees). Smoking and medical conditions associated with non-union underwent univariate analysis for significance.
Results: 71 1st MTPJ attempted fusions in 62 patients were included in this study. Patients mean age was 61 years (range, 29 to 81); with an average mean follow up of 13 months (range, 6 to 30 months). A total of 7 patients were identified as non/delayed union (9.9%). Of these, all had moderate to severe hallux valgus deformities (hallux valgus angle >25º). There were 32 moderate to severe hallux valgus deformities in total. All smokers healed (n = 13). Age, rheumatoid arthritis, diabetes mellitus, steroid use and renal failure all failed to demonstrate a significant association with non-union. Moderate to severe hallux valgus (relative risk: 1.29, $p < 0.005$) and under correction of >25º valgus at the MTPJ (relative risk: 14.44, $p < 0.001$) were both significantly associated with non/delayed union.
Conclusion(s): Preoperative severe hallux valgus and under corrected deformity are the most significant risk factors for non-union of 1st MTPJ arthrodesis using dorsal plate fixation.
Implications: This construct does not neutralise transverse plane deformities and supplemental fixation techniques may be needed in severe deformities.
Conflict of Interest: Andrew Molloy is a consultant for Stryker

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THE LEICESTER ACHILLES MANAGEMENT PROTOCOL (LAMP): A TREATMENT STRATEGY FOR ACHILLES RUPTURE

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Background: Conservative treatment of acute AT ruptures with functional rehabilitation has demonstrated superior results with equal reported re-rupture rates but without the added complications of surgical treatment. There is no consensus on the duration and method of treatment using functional rehabilitation regimes. The purpose of this paper is to define our treatment regime, the Leicester Achilles Management Protocol (LAMP), supported with patient reported outcomes and objective measures of assessment.
Methods: All patients with an acute achilles tendon rupture were treated with the same non-operative LAMP functional rehabilitation regime in a VACOped boot for 8 weeks. 12 months post rupture ATRS scores and objective measures of calf muscle girth and heel raise height were obtained and analysed. Venous thromboembolic rates and rates of re-rupture were recorded.
Results: 442 patients were treated with this regime between February 2011 and December 2015. The incidence of a thromboembolic event was 5.9% and a re-rupture rate of 2%.
The ATRS score at 12 months was available in 200 patients. Objective measures were available in 50 patients. The average age was 50 years (range 21-82). The average ATRS score was 75.3 (SD 22, 95% CI 72.2 - 78.4) at an average follow up of 25 months post injury. Men had better ATRS than women ($P< 0.05$).
The calf muscle girth and heel raise height were significantly different from the uninjured side. However these did not correlate with the ATRS ($P>0.05$)
Conclusion(s): The LAMP is a simple, effective regime which is very easy to adopt and involves a VACOped boot for 8 weeks. Compared to other studies, the overall time in the boot is less with similar patient reported outcomes.
Implications: Simple non-operative functional rehabilitation regime that can be applied to all patients with acute achilles tendon ruptures.
Conflict of Interest: None declared

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BURIED K WIRE TECHNIQUE FOR PIP FUSION

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Background: Proximal inter-phalangeal joint (PIPJ) arthrodesis is a commonly performed procedure as a part of hammer and claw-toe correction. Conventional K-wire stabilisation has the potential disadvantages of infection, violation of the DIP joint, external protrusion of the wire and necessity of removal. Newer intra-medullary stabilisation devices are also available, though tend to incur addition costs. We present our technique and results of using a single, buried 1.6 mm K-wire for proximal inter-phalangeal joint fusion.
Methods: With the objective of assessing union rates and patient satisfaction following intra-medullary K wires for PIP joint fusion, our method was as follows. We reviewed 26 consecutive patients (36 toes) who had undergone hammer or claw-toe correction. Case notes and radiographs were reviewed to establish results and complications and the need for revision surgery. Initial radiographs were taken at 6 weeks and a telephone survey was undertaken to assess patient satisfaction (16-44 weeks).
Results: Nineteen women and 5 men underwent surgery with a mean age of 59 years (24-77). Stable union was achieved in 33 of 36 toes. No patients had superficial or deep infection. No patient required wire removal or a revision procedure.
Conclusion(s): PIPJ Arthrodesis with buried K Wires has excellent clinical outcome and high patient satisfaction.
Results: Nineteen women and 5 men underwent surgery with a mean age of 59 years (24-77). Stable union was achieved in 33 of 36 toes. No patients had superficial or deep infection. No patient required wire removal or a revision procedure.
Conclusion(s): PIPJ Arthrodesis with buried K Wires has excellent clinical outcome and high patient satisfaction.
Conflict of Interest: None declared

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MANIPULATION UNDER ANAESTHESIA AND STEROID INJECTION FOR PAIN & STIFFNESS AFTER SURGERY TO THE FIRST METATARSOPHALANGEAL JOINT

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Background: Stiffness of the first metatarsophalangeal joint (1st MTPJ), after hallux valgus and hallux rigidus surgery is common. We aimed to determine the effectiveness of manipulation under anaesthesia and local steroid injection to treat arthrofibrosis of the 1st MTPJ following surgery.
Methods: Patients were identified who had undergone surgery for hallux rigidus or hallux valgus and were subsequently treated with manipulation and steroid injection for stiffness of their joint. Patient records were reviewed to determine the range of movement of the joint prior to and following treatment. Manchester-Oxford Foot Questionnaires (MOXFQ) were sent to patients to evaluate symptoms post-operatively.
Results: In total, 35 patients were analysed, which included a total of 38 foot operations where post-operative stiffness of the 1st MTPJ occurred. Twenty- seven had index procedures for hallux rigidus and 11 for hallux valgus correction. The total range of movement improved following manipulation by an overall mean of 44.7 degrees ($p < 0.0001$). In the hallux rigidus group the mean ROM improved by 43.9 degrees in the hallux valgus group the mean improvement was 46.8 degrees ($p < 0.0001$). At subsequent follow up the total range of movement of the joint was still improved by 23.8 degrees ($p < 0.0001$) overall. The majority of patients reported none or only rare limitations to activities on post-operative MOXFQ questionnaires. However, there was no correlation with increase in ROM and MOXFQ score using the Kendall correlation (tau b=0.04).
Conclusion(s): Manipulation under anaesthesia and local steroid injection is an effective way of treating stiffness of the 1st MTP joint following surgery and results in an improved total range of movement of the joint.
Implications: This technique may help to postpone more radical surgery such as joint

fusion in patients suffering from stiffness from hallux rigidus or hallux valgus surgery.
Conflict of Interest: None declared

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SPEEDBRIDGE RE-ATTACHMENT OF THE ACHILLES TENDON FOR INSERTIONAL TENDINOPATHY

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Background: Recalcitrant insertional Achilles tendinopathy presents a surgical challenge. Associated Haglund lesions often need removal alongside pathological tendon, which can compromise the integrity of the insertion. The Arthrex Speedbridge is an innovative knotless anchor device, enabling Achilles tendon re-attachment following complete detachment and debridement. The technique has been performed at our Trust since June 2014 for all surgical cases that have failed conservative measures where there is a threat to the Achilles insertion integrity. We present a minimum four month follow-up of the largest patient group currently available in the literature.
Methods: All patients treated with Achilles tendon debridement and Speedbridge re-attachment from June 2014-August 2016 were identified. The Manchester-Oxford Foot Questionnaire (MOxFQ) and a satisfaction survey were sent to all patients. All patient correspondence, operative reports, clinic letters and discharge summaries were reviewed. Follow-up telephone interviews were carried out with non-responders.
Results: A total of 38 patients were identified. 29/38 completed the questionnaires (response rate 76%). There were no re-ruptures or wound complications. The mean MOxFQ score was 27.3% and the mean satisfaction score was 9.1/10 (10=very satisfied). 97% would have the procedure again and 66% were working post-surgery. The mean time to return to work was 14 weeks. 34% were playing sport following fixation, including squash and football.
Conclusion(s): Detachment, debridement and Speedbridge reattachment is a safe and effective treatment for insertional Achilles tendinopathy with high MOxFQ and satisfaction scores.
Implications: This paper supports the use of the Arthrex Speedbridge for tendon re-attachment following surgical debridement of Achilles tendinopathy.
Conflict of Interest: None declared

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DEFINING GASTROCNEMIUS TIGHTNESS-A STUDY ON 400 PARTICIPANTS WITHOUT FOOT AND ANKLE PATHOLOGY

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Background: Gastrocnemius tightness is believed to be associated with multiple musculoskeletal pathologies of the foot and ankle such as metatarsalgia, plantar fasciitis and achilles tendinopathy. Surgical release or recession of the gastrocnemius is gaining popularity in the treatment of such conditions. However the objective definition of a gastrocnemius contracture has not been determined. The aim of our study was therefore to quantify gastrocnemius tightness in a normal population without foot and ankle pathology.
Methods: Adult participants with no obvious pathology or previous surgery of the foot and ankle were recruited. Demographic data was collected and gastrocnemius tightness was quantified using a weight-bearing lunge test. Maximal ankle dorsiflexion was measured on both ankles with the knee in extension and flexion using a digital inclinometer. The difference in ankle dorsiflexion, an objective measure of gastrocnemius tightness was then calculated and subjected to statistical analysis.
Results: 400 participants were recruited. The ankle dorsiflexion difference (ADD) ranged from 0-19 degrees and approximated to a normal distribution. The mean ADD was found to be 6.04 degrees. The ADD was positively correlated with age (Pearson´s correlation co-efficient 0.133, $p< 0.05$) and negatively correlated with physical activity (Pearson´s correlation co-efficient -0.87, $p< 0.05$). Results by ethnicity revealed that the largest ADD of 8.26+/-3.52 was observed in our Afro-Caribbean cohort ($p< 0.05$).

Conclusion(s): Our study is the first to quantify gastrocnemius tightness in a healthy adult population with differences noted according to age, ethnicity and physical activity. Further work should be aimed to quantify the ADD in patients with foot and ankle pathology thereby identifying the conditions most associated with gastrocnemius tightness.
Implications: By defining what constitutes gastrocnemius tightness, our results will aid in the decision-making process regarding surgical intervention of gastrocnemius tightness. Further work is needed to evaluate clear indications for surgical management of gastrocnemius contracture.
Conflict of Interest: None declared

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PATIENT FACTORS AFFECTING OUTCOME FOLLOWING MORTON'S NEUROMA EXCISION: A PROSPECTIVE STUDY

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Background: Patient-reported outcomes and satisfaction scores following excision of interdigital Morton´s neuroma have been recently established. However, little is known regarding what patient factors affect these outcomes. This is the first and largest prospective study to determine which patient factors influence surgical outcome following Morton´s neuroma excision.
Methods: Over a seven-year period, 99 consecutive patients (112 feet) undergoing surgical excision of Morton´s neuroma were prospectively studied. 78 patients were female with a mean age at operation of 56 years. Patient-recorded outcomes and satisfaction were measured using the Manchester-Oxford Foot Questionnaire (MOXFQ), Short Form-12 (SF12) and a supplementary patient satisfaction survey three months pre- and six months post-operatively. Patient demographics were recorded in addition to co-morbidities, deprivation, associated neuroma excision and other forefoot surgery.
Results: Obesity, deprivation and revision surgery proved to statistically worsen MOXFQ outcomes post-operatively ($p=0.005$, $p=0.002$ and $p=0.004$ respectively). Deprivation significantly worsened the mental component of the SF12 ($p=0.043$) and depression the physical component ($p=0.026$). No difference in outcome was identified for age, sex, time from diagnosis to surgery, multiple neuroma excision and other forefoot surgeries. 23.5% of deprived patients were dissatisfied with their surgery compared to 7% of the remaining cohort.
Conclusion(s): Patient-reported outcomes following resection of symptomatic Morton´s neuroma are shown to be less favourable in those patients who display characteristics of obesity, depression, deprivation and in those who undertake revision neuroma resection. Surgery can be safely delayed, as time to surgery from diagnosis bears no impact on clinical outcome.
Implications: This study may aid guidance in deciding which patients should undergo an extended period of conservative treatment prior to consideration of operative intervention based on known poor prognostic factors.
Conflict of Interest: None declared

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REDUCING THE HYPERTENSIVE EFFECTS OF THE PROLONGED SURGICAL TOURNIQUET USING A DUAL-CUFF STRATEGY: A PROSPECTIVE RANDOMISED CONTROLLED TRIAL

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Background: We evaluated whether moving the "line of crush" from the thigh to the calf prior to onset of tourniquet mediated hypertension would prevent or diminish this physiological response during Foot & Ankle Surgery. We also evaluated any change in pain or functional outcome.
Methods: Twenty adult patients were recruited and randomly assigned to either control or intervention groups. Exclusion criteria included: contraindication to general anaesthesia, peripheral neuropathy affecting lower limbs of any aetiology, chronic pain requiring regular opiate analgesia. The intervention group received a thigh tourniquet for 60 minutes after which a calf tourniquet was inflated, and the thigh deflated. The control group received only a thigh tourniquet throughout surgery.

Results: At 90 minutes, control group had mean arterial pressure of 86.8mmHg, compared to the intervention group at 76.3 (p=0.014). At end of surgery the difference had increased further (control 98.1mmHg, intervention 78.3mmHg; p= < 0.001).
Conclusion(s): Moving the "line of crush" during limb tourniquet application prevents development of the hypertensive response.
Implications: For cases where a prolonged tourniquet application is required, a dual tourniquet technique will prevent intra-operative hypertension, and may influence long-term pain and function.
Conflict of Interest: None declared

Knee free papers

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UNSATISFACTORY OUTCOMES FOLLOWING UNICOMPARTMENTAL KNEE REPLACEMENT FOR PARTIAL THICKNESS CARTILAGE LOSS: A MEDIUM TERM FOLLOW UP

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Background: Whilst medial UKR is indicated for full-thickness cartilage loss (FTCL), on occasion it has been used to treat partial-thickness cartilage loss (PTCL). This matched case-control study investigates the five-year outcomes in a consecutive series of UKR implanted for PTCL.
Methods: Between 2002 and 2014, 94 consecutive UKR (90 patients) were implanted by two surgeons for PTCL and followed up independently for a mean 6 years (range 1-13). These cases were matched 1:2 based on age, gender and preoperative OKS with knees with FTCL OA managed with UKR. Functional outcomes, implant survival and reoperations were assessed at one, two and five years. A sub-study of 36knees (36patients) with PTCL who had had pre-operative MRI was performed to identify whether there were MRI factors that predicted outcomes.
Results: Knees with PTCL had worse functional outcomes (OKS and AKSS-O) at all timepoints. A quarter of knees with PTCL reported fair or poor results and a fifth failed to achieve a clinically significant improvement from baseline, double that seen in knees with FTCL. Whilst no difference in implant survival was detected between groups, knees with PTCL had a triple the reoperation rate with the majority, three-quarters, being arthroscopies for persistent pain. Patients with PTCL who achieved fair or poor outcomes were younger with worse preoperative functional scores, compared to those who achieve good or excellent outcomes however no other differences in baseline demographics were seen. MRI findings (FTCL, subchondral oedema, synovitis or effusion) did not provide additional prognostic information.
Conclusion(s): Medial UKR should be reserved for patients with FTCL, whilst some patients with PTCL do achieve good results, at present, we cannot identify which these will be and in this situation MRI is not only unhelpful but also misleading.
Implications: Medial UKR should be reserved for patients with FTCL.
Conflict of Interest: The author or one or more of the authors have received or will receive benefits for personal or professional use from a commercial party related directly or indirectly to the subject of this article. In addition, benefits have been or will be directed to a research fund, foundation, educational institution, or other non-profit organisation with which one or more of the authors are associated.

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A RANDOMIZED CLINICAL TRIAL ON PATELLOFEMORAL VS. TOTAL KNEE REPLACEMENT FOR PATELLOFEMORAL OSTEOARTHRITIS

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Background: Controversy exists over the surgical treatment for patellofemoral osteoarthritis. We aimed to compare the outcome of patellofemoral (PFA) to total knee arthroplasty (TKA) in a double-blinded RCT. The outcome was patient-reported (SF36, OKS, KOOS) and clinical.
Methods: The study was conducted as a multicentre trial. Patients were eligible if they had debilitating symptoms and isolated patellofemoral disease. One-hundred patients were randomized to PFA or TKA (double-blinded for the first year). Patients were seen for clinical follow-up and completed questionnaires. The current study reports on the full data for the first two years and 50 patients have been followed for more than five years. SF-36 bodily pain was primary outcome.

Results: The preoperative range of movement was 132 degrees (SD=12.0), and at four months, one year and two years, the PFA group had a better range of movement than the TKA group (126 vs. 113 (p< 0.001), 129 vs. 121 (p=0.002) and 130 vs. 121 (p=0.001)). The “bodily pain” and “physical functioning” of the SF-36, the “symptoms” dimension of the KOOS and the OKS showed all a significantly better result for PFA compared to TKA patients. The area under the PFA and TKA curve for the “bodily pain” was 9.4 vs. 6.6 months after two years (p=0.011). Similar figures were found for other patient-reported outcomes. During the observation period, there were three revisions (two PFA and one TKA) and no difference in reoperations.
Conclusion(s): PFA patients recover quicker and get a better functional and self-assessed outcome. The average TKA patient looses almost three months of knee function during the first two years relative to a PFA patient. We believe that patellofemoral implants should be used rather than total knee arthroplasty for patients with PF-OA. Registers cannot reliably compare different implant types.
Conflict of Interest: This study was supported equally by Stryker and Protesekompagniet (Danish DePuy distributor).The first author has done lecturing for both Stryker and Protesekompagniet.

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THE CORRELATION BETWEEN PATIENT REPORTED OUTCOME MEASURES AND ADVANCED BIOMECHANICS IN KNEE OSTEOARTHRITIS

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Background: Patient reported outcome measures (PROMs) are commonly used as the primary method of assessing levels of pain and function in patients with knee osteoarthritis (OA). However, quantitative information on knee function cannot be gained through these subjective assessments alone. This study aimed to correlate frequently used PROMs against advanced biomechanics in knee osteoarthritis.
Methods: Fifty adults (26 males & 24 females) with end-stage knee OA completed Oxford Knee Score (OKS) and SF-12 PROMs then underwent functional assessments with a bespoke motion capture system. Maximum active knee range of motion, knee flexor and extensor strengths and spatio-temporal parameters of gait were recorded and statistically analysed for correlations with the OKS and functional scores of the SF-12 questionnaires ($\alpha = 0.05$).
Results: At a significance level of $p < 0.05$ no correlations ($r < 0.4$) were found between PROMs and functional assessment results. The strongest correlations were between the physical SF-12 scores and maximum extensor strengths ($r = 0.295$, $p = 0.038$).
Conclusion(s): Objective functional capacity assessments of patients with knee OA did not correlate with the OKS or physical scores of the SF-12. These PROMs may be unreliable as they rely on patients being able to recall the kinds of activities they can carry out, and to what extent.
Implications: Functional PROMs scores can be used to supplement objective data recorded through functional assessments but are not reliable as a primary measure.
Conflict of Interest: None declared

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RANDOMISED CONTROL TRIAL : THE FUNCTIONAL BENEFITS OF RETAINING THE INFRAPATELLAR FAT PAD IN A TOTAL KNEE REPLACEMENT

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Introduction: This is a randomised control study to analyse whether the excision of the intrapatellar fat pad (Hoffa´s fat pad) during a Total Knee Replacement alters the post-operative pain and/or function. Previous studies found no difference in postoperative pain whether the fat was removed or not, but did not consider the functional outcomes between the two groups.

Method: Patients listed for a primary total knee replacement for osteoarthritis were recruited. The operating surgeons agreed a strict standardised protocol on the extent of soft tissue dissection. The patients undertook Oxford Knee Score, KOOS Score, Lysholm Score, Kujala Score, and Visual Pain Scale preoperatively at 3, 12 and 24 months postoperatively. A single blinded randomisation was adopted as to whether the fat pad was removed (Fat Pad Removed Patients) or not (Fat Pad Retained Patients).
Results: 66 patients were recruited, with similar demographics: Fat Pad Removed Patients had an average age of 67(54-85) and the Fat Pad Retained Patients 68 (51-82). Further, the two groups of patients had a similar preoperative function and pain. Across the measures employed, there was no significant difference in the two groups at 3 months postoperatively. However, at 12 months following the Total Knee Replacement, those patients who had retained their infrapatellar fat pad across the measures performed more favourably. There were significant differences in the KOOS Score ($p=0.022$) between the two groups. A similar picture was seen at 24 months post operatively.
Discussion and conclusion: This study is the first to consider the functional outcomes in relation to the removal of the infrapatellar fat pad during a primary knee replacement. The results demonstrate that at 12 and 24 months there is a significant difference, using the KOOS Score as a measure, in the patients who retained their infrapatellar fat during a primary total knee replacement.
Conflict of Interest: None declared

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2D/3D EOS IMAGING VERSUS STANDING LONG LEG X-RAY IN LOWER LIMB CLINICAL ASSESSMENT - INTER-OBSERVER AND INTRA-OBSERVER RELIABILITY

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Background: X-ray imaging is widely used as the gold standard for assessing lower limb conditions, such as arthritis, and for pre-operative planning. New low-radiation-dose EOS imaging system enables weight-bearing 3D imaging so it accounts for limb deformities and aids accurate pre-operative planning. The objective is to measure lower limb angles from EOS images to determine its accuracy, repeatability and reproducibility compared with standing long-leg x-ray radiographs.
Method: Over 1 year patients with end stage osteoarthritis were recruited from preoperative clinics. 40 long leg 2D EOS, 3D EOS images and x-ray radiographs were measured independently by 4 observers (2D EOS and x-ray: fAMA, mLDFA, aLDFA, MPTA, LDTA; 3D EOS: femur and tibia length, varus/valgus, fAMA, mLDFA, and MPTA). 2 observers repeated the measurements on 2D EOS and x-ray imaging.
Results: T-test and Bland-Altman (BA) analysis comparing 2D EOS with x-ray imaging showed that there was significant difference in MPTA (85.20 vs. 86.14, $p=0.04$), and no statistical difference in the other 4 measurements. T-test comparing 3D EOS with 2D EOS imaging showed no significant difference in all angles ($p>0.05$), and 3D EOS with x-ray radiographs measurements showed no significant difference in fAMA and mLDFA, apart from measuring MPTA (84.50 ± 3.07 vs. 86.27 ± 4.02, $p=0.03$). Linear regression analysis carrying out after BA analysis showed good agreement when measuring fAMA, mLDFA, aLDFA, and LDTA by 2D EOS and x-ray, 3D EOS and 2D EOS, and measuring fAMA and mLDFA by 3D EOS and x-ray. Inter-observer ICC for 2D EOS and x-ray was 0.99 and 0.99 respectively. The intra-observer ICC for 2D EOS and x-ray was 1.00 and 1.00 respectively. Both modalities have excellent repeatability and reproducibility.
Conclusion: This study has shown EOS imaging system as a valid alternative method of imaging lower limbs for alignment, measurements and preoperative arthroplasty planning.
Conflict of Interest: None declared

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MINIMUM 20-YEAR SURVIVORSHIP OF THE ST GEORG SLED MEDIAL UNICOMPARTMENTAL KNEE REPLACEMENT (UKR)

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Background: Revision rates of UKR are currently a topical debate and some authors raise concerns over long-term survivorship of fixed bearing designs. Our aim was to investigate the long-term outcome of a fixed-bearing unicompartmental replacement used to treat medial compartment osteoarthritis.
Methods: Between 1 November 1974 and 23 December 1994, 385 patients (479 knees) were implanted with this prosthesis in the medial compartment. Patients were scored pre-operatively and at regular intervals post-operatively with a validated outcome score. Minimum follow-up was twenty years (median 22 and range 20 -35 years). 238 patients (297 knees), were female and 147 (182 knees) were male. At final follow-up 71 patients (87 knees) were still alive.
Results: 58 medial knees (12.1%) have been revised with an average time to revision of 9 years and 11 months (range 8 months - 27 years). The most common reason for revision was progression of OA, followed by loosening and polyethylene wear. The patients who were revised had an average age of 63.6 at their primary surgery (range 48 - 82 years). Survivorship for the medial Sled group was 80% at 20 years and 77% at 25 years. Outcome scores remained significantly improved at all time periods except 35 years.
Conclusion(s): This is the largest cohort of medial UKR followed for a minimum of 20 years. The St Georg Sled fixed bearing UKR, used in the medial compartment, shows very good long-term survivorship of 80% at 20 years with sustained significant clinical improvement out to 30 years.
Implications: These very long-term results compare favourably with total knee replacement and support the registry results which show better survivorship for fixed versus mobile bearing UKR.
Conflict of Interest: None declared

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MINIMUM 20-YEAR SURVIVORSHIP OF THE ST GEORG SLED LATERAL UNICOMPARTMENTAL KNEE REPLACEMENT (UKR)

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Background: Long term survivorship of UKR is a current controversy. Lateral UKR is performed less frequently and less is known about long term outcome. Registries frequently do not distinguish between medial and lateral UKR, making long-term cohort studies more important. We aimed to investigate the long-term outcome of a fixed-bearing unicompartmental replacement used to treat lateral compartment osteoarthritis.
Methods: The St Georg sled unicompartmental replacement (UKA) is a fixed-bearing UKA with an all-poly tibial baseplate. Between 1 November 1974 and 23 December 1994, 71 patients (82 knees) were implanted with this prosthesis in the lateral compartment. Patients were scored pre-operatively and at regular intervals post-operatively with a validated outcome score. Minimum follow-up was twenty years (median 22 and range 20 -35 years). At final follow-up 6 patients (7 knees) were still alive. Mean age 70 years (range 35 - 91 years).
Results: 19 (23.5%) lateral knees were revised. The most common reason for revision was progression of OA, followed by loosening and polyethylene wear. Survivorship of the lateral St Georg Sled was 72% at 15 years, 68% at 20 years and 68% at 25 years. Patient outcome scores showed significant improvements at all time points post-operatively except at the 35-year mark.
Conclusion(s): This is the largest reported cohort of lateral UKR followed for a minimum of 20 years. Lateral UKR shows acceptable long-term survivorship of just over 1% per year for 25 years, with sustained significant clinical improvement out to 30 years. Survivorship of lateral UKR in the long term is not as good as medial UKR. Arthritis progression is more common as a failure mechanism in lateral UKR than in medial UKR.
Implications: Given excellent long-term clinical outcome, lateral UKR is a reasonable option for isolated lateral disease but patient selection is key to reduce arthritis progression failures.
Conflict of Interest: None declared

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CORRELATION BETWEEN VARUS DEFORMITY OF THE KNEE AND DYNAMIC BIOMECHANICAL LOADING IN PATIENTS WITH ISOLATED MEDIAL COMPARTMENT OSTEOARTHRITIS LISTED FOR HIGH TIBIAL OSTEOTOMY (HTO)

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Background: Varus knees are corrected into valgus with HTO to redistribute mechanical forces and delay medial arthritis progression. Knee adduction angular impulse (KAAI) and external knee adduction moment (EKAM) measured during gait analysis predict load distribution across the tibial plateau and are suggested biomechanical markers for osteoarthritis. This study explores relationships between varus knee alignment and dynamic loading in patients with medial osteoarthritis, prior to HTO.
Methods: Gait was evaluated for 26 pre-operative HTO candidates (BMI (28.8 ± 4.2kgm^2); age (50.4 ± 6.9 years); Oxford Knee Score 26.3 (± 8.9)) using 3D motion capture and Visual3D. Medial dynamic loading was quantified during stance phase with KAAI and the two peaks and trough of the EKAM waveform. Varus deformity was determined by the mechanical Tibio Femoral Angle (mTFA, range 1.9° to 18.7°) and Mikulicz point (range -5.3% to 42.5%) from long-leg radiographs. Statistical correlations were performed to test the hypothesis that increased deformity resulted in increased medial dynamic loading.
Results: Spearman´s rank correlation identified a positive relationship between mTFA and KAAI ($r=0.619$; $p< 0.001$), peak 1 EKAM ($r=0.544$; $p< 0.01$), peak 2 EKAM ($r=0.669$; $p< 0.001$) and EKAM trough ($r=0.688$; $p< 0.001$). Pearson´s correlation identified a negative relationship between Mikulicz point and KAAI ($r=-0.627$; $p< 0.001$), peak 1 EKAM ($r=-0.589$; $p< 0.001$), peak 2 EKAM ($r=-0.699$; $p< 0.001$) and EKAM trough ($r=-0.659$; $p< 0.001$).
Conclusion: Moderate to strong correlation occurs between varus deformity and dynamic loading, with strong statistical significance. Patients with greater varus deformity may therefore get greater benefit from the reduction in dynamic loading after HTO.
Implications: Gait analysis amongst patients with medial compartment OA can identify patients who would benefit from HTO as those with greater varus deformity may experience the greatest benefit following HTO.
Conflict of Interest: None declared

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DOES THE SITE OF VARUS DEFORMITY IDENTIFY THOSE AT HIGHER RISK OF PROGRESSION IN EARLY SYMPTOMATIC OSTEOARTHRITIS OF THE KNEE: DATA FROM THE OSTEOARTHRITIS INITIATIVE (OAI)

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Background: Varus deformity is known to contribute to progression and incidence of medial compartment osteoarthritis of the knee. It is not known whether the different measurements that contribute to varus alignment are of equal importance.
Methods: To be included in this study, subjects had to demonstrate early to moderate radiographic osteoarthritis (Kellgren Lawrence grade 1, 2 & 3), symptoms in the knee for more than half the days of a month in the past year, complete follow up at 24 months and have long leg radiographs (LLRs) available for analysis. 1,327 knees from 961 subjects were included.
All LLRs were assessed using Medicad® (Hectec GmbH, Germany) planning software. This gives reproducible measurements of the key angles which contribute to overall lower limb alignment, including: medial proximal tibial angle (MPTA), medial proximal femoral angle (MPFA), lateral distal tibial angle (LDTA) and lateral distal femoral angle (LDFA). Outcomes were assessed at 2 years. Symptom worsening was defined by a deterioration in WOMAC score of >9 points. Structural progression was defined by joint space narrowing >0.7mm. Demographic characteristics including age, BMI, employment status,smoking status and other co-morbidities were recorded. Generalised estimating equations were used to identify which variables predicted symptom or structural progression.
Results: In 1,327 knees (Female=60%, mean age 61 years) with symptomatic kneeosteoarthritis, 19% demonstrated structural progression and 16% demonstrated symptom progression at 2 yrs. Baseline WOMAC score ($p< 0.001$) and BMI ($p=0.02$) were predictive of symptom progression. Of the

four measures of alignment, only medial proximal tibia angle (MPTA) predicted structural progression ($p < 0.001$).
Conclusion(s): This is the first study to identify that specifically varus alignment of the proximal tibia predicts structural progression in early symptomatic knee OA.
Implications: This finding may inform clinical decision making in patients presenting with early knee OA and varus deformity.
Conflict of Interest: None declared

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ACTIVITY LEVELS AND RETURN TO WORK FOLLOWING TOTAL KNEE ARTHROPLASTY IN PATIENTS UNDER 65 YEARS OF AGE

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Background: Little is known about employment following total knee arthroplasty (TKA) in the UK and the assumption that young patients are very active is lacking evidence. This study aims to identify predictors of return to work (RTW) following TKA in patients of working age.
Methods: We prospectively assessed 289 TKAs in 289 patients ≤65 years (141 male) from 2010 to 2013. Preoperatively age, gender, BMI, social deprivation, comorbidities, indication, work status and nature, activity level (UCLA score) and Oxford Knee Scores (OKSs) were recorded. At mean 3.4 years (range 2-4) RTW status, OKS, EQ-5D, UCLA activity score and a WORQ score (Work, Osteoarthritis and Joint-Replacement Questionnaire) were obtained. Univariate and multivariate analysis was performed.
Results: Of 261/289 (90%) patients working prior to TKA 104/261 (40%) returned to any work (RTaW), 89 (34%) to the same work (RTsW), at mean 13.5 weeks (range 2-104). Patients not working prior to TKA did not RTW. UCLA scores improved in 58% (125/214) from median 4 (mild activity) to 6 (moderate activity) ($p < 0.001$). Significant ($p < 0.05$) predictors of RTaW were: age, heavy/moderate manual work, better postoperative UCLA score and OKS, and EQ-5D general health score. Significant predictors of RTsW were: age, heavy/moderate manual work, and postoperative OKS. Multivariate analysis confirmed heavy/moderate manual work and age to independently predict RTaW and RTsW. 100% of patients < 50 years working preoperatively RTaW; 60% of 50-54 years RTaW; 50% of 55-59 years RTaW; and 24% of 60-65years RTaW.
Conclusion(s): If working preoperatively, patients < 50 years invariably RTW following TKA in the UK. Only half of those aged 50-60 years return. High postoperative activity levels do not predict return to work following TKA.
Implications: Patients aged 45-55 are the fastest growing recipients of TKA, giving these findings significant socioeconomic implications.
Conflict of Interest: None declared

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IMPACT OF DEPRIVATION ON THE WOMAC INDEX AND SF-12V1 IN PRIMARY KNEE ARTHROPLASTY PATIENTS IN MERSEYSIDE, UK

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Background: Function scores have been used to quantify the success of an arthroplasty. This data investigates how the outcome of knee replacement arthroplasty is impacted by deprivation.
Methods: Data of 858 primary knee arthroplasties was collected from 350 males and 394 females with primary/post-traumatic osteoarthritis. The age range was 39 to 91 years and BMI range 18.1 to 48. Pre-operative and post-operative assessments included WOMAC score and SF-12v1 (physical component PCS /mental component MCS), the mean follow up was 5.48±3.6years. The English

Indices of Deprivation 2015 statistical release were utilised; specifically, the index of Multiple Deprivation(IMD), Health Deprivation and Disability(HDD) and Income Deprivation Affecting Older People(IDAOPI). For statistical purposes the ten deciles were divided into three groups: each has approximately one third of the patient population. We compared the most deprived decile, D-1 with the least deprived, deciles 6-10 D-3.
Results: The mean age at surgery was significantly lower in D-1 66.7±10.13 years than in D-3 70.8±9.38 years using either IMD or IDAOPI (p=0.001). Males in the IMD D-1 category had a significantly higher BMI (p=0.037). Pre-operative WOMAC was significantly inferior in the D-1 group (IMD p=0.013 and IDAOPI p=0.012). MCS was affect significantly lower in D-1 using IDAOPI (p=0.035). At the final follow-up MCS was significantly lower in D-1 using IMD, IDAOPI and HDD (p< 0.001). Both IDAOPI and IMD D-1 presented significantly lower PCS (p< 0.001), while IDAOPI D-1 also presented significantly worse WOMAC scores (p< 0.001). Smoking and respiratory problems were significantly higher in the D-1 (p< 0.001). The risk factors of metabolic syndrome (Dyslipidaemia, hypertension, glucose intolerance and obesity), were not significantly different between the groups.
Conclusion(s): Deprivation seems to affect the mental health status and functional outcome, income deprivation had a profound effect on function. Smoking, unlike other comorbidities, was strongly linked to the outcome.
Conflict of Interest: None declared

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ALIGNMENT IN TOTAL KNEE ARTHROPLASTY: A COMPARISON OF HAND-HELD ACCELEROMETER-BASED NAVIGATION WITH PATIENT SPECIFIC & STANDARD INSTRUMENTS

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Background: Malalignment and suboptimal implant positioning causes early failure and poor patient satisfaction in total knee arthroplasty (TKA). This study assessed the accuracy and precision of hand-held accelerometer-based navigation compared to standard and patient specific instrumentation (PSI)
Methods: Radiographic analysis was performed on 3 patient cohorts who underwent primary TKA: 50 patients using hand-held accelerometer-based navigation (KneeAlign2, Orthalign), 50 patients using PSI (Visionaire, Smith & Nephew), and 50 patients using standard instruments (STD). All procedures were performed by a single surgeon using the same implant (Legion PS, Smith & Nephew). Coronal limb alignment, plus coronal and sagittal alignment of the tibial and femoral components were measured on standing long-leg and lateral radiographs by an independent blinded observer. The percentage of inliers (accuracy) and variability (precision) were compared between groups.
Results: The 3 groups were well matched. Hip-Knee-Angle of 0º ±3º was seen in 86% KneeAlign vs 78% PSI and 76% STD patients (ns). Femoral component coronal alignment of 90º ±2º was seen in 74% KneeAlign vs 66% PSI vs 70% STD patients (ns). Femoral component flexion was 0º ±2º in 38% KneeAlign vs 28% PSI vs 66% STD patients (p< 0.001). Tibial component coronal alignment was 90º ±2º in 94% KneeAlign vs 76% PSI vs 72% STD patients (p< 0.05). Tibial slope was 3º ±2º in 84% KneeAlign vs 52% PSI vs 24% STD patients (p< 0.01). Tibial slope variability was significantly less in the KneeAlign group (SD 1.3º) vs PSI (SD 2.9º) vs STD (SD 2.5º).
Conclusion(s): Accelerometer-based, hand-held navigation demonstrates significantly better accuracy and precision for tibial component alignment in both sagittal and coronal planes than PSI and standard instruments. There was a trend to better overall mechanical alignment.
Implications: Hand-held accelerometer-based navigation is a promising alternative to PSI, without the drawbacks of large console computer navigation.
Conflict of Interest: Dr Gallie is a consultant for Smith & Nephew. No conflict of interests for other authors.

Simulation with free papers

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TRAINING SAFER KNEE ARTHROSCOPISTS: A RANDOMISED CONTROLLED TRIAL DEMONSTRATING THE BENEFITS OF THE IMPERIAL KNEE ARTHROSCOPY COGNITIVE TASK ANALYSIS (IKACTA) TOOL IN HIGH-FIDELITY PHANTOM LIMB SIMULATION

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Background: Virtual reality and cadaveric simulation are expensive and are not readily accessible. Innovative and accessible training adjuncts are required to help meet training needs. Cognitive Task Analysis (CTA) has been used extensively to train airline pilots and in other surgical specialties. However, the use of CTAs within orthopaedics is in its infancy.
Aim: To evaluate the efficacy of an innovative CTA tool to train novice surgeons in diagnostic knee arthroscopy.
Methods:
Design - 3 expert knee surgeons were interviewed independently to generate a list of technical steps, decision points and errors for diagnostic knee arthroscopy. A modified Delphi technique was used to generate the final CTA. A video and a voice over were recorded for each phase. These were combined to generate the IKACTA tool that utilizes written and audio-visual stimuli to describe each phase of a diagnostic knee arthroscopy.
Validation - Randomized double-blind controlled trial. 16 novice orthopaedic trainees (performed < 10 diagnostic knee arthroscopies) were randomized into 2 equal groups. Group 1 was given the IKACTA tool and group 2 had no additional learning material. They were assessed objectively (validated ASSET global rating scale) on a high fidelity phantom limb simulator. All participants, using the Likert rating scale, subjectively rated the tool.
Results: The mean ASSET score in group 1 was 19.5 (51.3% ±3.7) compared to 10.6 (27.9% ±2.3) in group 2. The improvement in the mean ASSET scores was 8.9 (23.4%; p = 0.002; 95% CI = 7.63-10.1). All participants (100%) agreed that the CTA learning tool was a useful training adjunct to learning in the operating theatre.
Conclusion(s): We have designed a new user-friendly, inexpensive CTA tool that has demonstrated significant benefits in training in diagnostic knee arthroscopy.
Implications: Similar CTA tools can have a wide application within orthopaedic training to enhance patient safety.
Conflict of Interest: No Conflict of interest amongst any of the authors.

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GENERIC COGNITIVE TASK ANALYSIS (GCTA) WIZARD - A TOOL TO TRAIN ORTHOPAEDIC TRAUMA SURGEONS OF THE FUTURE

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Background: Innovative and accessible training adjuncts are required to help meet training needs in the current environment of reduced training hours. Cognitive Task Analysis (CTA) has been used extensively to train airline pilots and in other surgical specialties. However, the use of CTAs within orthopaedics is in its infancy.
Aim: To develop an online generic orthopaedic trauma CTA wizard that can be used by experts to design procedure-specific CTAs.
Methods: 3 expert orthopaedic trauma surgeons were interviewed independently to generate a list of operative steps, decision points and errors that are applicable to any orthopaedic trauma procedure. Using the modified Delphi technique, the CTAs obtained from each expert were analysed by an independent reviewer and the process repeated until a consensus was reached to create the final CTA. An online web-based wizard tool was designed to incorporate this information and accompanying video clips and images.
Results: 26 technical steps and 29 decision points were identified in the final CTA following the Delphi process. These were subdivided into 7 phases ranging from pre-operative planning to post-operative follow-up and rehabilitation. The wizard tool has 4 sections:
(i) technical steps,
(ii) decision points,
(iii) errors and
(iv) video clips/images for each phase.
The information submitted to the creation tool generates a learning tool with the written information on the left and the video clips on the right of a split screen.

Conclusion(s): This study has led to the design of a novel web-based generic CTA wizard tool for orthopaedic trauma. This allows experts to impart complex cognitive knowledge to trainees in a simple, structured manner utilizing written and audio-visual stimuli simultaneously to teach surgical steps.
Implications: This has the potential to develop into a digital trauma CTA library that will be invaluable to train orthopaedic surgeons of the future.
Conflict of Interest: There are no conflict of interest amongst any of the authors.

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A VIRTUAL REALITY FUNDAMENTALS OF ARTHROSCOPIC SURGERY TRAINING PROGRAMME IMPROVES KNEE ARTHROSCOPY PERFORMANCE

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Background: The acquisition of arthroscopic skills can be challenging and often requires years of experiential learning. The Fundamentals of Arthroscopic Surgery Training (FAST) programme was developed to break down arthroscopy into its basic psychomotor tasks and provide a standardised, repeatable and safe method of skills acquisition. The purpose of this study was to determine whether a virtual reality(VR) FAST programme can improve performance in simulated knee arthroscopy using simulator metrics and validated global rating scales as outcome measures.
Methods: 66 participants including experts (n=13), intermediates (n=27) and novices (n=26) completed an diagnostic knee arthroscopy on a VR simulator. All participants then completed 21 FAST modules including camera manipulation and instrumented bimanual dexterity tasks. All participants repeated the diagnostic knee arthroscopy. The pre/post FAST diagnostic knee arthroscopies were recorded anonymously using camera feeds from the simulator display and the participants hand movements. The recordings were assessed using the Arthroscopic Surgical Skills Evaluation Tool (ASSET) global rating scale by two independent consultant arthroscopic surgeons. Simulator metrics including time to completion(seconds) and economy of camera movement(centimetres) were also measured.
Results: Novice participants demonstrated a statistically significant improvement in performance in diagnostic knee arthroscopy following completion of the VR FAST programme in terms of their mean ASSET pre:post score 12:26 ($P< 0.01$). Simulator metrics also significantly improved in terms of mean time taken pre:post 465:260 seconds ($P< 0.01$) and mean economy of camera movement pre/post 210:115 centimetres ($P< 0.01$). There was no statistically significant difference in ASSET scores between the two expert raters, thus demonstrating a high inter-rater reliability ($P = 0.95$).
Conclusion(s): The overall simulator score improved, the operation time decreased and the camera path length decreased which suggests that the FAST programme improves operative efficiency.
Implications: This study demonstrates that a VR FAST programme is able to improve diagnostic knee arthroscopy performance at all levels of experience.
Conflict of Interest: None declared

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SMARTPHONE SURGICAL SIMULATION FOR TRANSFORAMINAL LUMBAR INTERBODY FUSION (TLIF) PROCEDURE AMONGST ORTHOPAEDIC REGISTRARS

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Background: In order to improve patient safety and as a consequence of reduced training hours, surgical simulation is growing. Simulation provides a safe environment for trainees to prepare for both assisting and performing surgical procedures. Our aim was to assess whether a smartphone surgical simulator app (Touch Surgery) improved trainees' knowledge of a complex procedure and whether trainees felt this form of simulation was beneficial for training.
Methods: All orthopaedic registrars within the LETB were invited to participate. TLIF was the chosen procedure as few registrars had previous experience of it. Registrars completed a pre-intervention

questionnaire specific to TLIF followed by two modules of the TLIF simulation application on Touch Surgery and finally completed a post-module questionnaire.
Results: 47 of 48 registrars (ST3-ST7) completed the initial analysis and 22 completed the entire study. In the pre-module questionnaire the technical questions were answered inaccurately and over 90% thought their ability of performing a TLIF would be poor or dangerous. The median scores on the simulator app modules were 97% and 90%. There was a significant improvement in the technical answers after completing the modules as well as the perceived ability of the trainee to either assist or perform part of a TLIF. Over 90% of trainees found the simulation useful and thought it should be part of surgical training.
Conclusion: Barriers to simulation training can be bridged by app-based simulation. Most trainees found this form of training useful. As Touch Surgery is a cognitive trainer, this should be used to supplement training, not replace hands-on surgical experience. Whether simulation improves surgical skill acquisition or patient safety needs to be validated through a high fidelity RCT to assess the transferability of learned skills to the operating room.
Implications: Smartphone based simulation could be integrated into higher surgical training and assessment.
Conflict of Interest: None declared

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PERFORMANCE ON A VIRTUAL REALITY DHS SIMULATOR CORRELATES WITH PERFORMANCE IN THE OPERATING THEATRE

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Background: Dynamic Hip Screw (DHS) fixation of neck of femur fractures is one of the most commonly performed orthopaedic trauma operations. Changes in working practices have impacted on surgical training resulting in fewer opportunities to perform this procedure. Virtual reality (VR) simulation has been shown to be a valid means of gaining competency efficiently and safely, without compromising patient safety. The aim of this study is to determine whether performance on a VR DHS simulator correlates with performance in the operating theatre.
Methods: All episodes of DHS fixation of extracapsular neck of femur fractures performed at our institution between Jan 2014 and Dec 2015 were identified using the hip fracture database. The primary surgeon was identified using the electronic operative notes. The intraoperative fluoroscopic images were accessed and the Tip-Apex distance (TAD) was measured, as well as the probability of cut-out. The surgeon then performed DHS fixation on a VR DHS simulator and the TAD achieved in theatre was correlated with the simulated TAD.
Results: 25 surgeons including 6 novices (core surgical trainees), 12 intermediates (specialist registrars), and 7 experts (fellows and consultants) completed the study. There was no overall statistically significant difference in TAD between those achieved in the operating theatre and on the simulator for each participant ($P = 0.688$).
Conclusion(s): There is no significant difference between performance on a VR DHS simulator and the operating theatre. This suggests that the simulator is excellent for training in this component of the DHS procedure but further work is needed to assess whether training on the simulator can actually improve performance in the operating theatre.
Implications: This study strengthens the growing body of evidence that VR simulation can be a useful method of learning basic orthopaedic skills in a safe, risk free environment.
Conflict of Interest: None declared

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DIMENSIONLESS SQUARED JOLT (DSJ)- AN OBJECTIVE MEASURE IN THE ASSESSMENT OF ARTHROSCOPIC SURGICAL SKILLS

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Background: There has been limited progress in the objective assessment of arthroscopic surgical skills beyond motion analysis, force feedback and time taken to complete a procedure. Structured tools have been developed, such as checklists and Global Rating Scales (GRS), however there remains a subjective component to this structured tool. We propose a new method, the dimensionless squared jolt (DSJ) that has no subjective assessment domains. A construct validity study was performed to test its ability to differentiate between expert (consultants) and novices during shoulder arthroscopy tasks.
Methods: Twelve volunteers (6 experts and 6 novices) performed 3 standardized shoulder arthroscopic tasks on a dry shoulder model under same experimental set-up. The time taken to complete, total path length, acceleration parameters (average and maximum), number of movements (minimal and average) and DSJ were recorded. Motion analysis was performed using an optical tracking system. Differences in arthroscopic performance were investigated using a T-test.
Results: There was a significant statistical difference between novices and experts for time taken (p=0.0002), average acceleration (p=0.036), number of movements (minimal acceleration) (p=0.00017), number of movements (average acceleration) (p=0.00017) and DSJ (p=0.00002). There was no significant statistical difference between those groups for maximal acceleration (p=0.931), number of movements (minimum 10m/s2) (p=0.922), path length (p=0.131) or range of acceleration (p=0.677).
Conclusion(s): These results show the value of using DSJ in addition to motion analysis and task completion time as a method of objectively assessing arthroscopic performance.
Implications: We propose DSJ as a valid parameter for assessing arthroscopic surgical skills.
Conflict of Interest: None declared

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HIGH FIDELITY MULTI-DISCIPLINARY TEAM SIMULATION TRAINING FOR THE DEVELOPMENT OF NON-TECHNICAL SKILLS IN TRAUMA AND ORTHOPAEDICS (T&O): A FEASIBILITY STUDY

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Background: Simulation in healthcare is recognized as an effective tool for developing technical and non-technical skills in a safe environment. This is emphasized in the Intercollegiate Surgical Curriculum and by Health Education England´s Simulation Strategy. Despite this, no simulation program currently exists for T&O trainees in our department. We therefore aimed to establish a multi-disciplinary team-based simulation program to enhance T&O training and identify any unmet educational needs.
Methods: Small groups of four to seven healthcare professionals, including junior doctors, nurses and healthcare assistants participated in six high-fidelity simulation scenarios between July 2016 to January 2017. A range of orthopaedic-themed emergencies were simulated using an integrated manikin model at Torbay Hospital´s Environment for Clinical Safety and Excellence through Learning(ECSEL) simulation suite. With consent, participants' non-technical skills were assessed using the Non-Technical Skills for Surgeons(NOTSS) rating system by retrospective analysis of video footage. Clinical performance was evaluated using an Objective Structured Clinical Examination(OSCE) marking scheme. Participants' views of the scenarios were determined using a standardized questionnaire.
Results: Overall performance in technical and non-technical skills was below an acceptable standard, achieving a mean (S.D) OSCE and NOTSS score of 2.3 ±0.9 and 2.5 ±0.7 respectively (p>0.05). Situational awareness was significantly worse than communication skills with mean scores of 2 ±0.7 and 3.6 ±0.7 respectively(p=0.042). Significantly poorer performance was observed in differential diagnosis compared to escalation to seniors with mean scores of 2 ±0.9 and 3.6 ±0.6 respectively(p=0.030). Participants found the scenarios to be realistic and relevant to their learning needs.
Conclusion(s): The first high fidelity multi-disciplinary team simulation program has been successfully established in our T&O department. Analysis of clinical performance shows there is an unmet training need for non-technical skills and analytical thinking during emergencies.
Implications: To address this, we have brought human factors training into our formal teaching program.
Conflict of Interest: None declared

Trauma free papers

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TOTAL HIP REPLACEMENT IN COMPLEX ACETABULAR FRACTURES USING A CONED HEMIPELVIC ACETABULAR COMPONENT

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Background: Acetabular fractures in the elderly are a challenging problem associated with high levels of morbidity and mortality. Treatment is complicated by poor bone quality and multiple comorbidities, and currently ranges from conservative treatment, open reduction internal fixation and variations of total hip arthroplasty. We present the early results of the use of a coned hemipelvic acetabular component and total hip replacement in the primary treatment of these injuries.
Methods: We have prospectively monitored a series of ten patients (11 cases) with a mean follow-up of nine (1-20) months. They have been reviewed clinically and radiographically.
Results: The mean age was 77 (67-87), and they had a mean of three (2-5) medical comorbidities. Eight had low-energy injuries, most commonly a fall from standing, two had high-energy injuries. All sustained comminuted acetabular fractures, with pelvic discontinuity. There were six minor post-operative complications: two patients suffered mild serous wound ooze, two sustained an acute kidney injury and two a lower respiratory tract infection. One patient suffered pre-operative bilateral sciatic nerve injury, which has partially resolved. There have been no thromboembolic events, dislocations or infections and no cases of prosthesis migration on plain radiograph. Nine of ten patients were able to mobilise fully weight-bearing on day one post-operatively.
Conclusions: Early weight-bearing mobilisation is essential to achieve a successful outcome in these patients, in a similar way to neck of femur fracture patients. The coned acetabular prosthesis bypasses the fracture, creating an immediately stable construct. This allows immediate weight bearing, and the benefits this brings in a medically complicated cohort of patients. Early results suggest this to be a safe technique with an acceptable early complication rate.
Implications: This is the first series of a newly described technique. The early results are promising. We aim to monitor longer-term results.

Conflict of Interest: None declared

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A RETROSPECTIVE REVIEW OF 76 CONSECUTIVE ATYPICAL FEMORAL FRACTURES MANAGED WITH INTRAMEDULLARY NAILING OVER AN 8 YEAR PERIOD. DEMOGRAPHICS, OUTCOMES AND PREDICTORS OF COMPLICATIONS

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Background: Atypical femoral fractures as defined by the American Society for Bone and Mineral Research (ASBMR) are a common and challenging injury to manage surgically due to the higher rates of non union, and fixation or implant failure. We aimed to identify all Atypical femoral fractures surgically managed in our institutions and describe the patient demographics and risk factors. Surgical outcomes would then be studied, with the aim to identify predictors of failure and complications.
Methods: Using our trauma database, we retrospectively identified and reviewed the radiographs of all proximal femoral and femoral shaft fractures managed with intramedullary nail fixation between 2008-2016 in the city of Glasgow. Medical notes, radiographs and GP records were analysed to record patient and fracture demographics, duration to union and the nature and frequency of surgical complications.
Results: We identified 550 femoral fractures treated with intramedullary fixation. Using the ASBMR definition, 76 fractures satisfied the criteria to be classified as Atypical. 97% were female. 74% were on bisphosphonate therapy on admission. Mean duration of bisphosphonate therapy was 4.5 years. 12% fractures were incomplete stress fractures at time of surgery. 88% of fractures united radiologically and clinically. Mean time to radiological union was 7 months. 12% patients had complications. There were 4 non-unions, 3 implant fractures, 1 periprosthetic fracture and 1 failure of fixation. 5 patients underwent revision surgery with 3 exchange nails, 1 long stem hemiarthroplasty and 1 femoral locking plate fixation.

Conclusion(s): In our series, 14% of femoral fractures have Atypical Radiographic features. Of these, only 75% were on bisphosphonate therapy. 88% of patients were successfully managed with antegrade femoral nailing which reflects the current consensus of management.
Implications: Further research is recommended to ascertain whether atypical femoral fractures occur as a consequence of bisphonsphonate therapy or the underlying pathology.
Conflict of Interest: None declared

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DOES ACHIEVING THE 'BEST PRACTICE TARIFF' CRITERIA FOR FRACTURED NECK OF FEMUR PATIENTS IMPROVE ONE YEAR OUTCOMES?

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Background: ´Best Practice Tariff´ (BPT) criteria have been developed to improve peri-operative care for hip fracture patients. This paper aims to explore the impact of BPT on one-year outcomes.
Methods: Anonymised data was acquired from the National Hip Fracture Database (NHFD) for patients presenting to Bradford Royal Infirmary with a fractured neck of femur during the period April 2011 to October 2015. Two study groups were defined: those that achieved the BPT uplift criteria, and those that did not. Three primary outcome measures were identified: one year survival, mobility status and residential status. Further analysis was performed to ascertain whether any individual BPT target significantly affected one-year outcomes.
Results: 1,370 cases were included, 751 (55%) of whom met the BPT criteria. The 1-year mortality rate for the BPT-achieved group was 32.2%, compared with 38% in the non-BPT group (risk reduction=9.3%, p=0.0264, CI 95%). Mobility status declined by at least 1 grade in 50.3% of the BPT-achieved group, compared with 60.3% of the non-BPT group (risk reduction=16.5%, p=0.0031, CI 95%). BPT achievement had no significant effect on residential status at one year. Multivariate analysis identified that post-operative Abbreviated Mental Test Score (AMTS) and falls assessment were significantly associated with reduced one year mortality. Similarly, both pre- and post-operative AMTS assessments resulted in greater potential to return to pre-morbid mobility level.
Conclusion(s): Achieving the BPT requirements has a significant impact on one-year mortality and return to pre-morbid mobility level. The effect of AMTS and falls assessments on these outcomes may be due to their properties as surrogate markers for more thorough and considered peri-operative assessment.
Implications: Few studies describe the effect of BPT on one-year outcomes; therefore the results presented here vindicate the scheme. Furthermore, these results may help steer subsequent revisions to BPT requirements by encouraging greater focus on peri-operative assessment.
Conflict of Interest: None declared

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MEDIUM AND LONG-TERM FUNCTIONAL, UROLOGICAL AND SEXUAL OUTCOME AFTER OPERATIVELY TREATED PELVIC RING FRACTURES

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Background: Displaced pelvic ring fractures are usually a consequence of high-energy injury and can cause long-term disability in terms of physical, emotional, urological and sexual dysfunction. We investigated medium and long-term functional outcome a mean of 8 and 15 years after treatment with open reduction internal fixation.
Methods: All patients who sustained unstable pelvic ring injuries treated operatively between 1994 and 2005 were contacted at a mean of 8 and 15 years post-injury via a postal questionnaire. Participants completed generic and disease specific validated outcome measures including the SF-36, EQ-5D-3L, Majeed Pelvic Score and validated urinary and sexual functional outcome measures. Outcome scores were compared to SF-36 UK based normal data and individual patient data from previous work at 8 years´ to demonstrate trends over time.

Results: From the initial cohort of 181 patients, 151 responded at the mean of 8 years post injury. 74 of those eligible for further follow-up (50 Tile B and 24 Tile C type, mean ISS 16.9, mean age 57) responded again a mean of 15 years post injury. The patient cohort scored significantly lower in all domains of the SF-36 than an age and sex matched UK population norms. Both the SF-36 and EQ-5D-3L demonstrated pain to be the most affected domain. There was no significant change in functional scores for the same patients over time, from a mean 8 years following injury to 15 years.
Conclusion(s): This study is one of the longest and largest follow-up studies in the literature. Patients continue to have significant functional limitations compared to an uninjured population, however the disabilities do not deteriorate between 8 and 15 years.
Implications: Functional disability remains constant in the long-term. This study allows surgeons to counsel patients regarding long-term prognosis of their injuries as well as being a baseline for future studies.
Conflict of Interest: None declared

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VENOUS THROMBO-EMBOLISM (VTE) FOLLOWING TRANEXAMIC ACID (TXA) IN THE TRAUMA PATIENT

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Background: The multi-national CRASH-2 study supported early administration of Tranexamic acid (TXA) in major trauma patients without a detrimental increase in venous thrombo-embolism (VTE). Little data is available in civilian patients when considering moderate trauma patients (Injury Severity Score 9-15). We aim to determine the deep vein thrombosis (DVT) and pulmonary embolism (PE) rates in Trauma Audit and Research Network (TARN) patients from our major trauma centre (MTC) and the effect of TXA.
Methods: We reviewed our MTC patients reported to TARN over 3 years for evidence of VTE from radiology reports. Only positive VTE reports within 180 days post trauma were included for analysis.
Results: TARN patients treated between 01/04/12 and 31/03/15 numbered 2832. 1404 (49.6%) were major trauma (ISS>15) and 1099 (38.8%) were ISS 9-15. 384 patients had TXA with 313 ISS>15. 1.3% were diagnosed with DVT (38 DVT´s in 37 patients). Half (50.0%) were ISS>15, but only 8 of the 37 had TXA (2.2%).There is no significant increase in DVT rate in ISS 9 - 15 (P=0.248) or ISS>15 after TXA. 0.95% of patients were diagnosed with a PE (27 patients). ISS>15 comprised 55.5%, and 9 had TXA (2.3%). PE in ISS>15 is increased with TXA (P=value 0.000416). No significant rise in PE in ISS 9-15 (P=0.469) is observed.
Conclusions: The authors believe this to be the largest post-CRASH-2 civilian study investigating potential TXA complications. In our study population there was no statistically significant increase in VTE in patients treated with TXA with moderate trauma (ISS 9-15). There was a statistically significant increase in PE rate in major trauma patients.
Implications: These results suggest TXA administration does not significantly increase the risk of VTE and therefore where moderate trauma may pose a risk of major haemorrhage, its administration could be beneficial to patient survival outcomes.
Conflict of Interest: None declared

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CLOSED TIBIAL SHAFT FRACTURES TREATED WITH THE ILIZAROV METHOD; A TEN YEAR CASE SERIES

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Background: Tibial fractures can be managed in a variety of ways. The Ilizarov method is well established in complex, periarticular fractures often associated with soft tissue compromise. There is however limited literature on its use in less severe Tibial fractures.
Methods: The Ilizarov frame database was used to identify 76 skeletally mature patients who sustained an isolated, closed, extra-articular, simple, diaphyseal Tibial fracture; the injury also known as a “nail-able Tibial fracture.”

Results: The average age of the patient was 38 (17-70). All 76 patients progressed to union. The average time until union was 148 (55-398) days. The coronal and sagittal alignment was 3° (0-17°) and 4° (0-14°) respectively. No patient suffered from compartment syndrome. No patient developed septic arthritis. No patient had documented anterior knee pain or secondary knee specialist input post frame removal. On average, there were 9 (4-29) follow up appointments and 10 (5-26) radiographs post frame application. There is a 59% chance of a patient having a difficulty post frame application. The malunion rate was 5%. Persisting pinsite infection post frame removal occurred in 5 patients (6.5%). Drilling of the pinsite sequestrum resolved the infection in four of these patients, giving a deep infection rate of 1.3%.
Conclusion(s): The Ilizarov method has a role to play in the treatment of simple closed Tibial shaft fractures in patients who need to kneel. Patient education is a priority however; the patient must be made aware of the difficulty rate associated with the Ilizarov method when compared to the complication profile of alternative treatments.
Implications: The Ilizarov method is a safe alternative to internal fixation.
Conflict of Interest: None declared

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NATIVE HIP SURVIVAL AND LONG TERM PATIENT REPORTED OUTCOMES FOLLOWING ACETABULAR FRACTURE

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Background: The aim of this study was to report survival of the native hip joint following acetabular fracture and long term outcomes measured using validated patient reported outcome measures (PROMs).
Methods: All patients presenting to our institution with acetabular fracture from 1988 to 2010 were identified: 525 acetabular fractures in 524 patients (356 male, 68%) with mean age 51 years (range 14-100). 204 patients with displaced fractures underwent ORIF. Undisplaced fractures and unreconstructable fractures in the elderly were managed non-operatively. Patients were contacted for long term follow-up using PROMs at mean 13.2 years (range 7.9-28.8) and a Kaplan Meier survival analysis was performed.
Results: 172 had died (32.8%); 66 had undergone total hip arthroplasty (THA) (12.6%) at mean 6.4 years (0-25); 2 had undergone arthrodesis (0.4%); and 88 (16.8%) were lost to follow up. With the endpoint THA/arthrodesis, ten-year survival was 86.6% (95% CI 82.9 to 90.3) and twenty-year survival was 78.6% (73.1 to 84). Significant predictors of failure included ORIF ($p< 0.001$) and higher Injury Severity Score ($p=0.004$). Following ORIF, survival was significantly worse in patients >45 years (n=76, 10-year survival 61.4 (48.4 to 74.3)) compared to those < 45 years (n=129, 86.2% (78.8 to 93.5) log rank $p=0.015$). 138/199 (69.3%) living patients with intact hips completed PROMs at mean 16.4 years (6.9-28.9): mean Oxford Hip Score 37.0±13.3 (range 0-48), iHOT-12 71.2±28.7 (3-100) and EQ-5D index 0.72±0.32, (-0.5-1). Patients requiring ORIF and those >45 years old had significantly worse long-term PROMs (all scores $p< 0.05$). UCLA activity score declined following fracture (median 7 to 5, $p< 0.001$). Letournel classification did not correlate with outcome.
Conclusion(s): Native hip survival is worse when ORIF is required, especially in patients >45 years where patient-reported outcomes are also poorer.
Implications: Patient outcome counselling and patient selection for ORIF.
Conflict of Interest: None declared

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THE FIBULAR NAIL EXPERIENCE: CLINICAL AND PATIENT-REPORTED OUTCOMES IN 445 PATIENTS

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Background: Level-1 evidence has demonstrated the superiority of the fibular nail in unstable ankle fractures whilst avoiding soft tissue complications in the elderly.

Aim: To review a large cohort of patients treated with this device in order to establish the level of success in the general population.
Methods: The clinical and patient-related outcomes of all patients who had treatment of unstable ankle fractures with the fibular nail were reviewed using patient records and outcome scores: EQ-5D, Olerud and Molander, Manchester/Oxford Foot and Ankle (MOXFQ) scores. A custom questionnaire was used to identify compilations treated elsewhere and return to work.
Results: 445 patients were identified with mean age at the time of injury of 65 (14-96) and mean follow up of 64 months (range 6-177). Revision surgery due to nail failure was required in 25 patients (5.6%). Metalwork removal was performed in a further 29 patients (6.5%): six nails and locking screws, six proximal locking screws, two distal locking screws. Of the 6 nails removed, only one was due to infection. Patient reported outcomes revealed a satisfactory final clinical result with a mean EQ-5D of 0.72 (SD 0.32), a mean Olerud and Molander score of 67 (range 0-100), and mean MOXFQ 25 (range 0-94). All but one of the patients returned to work.
Conclusion(s): This is the largest series of fibular nails reported to date, demonstrating that low complication rates and favourable outcomes are possible with intramedullary ankle fracture fixation, and can be sustained for up to 14 years postoperatively.
Implications: These data have driven implant development and the next generation of the fibular nail will incorporate headless locking screws, with the aim of reducing the rate of metalwork removal. The fibular nail should be considered in the management of unstable ankle fractures.
Conflict of Interest: Mr white received consultant honoraria from Acumed for design consultation in the version 2 fibular nail: this abstracts details outcomes of version 1 only. Of the remaining authors, no conflicts of interest are declared.

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CLINICAL AND RADIOGRAPHIC OUTCOMES OF TALAR FRACTURES

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Background: Talar fractures are rare injuries associated with significant morbidity and poor long-term functional outcomes. There is variability of classification systems and ongoing debate regarding definitive management. We aimed to characterize the fracture morphology and outcomes in a large consecutive series of patients.
Methods: All adult talar fractures presenting to the Edinburgh Trauma Service between 2008 and 2015 were identified from a prospective database. Fractures were classified using the Hawkins-Canale system. Osteocohndral “dome” type fractures were excluded. All patient records and radiographs were scrutinized for avascular necrosis (AVN), fusion procedures and non-union. Mechanism of injury was classified as high-energy (road-traffic accident or fall from a height of greater than two meters) or low-energy.
Results: 66 fractures were identified over the 7-year period, of which 6 were open fractures and 3 were bilateral. The commonest fracture pattern identified was a displaced talar neck fracture (n= 46: 8 type I, 27 type II, 6 type III, 5 type IV) followed by talar body fractures (n=16). 35 cases were associated with multiple injuries. 34 fractures underwent operative treatment in one of three methods: anteroposterior screws, posteroanterior screws or plates and screws. There were 5 confirmed cases of AVN, 1 case of non-union, and 10 fusion procedures. 40 cases arose from high energy injuries and all cases of AVN, fusion, or non-union were seen in this group irrespective of fracture pattern. There were no cases of AVN, fusion, or non-union in the low-energy group.
Conclusion(s): We present a large series of talar fractures and demonstrate that a high energy mechanism is associated with AVN, non-union and the requirement for fusion
Implications: Careful initial assessment should focus on injury mechanism to identify patients at risk of a poor outcome.
Conflict of Interest: None declared

Spine free papers

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SPINAL INJURIES IN RUGBY UNION - A COMPARISON WITH CYCLING OVER 15 YEARS

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Background: Concerns have been expressed regarding the safety of rugby, however it remains a popular sport. Cycling continues to increase in popularity and is expounded as a good form of exercise. Our aim was to evaluate the incidence of serious spinal injuries in rugby over a 15-year period and compare it to cycling.
Methods: We performed a retrospective review of prospectively collected data from the FORD and RISUS databases. We reviewed all rugby and cycling injuries admitted to the Northern Ireland regional spinal unit between 2000 and 2015 for spinal injuries requiring hospital admission.
Results: 158 injuries were identified. Twice as many patients were admitted with serious spinal injuries from cycling in caparison with rugby (103 vs 55). 89% were males. The mean age at time of injury was younger in rugby (21.8 yrs) compared to cycling (38 yrs). 98% of injuries in rugby were to the cervical spine and only 55% in cycling. 10 rugby players (18%) required surgery in comparison to 32 cyclists (31%). 2 (4%) rugby players and 9 (9%) of cyclists required prolonged ICU admission. 3 rugby players sustained injuries resulting in complete paralysis over the 15 years. The incidence of rugby-associated injuries has remained static, whereas cycling injuries have more than trebled in 2015 compared with 2000.
Conclusion(s): Cycling injuries are twice as common as rugby injuries. Cervical spine injuries account for a higher proportion of those injured playing rugby, but the total number of patients requiring surgery and ICU admission was 2 to 3 times higher for cycling injuries.
Implications: Rugby is not a significant cause of spinal injuries, nor is it increasing in comparison with cycling injuries, which continue to rise.
Conflict of Interest: Irish Rugby Football Union MITRE Trust

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IMPACT OF INTRODUCING SPINAL PAIN PATHWAY IN AN NHS REGION (NORTHERN IRELAND)

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Background: The spinal service was unable to meet demand, with over 800 referrals received monthly to the central spinal orthopaedic hub from the region's five Health and Social Care Trusts. There was no agreed pathway for the management of patients with spinal pain in Northern Ireland. Audit data showed documented conservative management was insufficient and orthopaedic outcomes varied widely by referral source, with a low conversion rate to surgery.
Methods: NHS England National Pathway of Care for Low Back and Radicular Pain was adjusted to fit the current regional service through a series of consensus meetings with the Spinal team, orthopaedic ICATS leads and general practitioners. Implementation strategy included educational programmes for primary and secondary care clinicians; an electronic spinal query helpline with all queries answered by a spinal consultant within 24 hours.
Results: Within 6 months of implementation, waiting times for urgent orthopaedic appointment decreased by 10 weeks and referrals to the orthopaedic service by 500 per month. Primary care educational programmes had 85% good-excellent ratings, and clinicians in secondary care rated their ability to do their job including ability to counsel, manage and direct spinal patients as improved following seminars.
Conclusion(s): Implementing a National Pathway demonstrated significant reduction in waiting times and referral rates, improved clinician ability, and as a result improved patient care in this NHS region. This project was awarded Public Health Agency Northern Ireland Safety Forum Award 2016 for teamwork.
Implications: Improved patient care - right person to the right clinician at the right time.
Conflict of Interest: None declared

MANAGEMENT OF COMPLEX SPINAL COLUMN INFECTIONS FOLLOWING ENDOVASCULAR AORTIC REPAIR (EVAR) SURGERY. 10 YEAR EXPERIENCE

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Background: Endovascular aortic graft surgery is developing rapidly and its associated complications are continually evolving. Reported incidence of infection is 1% leading to significant mortality of 35% to 70% and is further complicated with presence of spinal column infection.
Methods: This is a retrospective study performed at a central London teaching hospital. We identified spinal infection in EVAR patients using a web-entry database used by the vascular surgeons.
Results: 9 consecutives cases of EVAR with associated spinal column sepsis were identified between dates January 2005 to September 2016, all male with a mean age of 69 years (56-81 years) with a follow up of 49 months (5-132 months). The original indication for EVAR was elective Abdominal Aortic Anuerysm (AAA) in 3 patients, Mycotic aneurysm in 5 and ruptured AAA in 1. Fifteen different organisms were identified. Five patients underwent explantation of EVAR and vascular reconstruction and 4 treated with antibiotics alone. Two patients required associated spinal surgery to address the spinal discitis/osteomyelitis and instability and are still alive at present. Four patients died at a mean time of 34 months.
Conclusion(s): To date, there are no published reports on management of spinal column infection following EVAR in the literature. Infected EVAR with spinal infection is a serious life threatening condition that requires a complex multidisciplinary approach in its management.
Implications: This study highlights that a high level of clinical suspicion is required in diagnosing spinal column infection and spinal surgeons should have a low threshold for MRI and sequential MRI´s. Obtaining tissue diagnosis either at the graft site or from the spinal column is crucial for microbiological diagnosis and subsequent antibiotic therapy. Spinal surgery is indicated if conservative measures fail to control local infection and systemic sepsis, and if there is clinical and radiological evidence of spinal instability.
Conflict of Interest: None declared

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ACCURACY OF MRI IN ASSESSING SPINAL INSTABILITY USING THE SPINAL INSTABILITY NEOPLASTIC SCORE (SINS) CRITERIA

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Background: Spinal Instability Neoplastic Score (SINS) is a validated scoring tool that assesses the spine´s stability in patients with spinal metastases. Conventionally, computed tomography (CT) scans have been used for SINS, as the bone lesion´s characteristic, which is one of the six components of SINS, is best visualised on CT. This means patients often need to have a CT scan even if they have already had MRI scans. This study aims to investigate the accuracy of MRI in assessing instability using SINS.
Methods: Adult patients with spinal metastases who had presented to the Royal Orthopaedic Hospital in Birmingham between 2012-2016 and whose scans were within 28 days of each other were included. Their MRI and CT scans were retrospectively scored using SINS. It was assumed that ´mixed lytic and blastic´ lesions cannot be determined on MRI. Cut-off score of ≥7 was used to determine the ´potentially unstable´ cases. Sensitivity and specificity of MRI were analysed for comparison.
Results: Thirty patients were identified, of which 9 (30%) had presented for the first time. Only 3 cases had a change in stability category when the scores were compared. Sensitivity and specificity of MRI were 96% and 40% respectively, compared to the previously reported 95.7% and 79.5% for CT. The positive predictive value of MRI was 88.9%.
Conclusion(s): The findings suggest that although MRI has a lower specificity, it is nearly as sensitive as CT in identifying potentially unstable lesions. Larger multi-centre studies should aim to validate our findings.
Implications: This study shows that MRI can be an acceptable alternative to CT in emergency cases where CT is unavailable, or when sending patients for CT would delay the urgent management. Moreover, this means SINS can be applied to the MRI scans of patients in whom CT is contraindicated, such as pregnant females.

Conflict of Interest: None declared

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THE RESULTS OF EARLY SURGICAL DECOMPRESSION AND STABILISATION FOR ACUTE TRAUMATIC SPINAL CORD INJURY IN PATIENTS WITH CONCOMITANT CHEST INJURIES

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Background: The benefits of early surgical decompression and stabilisation (within 24 hours of injury) for patients with acute traumatic spinal cord injury (SCI) is unclear. The objective of this study was to investigate the effects of early (< 24 hrs of injury) versus late (>24 hrs of injury) decompressive and stabilisation surgery for traumatic cervical SCI in patients with concomitant chest injuries.
Methods: A multi-centre retrospective cohort study. Thirty-eight consecutive patients who met the inclusion criteria and underwent decompressive surgery within 24 hours were compared with 41 patients who underwent decompressive surgery after 24 hours. The primary outcomes were ordinal change in ASIA impairment scale (AIS) at 6 months and ICU stay. Secondary outcomes included complications within 30 days and requirement for a tracheostomy.
Results: In the early surgery group, AIS grade improvement was as follows: 21 (55%) no improvement, 13 (34%) had a 1 grade improvement and 4 (11%) had a 2 grade improvement. Mean ICU stay was 17 days (3-71). 47% of patients developed a complication and 50% required a tracheostomy. In the late surgery group, AIS grade improvement was as follows: 26 (65%) no improvement, 12 (30%) had a 1 grade improvement and 2 (5%) had a 2 grade improvement. Mean ICU stay was 24 days (4-68). 58% of patients developed a complication and 56% required a tracheostomy. There was one mortality in the late surgery group.
Conclusion(s): For patients with acute traumatic cervical SCI and concomitant chest trauma, early surgical decompression and stabilisation was associated with improved neurological outcome, reduced ICU stay and a lower complication rate.
Implications: Early surgical stabilisation may be beneficial in acute spinal cord injury with concomitant chest injuries.
Conflict of Interest: None declared

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THE OUTCOMES OF SPINAL STENOSIS SURGICAL TREATMENT IN ACHONDROPLASIA: A SYSTEMATIC REVIEW

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Background: Achondroplasia, a skeletal dysplasia caused by mutations in the *FGFR3* gene, is the commonest form of disproportionate short stature. Individuals with achondroplasia have a spinal canal narrowed by shortened pedicles and decreased inter-pedicular distance. Approximately 20-30% of patients are symptomatic, and 10% require treatment. This review assesses the evidence supporting two treatment options (Decompression Vs Decompression and instrumented fusion) with respect to surgical and functional outcomes.
Methods: We performed a systematic search of the online databases of PubMed/Medline, Embase, Cochrane Library, AMED, and CINAHL to identify studies that evaluated the treatment outcomes of spinal stenosis in children and adults with achondroplasia.
Results: We identified 9 retrospective studies involving 268 patients. The average age was 30.8 years, with a mean follow up of 4.5 years and a mean duration of symptoms prior to intervention of 3.9 years. In 7 out of 9 studies, patients underwent decompression only; 2 studies performed decompression only, as well as, decompression and instrumented fusion in the same cohort. Patient Reported Outcome Measures (PROMs) were reported in 3 out of 9 studies. Symptoms fully or partially resolved in 48.5% of patients; recurrence of symptoms was reported in 11%. Intra-operative durotomy rate was 16.7%, while the total re-operation rate in this population was 38%. In one study of

spinal stenosis in a paediatric population, post-operative kyphotic deformity developed in 100% of patients, and all required instrumented stabilisation.
Conclusion(s): Studies were of noticeable heterogeneity in reporting their surgical and functional outcomes. Surgical intervention carries a significant risk of re-operation and associated complications in this population. Based on the available literature, there is insufficient evidence to suggest superiority of one surgical treatment option over another.
Implications: Multi-centre prospective collection of pre-identified data on specific surgical outcomes and validated PROMs is required to provide evidence to inform future practice.
Conflict of Interest: None declared

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MUA + INJECTION: QUICK FIX FOR THE COCCYX?

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Background: The management of coccydynia is initially conservative, with MUA + injection if this fails. Outcome data has been published for coccygectomy, but not for MUA and injection, meaning treatment success if difficult to quantify. This has implications for informed consent, and healthcare economics.
Methods: All patients who had MUA + injection of the coccyx at Sheffield Teaching Hospitals between 2013 and 2016 were identified from the British Spine Registry. 185 procedures were performed over this period. Patients without complete pre- and post-Oswestry Disability Index (ODI) scores were excluded, leaving 66 patients in the study. Primary outcome was improvement in ODI score of 8 or more points. Secondary outcomes were repeat treatment or progression to surgery.
Results: 35/66 (53%) had a change in ODI score at or above the MCID of 8 points. 8/66 (12%) patients had an improvement below MCID and 16/66 (24%) patients had a rise in ODI compared to pre-treatment scores. 24/31 (77%) of the patients who failed to reach MCID underwent a second MUA and injection. 11/66 patients (17%) ultimately underwent coccygectomy.
Conclusion(s): This is the first study to assess MUA and injection coccyx outcomes using a validated outcome measure. In this study 53% of patients reached the MCID after one injection, and 17% of patients ultimately progressed to surgery due to ongoing symptoms. 30% of patients did not undergo surgery despite not achieving MCID improvement in ODI scores.
Implications:
Collection of outcome scores remains difficult and needs further improvement. ODI appears to be a poor measure of treatment outcomes in coccydynia, and a more representative scoring system is needed. When consenting for MUA and injection patients should be told there is 83% chance that cases will not need surgical treatment based on this study.
Conflict of Interest: None declared

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INCIDENCE OF SCHWAB SAGITTAL MODIFIERS IN PATIENTS WITH FAILED BACK SURGERY

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Background: Sagittal malalignment is a key factor in failed spinal surgery. The role of spino-pelvic parameters is well documented in patients undergoing deformity correction. The SRS- Schwab classification incorporates spino-pelvic parameters in the assessment of adult spinal deformity. The purpose of this study was to assess the incidence of Schwab modifiers in a cohort of patients with failed spinal surgery irrespective if the initial pathology.
Methods: All adult patients referred to a tertiary spinal deformity centre across a 12-month period were included in the study. Data was retrospectively analysed but prospectively collected. Patients who had not previously undergone open spinal surgery were excluded from the study. Radiographs for these patients were then analysed and spino-pelvic parameters gleaned.

Results: A total of 147 patients were included in the study. 55 patients (37%) had three abnormal Schwab modifiers; 39 patients (26%) had two abnormalities and 38 patients 26% had a single abnormality. 43 patients (29%) had revision surgery and 104 patients (71%) had only single surgery. 43 patients had revision surgery. Between those patients who underwent revision and those that were managed conservatively there was a significant difference in the PI-LL mismatch (p=0.024).
Conclusion(s): Schwab modifiers within the SRS-Schwab classification of adult spinal deformity are important in assessing and managing patients undergoing spinal surgery. Significant derangement of spino-pelvic parameters is a predictive indicator of failed surgery. Correction of spino-pelvic parameters must be a pre-requisite of revision spinal surgery and represents an objective goal of surgery.
Implications: Use of SRS-Schwab classification can help predict those patients that will have a poor outcome after spinal surgery.
Conflict of Interest: None declared

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SPINOPELVIC DISSOCIATION FOLLOWING TRAUMA - THE ROYAL MELBOURNE HOSPITAL EXPERIENCE

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Background: Traumatic spinopelvic dissociation is a rare high-energy injury pattern often associated with neurological injury. Because of the relative infrequency of this injury pattern, little evidence is available to formulate a standard treatment algorithm. The purpose of this case series is to evaluate The Royal Melbourne Hospital (RMH) experience, surgical techniques, and to review the associated patient outcomes
Methods: Patients treated at RMH for spinopelvic dissociation between 2013-2016 have been identified using the Orthopaedic Unit Database. Clinical outcomes have then been evaluated following surgical treatment utilizing the RMH treatment algorithm. Patient age, mechanism of injury, type of surgical fixation, time from injury to fixation, Injury Severity Score and associated pre-operative and post-operative neurological deficit has been evaluated alongside clinical outcomes during follow-up.
Results: A total of 9 patients have been identified to meet the inclusion criteria for spinopelvic dissociation. Mean age for our patient cohort was 29, with 3 males and 6 females. Mechanism of injury was either fall from a height >2m or high speed motor vehicle accident. Mean time from injury to surgical fixation was 5 days. Five patients suffered lumbosacral nerve root injuries, and 4 patients had a normal neurological exam. Out of the 5 patients with neurological injury, 2 made a complete recovery by 5 months, 2 made a partial recovery with ongoing sensory derangements and 1 patient had a complete resolution of neurological symptoms immediately post-operatively.
Conclusion(s): Spinopelvic dissociation is an injury associated with high velocity trauma and carries with it a significant risk of lumbosacral nerve root injury. Utilizing the RMH surgical approach of insitu spinopelvic fixation, following open reduction without deliberate nerve root decompression, results in good outcomes for patients with improvement in neurological deficits.
Implications: Reconsider the importance of acute nerve root decompression in spinopelvic dissociation injuries.
Conflict of Interest: None declared

Shoulder and Elbow free papers

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HOW DOES MUSCLE PATTERNING IN PATIENTS WITH COMPLEX SHOULDER INSTABILITY DIFFERS FROM THE "NORM"?

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Introduction: Patients with atraumatic shoulder instability or "Polar Type III/II" under the Stanmore Classification are a poorly understood group. There are conflicting findings in the literature, and the

studies are of small or poor quality. We undertook a comprehensive Electromyography analysis to investigate shoulder muscle activation during an arm elevation task based on activities of daily living.
Method: Sixteen patients with atraumatic shoulder instability were included and 16 age match controls were recruited. Surface electrodes were utilized to record the activity of 10 muscles: upper trapezius, serratus anterior; pectoralis major; biceps brachii; lattissimus dorsi, teres major, infraspinatus, anterior, middle, and posterior deltoid. The FIT-HaNSA functional assessment was undertaken.
Results: The peak amplitude used an objective single measure that was used as a marker for the pattern of activation. In forward flexion, AD, MD, BB and ISP, the peak amplitude occurs earlier in the patients compared to the controls. By contrast, for PD, UT and SA, the reverse is true with the patients´ activations occurring later than the controls´. In abduction/adduction, for 7 of the muscles, AD, MD, UT, TM, LD, BB and ISP, the patient activation is delayed compared to the control group. Further, for the PD, SA and PM the patients´ peak activation occurs before the control group.
Conclusion & **Discussion:** This is the largest study undertaken looking at muscle patterning of patients with type II/III shoulder instability. Contrary to previous findings, our work establishes that there is no one muscle that causes shoulder instability and that it is a complex picture. This would be consistent with the dynamic movement of the shoulder, which is dependant on synchronised muscle activation to achieve stability.
Conflict of Interest: None declared

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GLENOHUMERAL ARTHRODESIS FOR LATE RECONSTRUCTION OF FLAIL SHOULDER IN PATIENTS WITH TRAUMATIC SUPRACLAVICULAR BRACHIAL PLEXUS PALSY

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Background: Traumatic injuries of the brachial plexus can cause devastating loss of upper limb function and can pose a significant challenge to conventional management strategies. Flail shoulder is characterized by painful subluxation of the glenohumeral joint and the inability to independently position the hand in space. The aim of this retrospective cohort study was to report the results of glenohumeral arthrodesis for late reconstruction of flail shoulder in patients with traumatic supraclavicular brachial plexus palsy.
Methods: Between May 2000 and July 2014 glenohumeral arthrodesis was carried out on 21 consecutive patients. Of these, seven cases were due to flail shoulder that occurred following a high-energy road traffic accident. Mean age at the time of surgery was 48 years (range, 28-80). The cohort consisted of six males and one female. The average time to surgery from date of injury was 5 years (range, 2.5-8). All patients were evaluated using the Oxford Shoulder score (OSS) and subjective shoulder value (SSV).
Results: Six patients achieved bony union with a mean time to fusion of 4.7 months (range, 2-8 months). Non-union occurred in one case. The mean OSS improved from 11 preoperatively (range, 4 - 16) to 27 postoperatively (range, 16 - 40) ($p = 0.016$). This was accompanied by an increase in the mean SSV, which improved from 7 (range, 0 - 15) preoperatively to 45 (range, 15 - 100) postoperatively ($p = 0.029$).
Conclusion(s): In our series, glenohumeral arthrodesis was associated with few complications, and effectively reduced pain and improved functional outcome in this selected patient population.
Implications: Glenohumeral arthrodesis for late reconstruction of flail shoulder in patients with traumatic supraclavicular brachial plexus palsy is associated with few complications, and effectively reduces pain and improves functional outcome.
Conflict of Interest: None declared

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MRI AND CLINICAL ASSESSMENT OF INTERPOSITIONAL DERMAL ALLOGRAFT REPAIR OF MASSIVE ROTATOR CUFF TEARS

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Background: Massive retracted rotator cuff tears represent a serious therapeutic dilemma, particularly in the young and middle aged patients who are not appropriate for a reverse total shoulder replacement. Interposition grafting using human dermal allograft offers an alternative treatment.
Methods: We conducted a retrospective review of all patients who underwent interposition grafting using human dermal allograft between December 2013 and May 2015 for massive rotator cuff tears at our tertiary referral centre (n7). Mean age at time of follow up was 54 years. Clinical evaluation included strength of abduction, external rotation, belly press and lift off tests. Oxford, Constant and DASH scores were collected. Pre-operative and six month post-operative MRI assessments were available for all patients.
Results: 84% of grafts were seen to have failed at 6 months on MRI evaluation. Strength was grossly reduced on the operative side when supraspinatus and subscapularis were tested; abduction, lift off and belly press testing. Abduction strength was 46% of the contralateral side. However, despite this Constant scoring was comparable to previous literature; mean 48.2. DASH and Oxford scores had a mean of 24.94 and 37.16 respectively.
Conclusion(s): 6 months post operatively, dermal allograft used as an interpositional graft fails, creating a measurable weakness in the rotator cuff. Despite this there seems to be acceptable functional scores. We feel that the functional scores and patient perceived improvement is due to the graft preventing proximal migration and abutment of the humeral head.
Implications: Due to these results, in particular the MRI findings, we cannot advocate the use of dermal allograft as an interposition graft for the repair of massive rotator cuff tears. Furthermore we have moved away from this technique within the shoulder. We feel the improved functional scores will be short lived, and we intend to follow up this cohort in the long term.
Conflict of Interest: None declared

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CAN CLINICAL SCORES IN SHOULDER INSTABILITY GIVE USE INSIGHT INTO DIFFERENT CORTICAL ACTIVATION?

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Introduction: The Oxford Shoulder Score and Western Ontario Shoulder Instability Index are validated and well used patient reported clinical scores. They are used in an attempt to both classify and assess progress of patients. We were interested to see if Functional Magnetic Resonance Scanning correlated with these clinical scoring schemes.
Method: We recruited 16 patients with shoulder instability (Polar Type II/III - Standmore Triangle) and 16 age matched controls. Both groups underwent Functional Magnetic Resonance Scanning whilst undertaking simple shoulder movements. The Oxford Instability Shoulder Score and Western Ontario Shoulder Instability Index was completed by both groups.
Results: This patient group showed activations that correlated with the Western Ontario Instability Index. Activations were seen in Brodmann areas 3, primary somatosensory cortex; 6, supplementary motor cortex, 11, orbitofrontal area; 26, cingulate gyrus and the amygdala. Further, for the patients, there was a correlation with the Oxford Shoulder Instability Score in the amygdala.
Discussion and conclusion: This is one of the first studies that objectively demonstrates the correlation between a shoulder instability score and cortical activation. The findings, with respect to the primary somatosensory cortex, supplementary motor cortex and the amygdala, are consistent with findings suggestive of a compensatory activation and a parallel activation of the limbic system. There is clear fMRI evidence of a motor and sensory reorganisation within the patient group. Drawing from previous work, in neurological conditions of various pathophysiologies, it is well established that the cortex reorganisation is a compensatory strategy to maintain or improve limb motor function.
Conflict of Interest: None declared

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CORONAL STABILIZATION AND BRACING OF DISPLACED CAPITELLUM FRACTURE: A SIMPLE 'J' SHAPED KIRCHNER WIRE STAPLING TECHNIQUE

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Background: The purpose of the prospective study was to evaluate and present the clinical, radiological and functional out comes of fractured capitellum treated with open reduction and internal fixation with a new technique of ´J´ shaped coronal Kirschner wires.
Methods: Since 1989, displaced closed 17 capitellum fractures were internally fixed by inserting J shaped Kirschner (K) wires in coronal plane from the capitellum into trochlea. 4 patients had extension of fracture into trochlea, and 3 patients had posterior-lateral condyle comminution which required additional screw fixation. The capitellum was approached between extensor carpi radialis brevis (ECRB) and extensor digitorum communis (EDC), anterior to lateral collateral ligament (LCL). The capitellum fracture was open reduced and held in situ by elbow flexion and then internally fixed. The lateral ends of wires were bent behind the fracture plane and anchored into the lateral humeral condyle. Total 17 patients (7 males and 10 females) with mean age 34.8 years (14 to 75) had fractures, Type I: (Hans Steinthal #) 12, Type II: (Kocher Lorez #) 1, and Type III: (Broberg and Morrey #) 4. Post-operatively the patients were mobilised immediately without plaster.
Results: Average follow up was 31.7 (18-35) months and fractures healed in all the patients. Mayo elbow performance index score (MEPIS) was excellent in 12, good in 4, and fair in 1 patient. Elbow ROM was 5 to 132 degrees, pronation 84.5 (79-90) degrees and supination 88 (85-91) degrees. Complications seen were wire pain in 3 and loosening of wires in 1 patient.
Conclusion(s): A simple hyper-flexion elbow manoeuvre reduced the capitellum under the radial head anatomically, and K wires stapling technique to be very stable and cost effective without damaging the articular surface. A limited exposure of capitellum helped to restore immediate stable elbow, with good function.
Conflict of Interest: None declared

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REVISION TOTAL SHOULDER ARTHROPLASTY FOR FAILED HUMERAL HEAD RESURFACING

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Background: Humeral head resurfacing hemiarthroplasty (HHRH) is most commonly undertaken for osteoarthritis of the shoulder. Understanding the reasons for failure of HHRH and the outcome of subsequent revision is essential for patient counseling and future prosthetic design. The aim of this retrospective cohort study was to analyse and report the clinical outcomes following revision total shoulder arthroplasty (TSA) for failed HHRH.
Methods: Between September 2009 and January 2014, 20 consecutive patients underwent revision TSA for failed HHRH at our study institution. Two patients had bilateral procedures, allowing 22 shoulders to be available for analysis. Mean age at the time of HHRH was 60 years (range, 42-75). The cohort consisted of 17 females and three males.
Results: The mean interval from HHRH to revision TSA was 5 years (range, 1-8 years). Mean age at the time of revision surgery was 62 years (range, 44-80). Patients were followed up for a mean of 3.3 years (range, 2-4 years). Reasons for failure included glenoid erosion in 18 shoulders, rotator cuff tear arthropathy in two shoulders, and painful stiffness without glenoid erosion in two shoulders. Following revision surgery, there was an increase in forward elevation from 67^0 (range, 0-130^0) to 97^0 (range, 40-160^0) (P=0.04). This was accompanied by an improvement in both the Oxford shoulder score and the subjective shoulder value, which increased from 13 (range, 2-28) to 39 (range, 24-48) (P=0.000) and from 23 (range, 0-65) to 79 (range, 25-100) (P=0.000) respectively.
Conclusion(s): Revision TSA for failed HHRH improves functional outcome in the short term. Larger long-term studies are needed to identify factors that increase the likelihood of failure and to establish the longevity of implants used in the revision setting.
Implications: Revision TSA for failed HHRH improves functional outcome in the short term.
Conflict of Interest: None declared

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THE WIDE ANGLED ARTHROSCOPE - AN INNOVATION TO IMPROVE ARTHROSCOPIC SKILLS PERFORMANCE

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Background: A conventional arthroscope has a field of view of 105^0. We have developed an arthroscope with a field of view of 150^0. The advantages of such an arthroscope include less motion needed to manoeuvre within the joint (thereby reducing iatrogenic damage), less optical error (thereby improving accuracy of instrumentation such as anchor position and tunnel placement), and possibly improving the learning curve of novices. We compared performances during simulated shoulder arthroscopy tasks between the 105^0 and 150^0 angled arthroscopes. This was measured using motion analysis, time and a new validated measure, the Dimensionless Squared Jolt (DSJ). We have shown the DSJ is a superior assessment tool in differentiating experts from novices during simulated shoulder arthroscopy. We hypothesize that performance on the wide-angled arthroscope would be superior compared to the conventional arthroscope.
Methods: We compared 13 arthroscopic novices´ surgical skills on the wide-angled versus conventional arthroscope. These novices completed 3 standardized tasks three times. Motion analysis was performed using an optical tracking system. Differences in arthroscopic performance parameter between the 2 arthroscopes was investigated using a T-test.
Results: There was a significant difference between the wide-angled and conventional arthroscope as measured by DSJ (P=.0008). The other parameters did not demonstrate a difference.
Conclusion(s): These results show the value of using DSJ in addition to motion analysis and task completion time as a method of objectively assessing arthroscopic performance. We have also shown its use in evaluating a new arthroscope, and conclude the wide-angled arthroscope has potential to improve arthroscopic performance.
Implications: The wide-angled arthroscope may improve arthroscopic performance and may provide a superior training tool than the conventional arthroscope.
Conflict of Interest: None declared

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OSTEOCHONDRAL ALLOGRAFT RECONSTRUCTION OF THE HUMERAL HEAD REVERSE HILL SACHS LESION

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Background: Posterior gleno-humeral dislocations are rare, accounting for approximately 2% of all shoulder dislocations and are often associated with an anterior impression fracture of the humeral head, the “reverse Hill Sachs lesion”. Reconstruction of the humeral head using fresh frozen femoral allograft is a recognized treatment option although little is known regarding patient outcomes. Our objective was to evaluate radiological and functional outcomes in patients who underwent this procedure.
Methods: Between 2010 and 2015 we used this method to treat 5 patients (3 males, 2 females), average age 53.4 years. All had unstable posterior shoulder dislocations with a humeral head defect of between 30% and 60%. All proceeded to a timed open reduction and femoral head allograft reconstruction. At the most recent follow up (mean 34 months) radiological and CT evaluations were performed to assess articular anatomy and graft incorporation. The Constant-Murley shoulder score was utilized to assess functional outcomes.
Results: Mean time from injury to diagnosis was four days. Closed reduction under GA was attempted in all cases, one was irreducible and four were recurrently unstable. All patients showed graft incorporation. Three patients showed full preservation of the joint, one showed graft incorporation with partial flattening and one although fully incorporated developed articular retraction of the graft. Four

patients had no restriction of ADLs and three had no pain. None displayed instability. Mean Constant-Murley score at latest review was 83 (45-96).
Conclusion(s): Reconstruction of the humeral head with fresh frozen femoral head provides shoulder stability and good functional outcome scores. The allografts incorporate well, however graft retraction is a potential complication.
Implications: Due to excellent graft incorporation bone preserving revision arthroplasty surgery is possible. There are only a few studies in literature that describe this procedure and our results would support its use with good radiological and functional outcomes.
Conflict of Interest: None declared

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THE PREVALENCE AND CLINICAL IMPACT OF OSTEOLYSIS OF THE DISTAL CLAVICLE AND CORACOID FOLLOWING ACROMIOCLAVICULAR JOINT (ACJ) STABILISATION WITH A SYNTHETIC LIGAMENT. A MEDIUM-TERM FOLLOW-UP STUDY

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Background: Osteolysis has been reported following ACJ reconstruction with a synthetic graft. We present the first study into its prevalence and pattern, and whether it has an adverse effect on patient outcome.
Methods: Patients who underwent surgical treatment of an unstable ACJ injury using the Surgilig/LockDown implant were identified via our database. Patients were invited to attend a dedicated outpatient clinic for clinical examination, radiographic evaluation, and completion of Oxford shoulder score (OSS), DASH score, and Patient Global Impression of Change (PGIC). Patients who were unable to attend clinic were contacted by telephone to complete scoring.
Results: 49 patients were identified from our surgical database. We assessed 21 clinically at a mean of 7 years post-procedure (range 3-11 years). All patients had radiographic evidence of distal clavicle and coracoid osteolysis. We did not observe progression of osteolysis from the final post-operative radiographs to those taken at our assessment. A further 13 were contacted by phone. The mean OSS was 43 (range 31-48) and mean DASH score was 8.5 (range 3-71). Each patient gave their overall impression using the PGIC with an average score of 6 (range 2-7). Six patients underwent removal of a prominent screw at a mean time of 2 years after surgery; the pattern and presence of osteolysis was no different in this group. All patients had comparable abduction, forward flexion and internal rotation to their uninjured shoulder, but two had a mild restriction of passive external rotation. We did not observe any relationship between patient demographics, position of implant or etiology and the pattern of radiographic osteolysis observed.
Conclusions: Osteolysis of the distal clavicle and/or coracoid is always seen following synthetic reconstruction of the ACJ using this implant, but is non-progressive. Despite this finding, range of shoulder movement is largely unaffected and patient outcomes remain high.
Conflict of Interest: None declared