Wednesday 13th November
Free Paper Session 1

FP1
Cartiva synthetic cartilage implant hemiarthroplasty for treatment of hallux rigidus

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Objectives: Cartiva synthetic cartilage implant (SCI) is licenced for use in management of symptomatic hallux rigidus in several countries including the UK. As for now, there are no independent comparative series for treatment of hallux rigidus utilising polyvinyl alcohol implants.
Study design and methods: Patients at a single centre with symptomatic hallux rigidus who underwent Cartiva SCI implant procedure were identified. First metatarsophalangeal joint arthritis was radiographically graded according to the Hattrup and Johnson (HJ) classification. Pre-operative and post-operative patient-reported outcomes were evaluated using the Foot and Ankle Ability Measure (FAAM) activities of daily living subscale and the Manchester-Oxford Foot Questionnaire (MOXFQ).
Results: 66 patients (19M, 47F) (43R and 23L) were followed up for an average of 14 months (min=2, max=36). 17 patients suffered from HJ2/moderate arthritis and 49 patients with grade HJ3/severe arthritis. Post-operative mean FAAM scores showed statistically significant improvement ($p < 0.0001$). Patients reported a 40% increase in functionality during activities of daily living.
All 3 MOXFQ Domain scores improved significantly ($p < 0.02$). The Index score improved by 28 points ($p < 0.0001$).
There was no correlation between length of follow up or age and PROMs ($r=0.129$). No statistical difference was demonstrated between sexes. However clinically, males and older patients exhibit better outcomes.
There was a 89.4% patient satisfaction with the use of Cartiva.
Conclusions: Our study shows excellent results with statistically significant improvements in functional outcomes, and promising short-term follow-up with low early revision rates. Pain in particular was significantly reduced. One third of patients developed post-operative stiffness requiring a manipulation under anaesthesia. Patient selection is key. Additional imaging may be required to assess sesamoid osteoarthritis. At 3 years the implant has demonstrated to be safe and efficacious in the management of hallux rigidus. Durability and survivability of the implant will continue to be studied in this cohort.

FP2
Long term clinical results of hallux varus correction by a reversed abductor hallucis transfer

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Background: Iatrogenic hallux varus is a rare complication after hallux valgus surgery. Operative treatment comprises a wide variety of techniques, of which the reversed transfer of the abductor hallucis tendon is the most recent described technique.
Methods: This paper will present the long-term clinical results of the reversed transfer of the abductor hallucis longus. Therefore, we performed a prospective clinical observational study on 16 female patients. Our hypothesis is that the tendon transfer will persist in a good alignment and patient satisfaction on long term. There is a 100% follow-up rate with a range from 10 to 101 months. Patients were subjected to a clinical examination, three questionnaires and their general satisfaction.
Results: Out of 16 patients, at time of follow-up, we found a positive correlation between the subjective outcome score and alignment ($r = 0.59$), and between the general satisfaction and alignment ($r = 0.77$). Based on the general satisfaction we achieved a success satisfaction rate of 69% (11 patients). The other 31% (5 patients) patient group was only satisfied with major reservations or not satisfied at all. The two most invalidating complications were a coronal or sagittal malalignment or the combination of both.
Conclusion: Our results suggest that the reverse abductor hallucis tendon transfer is a good technique to treat a supple iatrogenic hallux varus with an observed success satisfaction rate of 69% at a mean follow-up time of 48 (range 10-101) months. However, patients should be informed that on the long-term loss of correction is possible.

FP3
Outcome and complications after cheilectomy for hallux rigidus at an average of 6 years

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Introduction: Cheilectomy is a recommended procedure for the earlier stages of osteoarthritis of the 1st metatarsophalangeal joint. Although good improvement in symptoms have been reported in many studies, the long term performance of this procedure is not well understood. It is thought that a significant number of

patients go onto have arthrodesis or joint replacement. We report on a large cohort of patients who received this procedure and report on the complications and mid-term outcome.
Methods: This is a retrospective study looking at all patients who underwent cheilectomy for hallux rigidus between November 2007 and August 2018. Departmental database was used to access patient details and outcome measures recorded include: postoperative wound infection, patient reported improvement in pain and the incidence of further surgical interventions like revision cheilectomy and conversion to arthrodesis and arthroplasty. X-rays were studied using PACS to stage the osteoarthritis (Hattrup and Johnson classification).
Results: A total of 240 feet in 220 patients (20 bilateral surgeries) were included in the study, there were 164 Females (75%) and 56 Males (25%), the median age was 55 years (range 22-90 years). Radiological assessment showed 89 Stage 1 arthritis(42%), 105 Stage 2 (50%), 17 Stage 3 (8%) and 9 patients were excluded due to unavailable X-rays. 5 patients (2%) had superficial wound infection. There were 16 further surgeries (7%) performed in this cohort, 12 arthrodesis (5%), 3 revision cheilectomy and 1conversion to arthroplasty. 157 patients were found to be pain-free at the latest post-operative visit (77%), 48 reported minimal pain (23%), 15 patients were excluded due to unavailable data.
Conclusion: Cheilectomy appears to produce good improvement in pain with a low complication rate. The rate of conversion to arthrodesis/arthroplasty is lower than in many reported studies.

FP4

Patients expectations versus their functional outcomes after hallux valgus corrective surgery: a prospective study

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Purpose: To explore the relationship in terms of time scale between pre-operative expectations and postoperative outcomes and satisfaction after Hallux valgus surgery.
Methods: A patient derived questionnaire was developed and 30 patients aged 19 to 67 were included undergoing primary hallux valgus correction with a first metatarsal osteotomy and distal soft tissue release. Patients were asked pre-operatively to quantify their expected time scale for improvement in pain, ability to walk unaided, ability to drive, routine foot wear and foot feeling normal at 6 weeks, 3 and 6 months following surgery, and to indicate their confidence in achieving this result. Patients recorded postoperative outcomes achieved at number of weeks. Ordinal logistic regression multivariate modelling was used to examine predictors of postoperative satisfaction.
Results: 90% of the patients were able to walk unaided and drive before or around the expected time scale at an average of five weeks´ time. Persistent pain subsided at an average of two weeks post operatively which led to high satisfaction Although differences between patients´ expectation and achievement were minimal at 6 weeks post-operatively, there was some discrepancy at 3 months, with patient expectations far exceeding achievement. The least satisfactory outcome was normal feeling of foot at six months follow up. There were significant correlations between failure to achieve expectations and the importance patients attached to recovery.
Conclusions: This study underlines the importance of taking preoperative expectations into account to obtain an informed choice on the basis of the patient´s preferences. Patients´ pre-operative expectations of surgical outcome exceed their functional achievement but satisfaction remains high if pain control and ability to walk unaided is achieved early after hallux valgus corrective surgery.

FP5

Five-year outcomes after ankle fracture fixation in a UK teaching hospital

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Introduction: Ankle fractures represent approximately 10% of the fracture workload and are projected to increase due to ageing population. We present our 5 years outcome review post-surgical management of ankle fractures in a large UK Trauma unit.
Methods: A total of 111 consecutive patients treated for an unstable ankle fracture were entered into a database and prospectively followed up. Baseline patient characteristics, complications, further intervention including additional surgery, functional status were recorded during five-year follow-up. Pre-injury and post-fixation functional outcome measures at 2-years were assessed using Olerud-Molander Ankle Scores (OMAS) and Lower Extremity Functional Scales (LEFS). A p value < 0.05 was considered significant.
Results: The mean age was 46 with a male:female ratio of 1:1.1. The distribution of comorbidities was BMI >30 (25%), diabetes (5%), alcohol consumption >20U/week (15%) and smoking (26%). Higher BMI was predictive of worse post-op LEFS score ($p = 0.02$). Between pre-injury and post fixation functional scores at 2 years, there was a mean reduction of 26.8 (OMAS) and 20.5(LEFS). Using very strict radiological criteria, 31 (28%) had less than anatomical reduction of fracture fragments intra-operatively. This was, however, not predictive of patients' functional outcome in this cohort. Within 5-year period, 22 (20%) patients had removal of metalwork from their ankle, with majority 13 (59%) requiring syndesmotic screw removal. Further interventions included: joint injection (3), deltoid reconstruction (1), arthroscopic debridement (1), superficial sinus excision (2), and conversion to hindfoot nail due to failure of fixation (1). Reduction in OMAS was predictive of patients' ongoing symptoms ($p=0.01$).
Conclusion: There is a significant reduction in functional outcome after ankle fracture fixation and patients should be counselled appropriately. Need for removal of metalwork is higher in patients who require syndesmosis stabilisation with screw(s).

FP6

Fibular nails - Is this the answer to ankle fracture fixation?

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Introduction: Positive reports from implant designer centres on the use of fibular nails in the complex ankle fractures has resulted in a marked increase in their use nationally. Our aim in this study was to report on the outcomes of the use of all fibular nails in two major trauma centres.
Methods: All patients who underwent ankle fracture fixation using a fibular nail in two major trauma centres, were included for analysis. MTC 1 included patients from April 2013 to May 2015, and MTC 2 included patients February 2015 to March 2018. A minimum follow up of 1 year was achieved for all patients. Radiographic reduction was confirmed by Pettrones criteria at time of operation and at 6 weeks and 1 year post-operatively. Kellgren Lawrence radiographic criteria was used to classify osteoarthritis. All complications and further surgery were recorded.
Results: Forty-four patients underwent fibular nail fixation in the two centres. The average age was 59 (range 21-91). Using Pettrones criteria, 86% were malreduced at time of operation. A further 34% deteriorated by at least 1 grade by 6 weeks and an additional 16% (n=7) deteriorated by at least 1 grade by 1 year. 57% had developed radiographic evidence of osteoarthritis by 1 year. Only 4.5% (2ankles) maintained complete reduction by 1 year. Other significant complications were reported in 43% of patients.
Conclusion: Both major trauma centres report the same experience in the use of fibular nails for ankle fracture fixation. As previously reported in smaller number studies, initial reduction is challenging. Worryingly, the majority of well-reduced lose position with time. We suggest that the fibula nail is used with caution and as part of an appropriately approved audit.

FP7

Early Motion And Directed Exercise (EMADE) versus usual-care, post ankle fracture fixation: 12 and 24-week results from a pragmatic randomised controlled trial

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Background: Ankle fractures are extremely common but unfortunately, over 20% fail to obtain good to excellent recovery. For those requiring surgical fixation, usual-care post-surgery has included six-weeks cast immobilisation and non-weightbearing. Disuse atrophy and joint stiffness are detrimental sequelae of this management. While rehabilitation, starting at two-weeks post-surgery is viewed as safe, the literature contains methodological flaws and a lack of focus on early exercise, perpetuating the controversy over the effectiveness of early exercise interventions.
Objectives: Our objectives were to determine if following operative fixation for Weber B fracture, the physiotherapy intervention, early motion and directed exercise (EMADE), applied in the clinical setting, were superior to Usual-care at 12-weeks (primary outcome) and 24-weeks.
Design and Methods: We undertook a pragmatic-RCT, recruiting 157 surgically fixed Weber B ankle fracture patients, to establish if EMADE was superior to the Usual-care of 6-weeks immobilisation. The EMADE physiotherapy intervention (between week-2 and 4 post-surgery) utilised a removable cast and combined non-weightbearing progressive home exercises with manual therapy, advice and education. The primary outcome measure was the OMAS at 12-weeks.
Results: 130 participants returned their 12-weeks post-surgery data, exceeding the 60/group threshold set by the a-priory power calculation. Group OMAS means were; 62.0 and 48.8 (SD 21, 22.5) EMADE, Usual-care respectively, yielding a clinically meaningful mean difference of 13.2 on the OMAS and a statistical difference (95% CI p< 0.001, 5.66 to 20.73). Both clinically meaningful and statistically significant findings were maintained at week-24. There were no intervention related or unexpected adverse events, including instability.
Conclusions: This clinic set pragmatic-RCT yielded both clinical and statistical outcomes at week-12 in favour of the EMADE physiotherapy intervention over the Usual-care of 6-weeks immobilisation, in surgically fixed Weber B ankle fracture patients. These positive findings were maintained at week-24 and justify EMADE physiotherapy as a viable treatment option.

FP8

Charcot neuroarthropathy: surgical outcomes following hind and midfoot reconstruction. A minimum 12 month follow up from a tertiary hospital

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Background: Corrective fusion of a deformed / unstable Charcot neuroarthropathy (CN)of the midfoot and

hindfoot is performed with the aim to prevent ulcers and maintain patient mobility.
Methods: Between October 2007 and July 2018, 103 CN mid and hind foot corrections in 95 patients were performed. There were 34 hind-foot, 38 mid-foot and 31 combined hind and mid-foot surgeries. 83 feet had single stage corrections, whereas 20 required a staged operation.
Results: Ninety-five patients were prospectively followed up. The mean patient age in our study was 57 years (21 - 85). Twenty-seven patients had type1 diabetes, 64 patients had type 2 and 4 patients had a neuropathy secondary to other conditions. Forty patients (42%) were offered a below knee amputation prior to attending our foot clinic.
At a mean follow up of 56 months (12- 140) we achieved 100% limb salvage with a 75% full bone fusion rate. There were 17 mortalities within our cohort at a mean period of 3 years. Ninety-seven percent (n=92) patients were mobilizing post-operatively in orthotic footwear.
Fifty-two feet had pre-operative ulcers. Post-operatively 17 feet (16 patients) had persistent ulceration. Eight patients had ulcer resolution following further surgery and alteration of footwear, one patient has been listed for a below knee amputation for unstable non-union, whilst the remaining 7 patients have stable ulcers which are managed with dressings.
Of the 26 feet (25 patients) with non-unions, 6 patients had revision fixation procedures whilst 8 patients required minor surgical procedures. The remaining 11 patients are stable non-unions who are asymptomatic and weight bearing.
Other complications included a deep infection rate of 8% (n=7).
Conclusion: We demonstrated a 100% limb salvage rate and an 83% success rate in ulcer resolution. We recommend this be done with the support of the multi-disciplinary team.

FP9
Infected charcot ankle neuroarhtrpathy, any hope before amputation? A prospective study

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Background: Charcot neuroarthropathy is a destructive disease characterized by progressive bony fragmentation as a result of the isolated or accumulative trauma in patients with decreased sensation that manifests as dislocation, periarticular fractures and instability. Although amputation can be a reasonable cost economic solution, many patients are willing to avoid that if possible. We explored here one of the salvage procedures.
Methods: 23 patients with infected ulcerated unstable Charcot neuroarthropathy of the ankle were treated between 2012 and 2017. The mean age was 63.5 ±7.9 years; 16 males and 7 females. Aggressive open debridement of ulcers and joint surfaces, with talectomy in some cases, were performed followed by external fixation with an Ilizarov frame. The primary outcome was a stable plantigrade infection free foot and ankle that allows weight bearing in accommodative foot wear.
Results: Limb salvage was achieved in 91.3% of cases at the end of a mean follow up time of 25 months (range: 19-32). Fifteen (71.4%) solid bony unions were evident clinically and radiographically, while 6 (28.5%) patients developed stable painless pseudoarthrosis. Two patients had below knee amputations due to uncontrolled infection.
Conclusion: Aggressive debridement and arthrodesis with ring external fixation can be used successfully to salvage severely infected Charcot arthropathy of the ankle. Pin tract infection, delayed wound healing and stress fracture may complicate the procedure but can be easily managed. Amputation may be the last resort in uncontrolled infection.
Level of evidence: IV prospective case series

Thursday 14th November
Free Paper Session 2

FP10
Autologous Osteochondral Transplantation for large osteochondral lesions of the talus is a viable option in an athletic population

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Autologous osteochondral transplantation (AOT) is an effective treatment for large Osteochondral Lesions of the Talus (OLT), however little is reported on an athletic population, who are likely to place higher demands on the reconstruction. The aim is to report the outcomes of large OLT (>150mm^2) within an athletic population.
The study population was limited to professional or amateur athletes (Tegner score >6) with an OLT of size 150mm^2 or greater. The surgical intervention was AOT with a donor site from the lateral femoral condyle. Clinical outcomes at a minimum of 24 months included Return to Sport, VAS and FAOS Scores. In addition,

graft incorporation was evaluated by MRI using MOCART scores at 12 months post-surgery.
38 athletes including 11 professional athletes were assessed. Mean follow-up was 46 months. Mean lesion size was 249mm^2. 33 patients returned to sport at their previous level and one did not return to sport (mean return to play 8.2 months). Visual analogue scores improved from 4.53 pre-operatively to 0.63 post-operatively ($p=0.002$). FAOS Scores improved significantly in all domains ($p< 0.001$). Two patients developed knee donor site pain, and both had three osteochondral plugs harvested. Univariant analysis demonstrated no association between pre-operative patient or lesion characteristics and ability to return to sport. However, there was a strong correlation between MOCART scores and ability to return to sport (AUC=0.89).
Our study suggests that AOT is a viable option in the management of large osteochondral talar defects in an athletic population, with favourable return to sport levels, patient satisfaction, and FAOS/VAS scores. The ability to return to sport is predicated upon good graft incorporation and further research is required to optimise this technique. Our data also suggests that patients should be aware of the increased risk of developing knee donor site pain when three osteochondral plugs are harvested.

FP11
Identification of healthy and tendinopathic cell sub-types in foot and ankle tendons using single cell transcriptomics

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Tendinopathy can commonly occur around the foot and ankle resulting in isolated rupture, debilitating pain and degenerative foot deformity. The pathophysiology and key cells involved are not fully understood. This is partly because the dense collagen matrix that surrounds relatively few resident cells limits the ability of previous techniques to identify and target those cells of interest. In this study, we apply novel single cell RNA sequencing (CITE-Seq) techniques to healthy and tendinopathic foot/ankle tendons. For the first time we have identified multiple sub-populations of cells in human tendons. These findings challenge the view that there is a single principal tendon cell type and open new avenues for further study.
Healthy tendon samples were obtained from patients undergoing tendon transfer procedures; including tibialis posterior and FHL. Diseased tendon samples were obtained during debridement of intractable Achilles and peroneal tendinopathy, and during fusion of degenerative joints.
Single cell RNA sequencing with surface proteomic analysis identified 10 sub-populations of human tendon derived cells. These included groups expressing genes associated with fibro-adipogenic progenitors (FAPs) as well as ITGA7+VCAM1- recently described in mouse muscle but, as yet, not human tendon. In addition we have identified previously unrecognised sub-classes of collagen type 1 associated tendon cells. Each sub-class expresses a different set of extra-cellular matrix genes suggesting they each play a unique role in maintaining the structural integrity of normal tendon.
Diseased tendon harboured a greater proportion of macrophages and cytotoxic lymphocytes than healthy tendon. This inflammatory response is potentially driven by resident tendon fibroblasts which show increased expression of pro-inflammatory cytokines. Finally, identification of a previously unknown sub-population of cells found predominantly in tendinopathic tissue offers new insight into the underlying pathophysiology. Further work aims to identify novel proteins targets for possible therapeutic pathways.

FP12
Comparing MIS to open calcaneal osteotomy: are they benign procedures?

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Lateral approach open calcaneal osteotomy is the described gold standard procedure in the management of hindfoot deformity. With development of minimally invasive surgery, a MIS approach has been described, citing fewer wound complications and lower risk of sural nerve injury. This audit compares MIS to the traditional procedure.
A retrospective review of all patients undergoing calcaneal osteotomy in Northumbria Trust in the past 5 years was performed.A total of 105 osteotomies were performed in 97 patients; 28 (13M:15F) in MIS group and 77 (40M:37F) had an open approach. The average age was 52.1 (range 16-83) for MIS and 51.5 (range 18-83) in the open group. All patients were followed up for development of wound complication, nerve injury and fusion rate.
Wound complications were similar (10.7% in MIS group vs 10.3% in Open group) with no significant difference ($p=0.48$). Patients were treated for infection in 3(3.8%) cases in the open group and 2(7.1%) in the MIS group. This difference was not significant ($p=0.43$). 4 (14.3%) patients in the MIS group had evidence of sural nerve dysfunction post-operatively (managed expectantly), compared to 12(15.5%) patients in the open group ($p=0.44$). Of these, 2 went on to undergo neuroma exploration. There was no difference in nerve dysfunction in varus or valgus correction. Mean translation in the open group was measured as 7.3mm(SD=1.91;3 to 13mm) and 7.5mm(SD=1.25;5 to 10mm) in the MIS group. Translation was similar in varus or valgus correction. Non-union occurred in 2 patients in the MIS group and none in the open group ($p= 0.06$).
MIS calcaneal osteotomy is a safe technique, that works as effectively as osteotomy performed through an open approach. There were lower rates of nerve injury, wound complication and infection, but this was not significantly different comparing groups. There was a higher risk of non-union in MIS technique.

FP13
Lateral transligamentous approach to the talar dome

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Introduction: Anatomic reduction of talar body fractures is critical in restoring congruency to the talocrural joint. Previous studies have indicated a maximum of 25% talar body exposure without malleolar osteotomy. The aim of this study was to investigate the percentage talar body exposure when using the lateral transligamentous approach.
Methods: The lateral transligamentous approach to the talus was undertaken in 10 fresh frozen cadaveric specimens by surgeons inexperienced in the approach, following demonstration of the technique. An incision was made on the anterolateral aspect of the ankle augmented by the removal of the anterior talofibular ligament (ATFL) and the calcaneofibular ligament (CFL) from their fibular insertions. A bone lever was then placed behind the lateral aspect of the talus and levered forward with the foot in equinus and inversion.
The talus was disarticulated and high resolution images were taken of the talar dome surface. The images were overlain with a reproducible nine-grid division. Accessibility to each zone within the grid with a perpendicular surgical blade was documented. ImageJ software was used to calculate the surface area exposed with each approach.
Results: The mean percentage area of talar dome available through the transligamentous approach was 77.3 % (95% confidence interval 73.3, 81.3). In all specimens the complete lateral talar process was accessible, along with the lateral and dorsomedial aspect of the talar neck. This approach gives complete access to Zones 1,2, 3,5 & 6 with partial access to Zones 4,8 &9.
Conclusion: The lateral transligamentous approach to the talus provides significantly greater access to the talar dome as compared to standard approaches. The residual surface area that is inaccessible with this approach is predominantly within Zone 4 and Zone 7, the posteromedial corner.

FP14
Evaluating short term outcomes post intra-articular calcaneal fracture fixation via a Sinus Tarsi approach in a non-exclusively selected cohort

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Aims: Management of intra-articular calcaneal fractures remains a debated topic in orthopaedics, with operative fixation often held in reserve due to concerns regarding perioperative morbidity and potential complications. The purpose of this study was to identify the characteristics of patients who developed surgical complications to inform the future stratification of patients best suited to operative treatment for intra-articular calcaneal fractures and those in whom surgery was highly likely to produce an equivocal functional outcome with potential post-operative complications.
Methods: All patients who underwent open reduction and internal fixation of calcaneal fractures utilizing the Sinus Tarsi approach between March 2014 and July 2018 were identified using theatre records. Patient imaging was used to assess pre- and post-operative fracture geometry with Computed Tomography (CT) used for pre-operative planning. Each patient's clinical presentation was established through retrospective analysis of medical records. Patients provided verbal consent to participation and patient reported outcome measures were recorded using the Maryland Foot Score.
Results: Fifty-eight intra-articular calcaneal fractures (fifty-three patients including five bilateral, mean age = 46.91 years) were included. Forty-nine patients were injured as a result of a fall from a height (92.4%). Mean time from presentation to surgery was 3.23 days (range 0-21). Mean Maryland Foot score was found to be 77.6 (+/- 16.22) in forty-five patients. Five patients (9.4%) had wound complications; two superficial (3.7%) and three deep (5.6%).
Conclusion: Intra-articular fractures of the calcaneus should be considered for surgical intervention in order to improve long-term functional outcomes. The Sinus Tarsi approach provides the potential to decrease the operative complication rate whilst maintaining adequate fixation, however, the decision to surgically manage these fractures should be carefully balanced against the risk of post-operative complications. This increased risk of complication associated with smoking may tip the balance against benefit from surgical management.

Friday 15th November
Free Paper Session 3

FP15
Outcome of revision surgery for failed ankle arthroplasty: revision arthroplasty vs arthrodesis

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Introduction: When ankle arthroplasty fails the options are revision to arthrodesis or revision to arthroplasty. We report early outcomes of revision procedures for failed total replacement.
Methods: Retrospective review of prospectively collected data including post-operative complications, union, survivorship and PROMS scores to compare revision to arthrodesis and revision to arthroplasty.
Results: 31 revision procedures (10 revision to arthrodesis and 21 revision to arthroplasty) were performed for failed primary ankle arthroplasty (30 patients) between January 2012 and June 2019. 23 males: 8 females, average age of 68. Indications for revisions were aseptic loosening (13), cysts/lysis (6), pain (5), periprosthetic infection (3), fracture (2), fibula erosion (1), polyethylene dislocation (1).
Union rate following arthrodesis was 77.9% after primary revision procedure. Impaction bone grafting technique was utilised in seven patients with a union rate of 83%.
Survivorship following revision to arthroplasty was 100% at two years; 87.5% at three years and 75% at four years Failed revision arthroplasty was revised to arthrodesis successfully..
Median MOxFQ was 73.5 for the arthrodesis group versus 17 in the arthroplasty group (p=0.02). Median AOS was 87 for the arthrodesis group versus 12 for the arthroplasty group (p=0.04)
Discussion: This study demonstrated the potential advantages in the short term of revision arthroplasty over conversion to arthrodesis with statistically significant improvements in MOxFQ and AOS within the first two years following revision.

FP16
Trends in total ankle replacement in Scotland

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Introduction: Total ankle replacement (TAR) is performed for post-traumatic arthritis, inflammatory arthropathy, osteoarthritis and other indications. The Scottish Arthroplasty Project (SAP) began collection of data on TAR in 1997. In this study, using data from the SAP, we look at trends in the use and outcomes of TAR in Scotland.
Methods: We identified 499 patients from the SAP who underwent TAR between 1997 and 2015 with imaging available on the National Picture Archiving and Communication System (PACS). We identified, and looked at trends in, implant type over the following time periods: 1998-2005; 2006-2010 and 2011-2015. Age, gender, indication and outcomes for each time period were examined and also trends with implant type over time.
Results: There were 499 primary TAR procedures with an overall incidence of $0.5/10^5$ population per year. Eight different implants were identified with significant changes in the numbers of each type used over time. The peak incidence of TAR was in the 6th decade. The mean age of patients undergoing TAR from 59 years in 1997-2005, to 65 years in 2011-15 ($p< 0.0001$). The percentage of patients with inflammatory arthropathy was 52% in 1997-2005, compared with 10% in 2011-2015. Subsequent arthrodesis and infection rates appeared to be higher during the first time period. The female to male ratio also changed over time. The incidence of TAR increased overall during the study period ($r= 0.9$, $p=< 0.0001$). This may be due to a broadening range of indications and patient selection criteria, in turn due to increased surgeon experience and the evolution of implant design.
Conclusion: This study examines a large number of TARs from an established arthroplasty registry. The rate of TAR has increased significantly in Scotland from 1997 to 2015. Indication and patient age has changed over time and this could potentially impact outcomes after ankle replacement.

FP17
Early outcomes of revision total ankle arthoplasty using the INBONE II and INVISION systems

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Revision options for a failed Total ankle arthroplasty (TAA) have historically been limited to complex hindfoot fusions, bespoke ankle arthroplasty revision or amputation. The patient outcomes of these procedures has been felt to be poor. The introduction of the INBONE-II and INVISION ankle arthroplasty revision systems has created a range of revision arthroplasty options, with the possibility of improved patient outcomes. We aim to report on the early results of 20 sequential revision TAA.
All patients undergoing revision TAA with INBONE-II or INVISION had prospective collection of pre-operative and post-operative MOx-FQ and EQ-5D scores. Between September 2013 and June 2019 23 patients underwent revision TAA with mean time from implantation of 35 months (6 to 74). Those with greater than 1 year follow-up had scores included. Other outcomes included radiographic assessment for loosening and revision.
13 patients had INBONE-II and 10 INVISION. None required revision at the time of review. Pre-operative MOx-FQ averaged 40.6 (13.4 pain, 21 walking, 6.2 social). Post-operative MOx-FQ averaged 17.4 (6.2 pain, 8.1 walking, 3.1 social). Average EQ-5D improved from 8 to 6.6 and average EQ-VAS from 60 to 80. On radiograph review one patient had radiolucent lines around their INBONE-II stem evident at 1 year. This had not progressed by 4 years total follow-up. Another patient had uncoupling of part of the stem of her INBONE-II but had not required revision. This was attributed to surgeon error.
Revision TAA using the INBONE-II and INVISION systems shows promising early results relating to loosening and revision and good maintained improvement in MOx-FQ and EQ-5D scores. This provides further evidence

that patients with a failed TAA can safely have revision rather than having to commit to complex ankle/hindfoot fusion. This provides surgeons with flexibility particularly in those patients with other hindfoot arthritis or arthrodesis.

FP18
The role of rotation in total ankle replacement

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Background: The importance of total ankle replacement (TAR) implant orientation in the axial plane is poorly understood with major variation in surgical technique of implants on the market. Our aims were to better understand the axial rotational profile of patients undergoing TAR.
Methods: In 157 standardised CT Scans of end-stage ankle arthritis patients planning to undergo primary TAR surgery, we measured the relationship between the knee posterior condylar axis, the tibial tuberosity, the transmalleolar axis(TMA) and the tibiotalar angle. The foot position was measured in relation to the TMA with the foot plantigrade. The variation between medial gutter line and the line bisecting both gutters was assessed.
Results: The mean external tibial torsion was 34.5±10.3**°**(11.8-62**°**). When plantigrade the mean foot position relative to the TMA was 21±10.6**°**(0.7-38.4**°**) internally rotated. As external tibial torsion increased, the foot position became more internally rotated relative to the TMA(pearson correlation 0.6;p< 0.0001). As the tibiotalar angle became more valgus, the foot became more externally rotated relative to the TMA(pearson correlation -0.4;p< 0.01). The mean difference between the medial gutter line and a line bisecting both gutters was 4.9±2.8°(1.7°-9.4°). More than 51% of patients had a difference greater than 5°. The mean angle between the medial gutter line and a line perpendicular to the TMA was 7.5°±2.6°(2.8°-13.7°).
Conclusion: There is a large variation in rotational profile of patients undergoing TAR, particularly between the medial gutter line and the transmalleolar axis. Surgeon designers and implant manufacturers need to develop consistent methods to guide surgeons towards judging appropriate axial rotation of their implanton an individual basis. We recommend careful clinical assessment and CT scanspre-operatively to enable the correct rotation to be determined.

FP19
The Hintegra Total Ankle Replacement: survivorship, failure modes and patient reported outcomes in 70 consecutive cases with a minimum 5 year follow up

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Introduction: We report the functional outcome and survivorship of the Hintegra Total Ankle Replacement (TAR), in consecutive cases by multiple surgeons in a single UK institution. Between 2010-2014 the Hintegra TAR held 7.1% UK market share and surgeons should be aware of failure mechanisms.
Methods: We conducted a retrospective review of prospectively collected data for 70 consecutive Hintegra TAR cases in a single institution between 2010-2014. Data collected included patient demographics, complications, reoperations, patient reported outcome measures (PROMS: AOS, MOX-FQ, pain VAS) and patient satisfaction.
Results: The 70 patients (54 male/ 16 female) had an average age of 69 (range 48-84 years). Mean follow up was 76 months (range 60-104), 10 patients died during the follow up. Implant survivorship was 81.4% at most recent follow up. The commonest radiographic finding was periprosthetic cysts (n=28, 40%), size range (7-40mm), location of cysts: isolated talus (n=14), isolated tibia (n=6), mixed (n=8). 10 failed TARs were revised to Inbone TAR at a mean of 48 months (range 9-69). 3 Failed TARs were revised to arthrodesis (2 tibiotalar fusions, 1 hindfoot nail). 11 patients required reoperation with implant retention: 8 periprosthetic cyst debridement and grafting at a mean of 61 months (range 27-91), 1 lateral gutter debridement and 1 periprosthetic fracture ORIF. PROMS data was available for all patients. Overall patients showed marked improvement in functional outcome scores between pre-operative and final follow up questionnaires. Mean pre-op AOS: 62, MOX-FQ: 68 and pain VAS: 67.5 with mean final follow up scores of: AOS: 35, MOX-FQ: 36 and pain VAS: 30.
Conclusion: Our experience demonstrates improved PROMS following ankle arthroplasty for patients with a mean follow up of 6.4 years. Implant survivorship is similar to other TAR studies. We have identified a high incidence of periprosthetic cysts and would recommend ongoing surveillance of these patients.

FP20
Pes cavovarus in Charcot-Marie-Tooth compared to the idiopathic cavovarus foot: a preliminary weightbearing CT analysis

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Introduction: Pes cavovarus is a foot deformity that can be idiopathic (I-PC) or acquired secondary to other pathology. Charcot-Marie-Tooth disease (CMT) is the most common adult cause for acquired pes cavovarus

deformity (CMT-PC). The foot morphology of these distinct patient groups has not been previously investigated. The aim of this study was to assess if morphological differences exist between CMT-PC, I-PC and normal feet (controls) using weightbearing computed tomography (WBCT).
Methods: A retrospective analysis of WBCT scans performed between May 2013 and June 2017 was undertaken. WBCT scans from 17 CMT-PC, 17 I-PC and 17 healthy normally-aligned control feet (age-, side-, sex- and body mass index-matched) identified from a prospectively collected database, were analysed. Eight 2-dimensional (2D) and three 3-dimensional (3D) measurements were undertaken for each foot and mean values in the three groups were compared using one-way ANOVA with the Bonferroni correction.
Results: Significant differences were observed between CMT-PC or I-PC and controls ($p< 0.05$). Two-dimensional measurements were similar in CMT-PC and I-PC, except for forefoot arch angle ($p= 0.04$). 3D measurements (foot and ankle offset, calcaneal offset and hindfoot alignment angle) demonstrated that CMT-PC exhibited more severe hindfoot varus malalignment than I-PC ($p= 0.03$, 0.04 and 0.02 respectively).
Discussion: CMT-related cavovarus and idiopathic cavovarus feet are morphologically different from healthy feet, and CMT feet exhibit increased forefoot supination and hindfoot malalignment compared to idiopathic forms. The use of novel three-dimensional analysis may help highlight subtle structural differences in patients with similar foot morphology but aetiologically different pathology.

FP21
Risk of saphenous nerve injury during syndesmotic stabilisation with the TightRope technique

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Background: The use of a knotless TightRope for the stabilisation of a syndesmotic injury is a well-recognised mode of fixation. It has been described that the device can be inserted using a "closed" technique. This presents a risk of saphenous nerve entrapment and post-operative pain.
Aim: We aimed to establish the actual risk of injury to the Saphenous Nerve using a "closed" technique for the insertion of a TightRope.
Method: 20 TightRopes were inserted into Fresh Frozen Cadavers. This was done using the senior authors preferred technique of divergent tightropes with the distal implant directed slightly anterior to the fibula-tibia axis and the proximal implant slightly posterior in order to simulate the greatest risk to the nerve. This was done under image Intensifier guidance to simulate an intraoperative environment. The medial side of the distal tibia was then dissected to directly record and measure the relationship of the TightRope to the Saphenous Nerve. Measurements were taken using digital calipers from the centre of the button on the medial side of the TightRope to the centre of the nerve at the point of closest proximity.
Results: 12 TightRopes were found to exit posterior to the nerve, 7 anterior and 1 penetrated through the centre of the nerve. The mean distance from the centre of the button to the nerve was 6.99mm (range 0.72-14.52mm, standard deviation 4.33mm). In 9 of the 20 TightRopes, the nerve was found to be less than 5mm away.
Conclusion: Our findings demonstrated that the risks of damaging or indeed entrapping the Saphenous nerve were high, and therefore we would advocate an open incision on the medial side with judicious exploration to ensure there is no damage to the medial neurological structures.

FP22
Day Case Total Ankle Replacement

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Introduction: Day Case Surgery (defined as same day discharge) is a priority within the National Health Service and has been shown to provide beneficial outcomes for patients and hospitals. We report our experience developing a Day Case Programme for Total Ankle Replacement (TAR).
Methods: Prior to the introduction of a Day Case Programme, average length of stay following TAR in our unit was 3.5 days. Stakeholders were consulted about ways in which same day discharge could be facilitated. Patients' post-operative pain charts were reviewed prior to the introduction of this programme. Inclusion criteria included non-complex surgery (anticipated tourniquet < 2hrs), friend or relative support and pre-operative walking-aid assessment. An enhanced recovery protocol included long-acting popliteal block and dexamethasone. Patients were discharged with opiate analgesia and written pain instructions. Patients were asked to complete a pain and satisfaction questionnaire. Patient Reported Outcome Measures (PROMs) were recorded.
Results: From September 2017 to April 2019 21 of 70 patients underwent TAR as a Day Case. Mean age was 67 years (43-85 years). Complications included two delayed wound healings and one representation on day three with urinary retention. No patients reported post-operative nausea or vomiting, 60% did not use Oramorph at home. Average Visual Analogue Score for pain was 23/100 on day one and 21/100 day three post-operatively. There was no significant difference in pre-operative or overall change in MOXFQ, VAS or EQ5D PROMS.
Conclusions: Early results suggest that Day Case Total Ankle Replacements are safe. Appropriate patient selection is necessary. Day Case Surgery relies on support and communication between multiple teams to organise and run effectively.

FP23

The deep deltoid ligament and stability after ankle fracture: a cadaveric study

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Background: Supination-external rotation (SER) injuries make up 80% of all ankle fractures. SER stage 2 injuries (AITFL and Weber B) are considered stable. SER stage 3 injury includes disruption of the posterior malleolus (or PITFL). In SER stage 4 there is either medial malleolus fracture or deltoid injury too. SER 4 injuries have been considered unstable, requiring surgery. The deltoid ligament is a key component of ankle stability, but clinical tests to assess deltoid injury have low specificity. This study specifically investigates the role of the components of the deep deltoid ligament in SER ankle fractures.
Aim: To investigate the effect of deep deltoid ligament injury on SER ankle fracture stability.
Methods: Four matched pairs (8 specimens) were tested using a standardised protocol. Specimens were sequentially tested for stability when axially loaded with a custom rig with up to 750N. Specimens were tested with: ankle intact; lateral injury (AITFL and Weber B); additional posterior injury (PITFL); additional anterior deep deltoid; additional posterior deep deltoid; lateral side ORIF. Clinical photographs and radiographs were recorded. In addition, dynamic stress radiographs were performed after sectioning the deep deltoid and then after fracture fixation to assess tilt of the talus in eversion.
Results: All specimens with an intact posterior deep deltoid ligament were stable when loaded and showed no talar tilt on dynamic assessment. Once the posterior deep deltoid ligament was sectioned there was instability in all specimens. Surgical stabilisation of the lateral side prevented talar shift but not talar tilt.
Conclusion: If the posterior deep deltoid ligament is intact SER fractures may be managed without surgery in a plantigrade cast. Without immobilisation the talus may tilt, risking deltoid incompetence.