FREE PAPERS 1
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FP1
Windows to the midfoot - the safety of a modified dorsal approach in a series of 150 Lisfranc injuries

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Introduction: We describe a novel single incision approach and its safety in the largest reported series of Lisfranc injuries to date. Via separate subcutaneous windows it is possible to access the medial three rays of the foot for bridge plating, without the concern of narrow skin bridges between multiple incisions.
Methods: A retrospective review identified all 150 patients who underwent a Lisfranc ORIF via the modified dorsal approach at the Royal Melbourne Hospital between January 2011 and June 2016. All patients were operated by a single surgeon. Removal of metalwork (ROM) was routinely undertaken at six months post-operatively via the same incision. Medical recored were reviewed to record patient demographics, mechanism of injury and surgical details. Outpatient notes were reviewed to identify wound-related complications including; delayed wound healing, superficial infection ,wound dehiscence, deep infection, complex regional pain syndrome (CRPS), neuroma and impaired sensation. Median follow-up was 1012 days (range 188-2141).
Results: Median age was 37 years (19-78). 110 (73%) patients were male. Mechanism of injury was: motor vehicle accident (37%), motor bike accident (19%) and fall (18%). 24 (16%) injuries were open, 5 of which required soft tissue reconstruction at the primary surgery. A total of 34 wound related complications occurred (22%); superficial infection (14), delayed wound healing (7), wound dehiscence (5), CRPS (4), impaired sensation (3), neuroma (1). Re-operation was necessary in the 5 patients who experienced wound dehiscence; 4 requiring split skin grafts and 1 requiring a free flap. Crush injuries were 10 times more likely to have wound complications than those sustained in motor vehicle accidents. Patients undergoing ROM were more likely to have wound complications than those who did not.
Conclusion: The modified dorsal approach using subcutaneous windows to access the midfoot joints offers a viable alternative to existing approaches.

FP2
Lisfranc fracture dislocations: percutaneous reduction and fixation using screws

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Aim: Anatomical reduction and Stable fixation of Lisfranc injuries is considered the gold standard. There is controversy about how it is best achieved. Some surgeons would advocate routine open anatomical reduction, which as a concept was popular in 1980s but the same anatomical reduction and fixation can be achieved percutaneously. We describe our method of close reduction and percutaneous fixation and present our results.
Materials and methods: 22 patients with a minimum follow up of 12 months were included. We achieved satisfactory anatomical reduction percutaneously in all patients and internal fixation was performed using cannulated screws for medial and middle columns. Functional outcome was evaluated using Foot and Ankle Disability Index (FADI) and components of this score were analysed individually to assess which domain was most affected. Vertical ground reaction forces were measured using a force plate in a walking platform.
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 domains of functional Index that showed poor recovery. None of the patients had pain at rest. Only three patients found it extremely hard to return to recreational activities. None of the patients had problems related to wound.
Gait analysis showed a prolonged push-off ($p=0.22$) and significantly prolonged pre-swing phase ($p=0.015$) of the affected limb.
Conclusions: Percutaneous reduction and fixation technique for Lisfranc injuries provides predicatable good functional outcome and gait pattern similar to open tecchinques with a potentially decreased risk of wound problems.

FP3
Talus fractures: are they as bad as we think they are? A review of 28 cases in a tertiary trauma centre

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Introduction: Talus fractures have traditionally been reported as having poor outcomes with rates of avascular

necrosis in excess of 80% in some studies. It was noted by the senior author that this was not his experience in a tertiary institution with many patients having good to excellent outcomes and lower rates of avascular necrosis than anticipated despite high-energy trauma. The aim of this paper is to review all talus fractures that have been fixed internally at our institution to determine whether current surgical techniques have improved traditionally poor outcomes. This could result in improved outlook for patients on initial presentation and improved ability to manage the long-term consequences of the multiply-injured patient.
Method: A review of all lower limb trauma cases from 2012-2015 was made. This yielded 28 talus fractures that had been internally fixed at Southmead hospital.
Patients were contacted using telephone and letters. The AAOS Foot and Ankle Outcome Questionnaire, patient satisfaction surveys and analysis of radiographs were made.
Results: Our preliminary results suggest avascular necrosis rates of less than 10% despite the high energy, sometimes open nature of these injuries. We also report that patients are returning to work and are reasonably satisfied following their injury. Fixation methods varied between cases but generally good outcomes were reported amongst most patients. We summarise the demographics of patients presenting with talus fractures and classify their initial injury according to the Hawkins talus fracture classification.
Conclusion: Our results were surprising. They suggest that modern surgical techniques may be improving outcomes for patients with talus fractures. It was previously thought that these injuries can be career-ending for some patients but we would suggest that there is hope for good outcomes in this patient group.

FP4
The lateral malleolar bony fleck classified by size and pathoanatomy

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Background: This study analyzes position of the peroneal tendons and status of the superior peroneal retinaculum (SPR) whenever a lateral malleolar bony flake fracture occurs.
Methods: Twenty-four patients had a lateral malleolar bony fleck on anteroposterior ankle radiographs, either in isolation or associated with other hindfoot injuries. We studied size of the bony flecks, presence or absence of peroneal tendon dislocation and pathoanatomy on CT scans.
Results: In 11 patients, a small bony fleck lies within the superior peroneal retinaculum and contiguous periosteum, which are stripped off the lateral fibula (Class II lesions). Tendons dislocate into the subperiosteal pouch thus formed, resembling Class I lesions without associated bony avulsion. Treatment for Class II is same as for Class I injuries.
In 8 patients with big bony fleck, tendons dislocate into the fracture site and SPR is intact (Class III lesions). Surgical approach for tendon relocation and bone fixation differs. In particular, the intact attachment of the SPR on the bony fleck must not be incised. The healing process of neglected Class III lesions resembles a groove deepening procedure, representing an attempt to form a stable platform for the dislocated tendons. A neglected Class II lesion resembles a neglected Class I lesion.
In Class IV lesions, observed in 5 patients with 2-part calcaneal fracture/dislocation, SPR remains intact and peroneal tendons are not dislocated. The invariably large fleck results from the displacing lateral calcaneal fragment abutting against the fibula, whereas the dislocating tendons cause the bony avulsions in Classes II and III.
Conclusions: Due to pathoanatomical differences, surgical approach and natural history of neglected lesions differ depending on size of the bony fleck. The SPR must not be incised in case of big Class III flecks. Beware of false negatives when probing the peroneal tendons intra-operatively in Class III and IV lesions.

FP5
Is magnetic resonance imaging (MRI) reliable in the diagnosis of osteochondrallesions (OCL's) in the ankle?

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Background: MRI is the preferred modality for the diagnosis of ankle joint pathology. Musculoskeletal radiologists aim to determine and report both chondral and/or osseous stability/instability of each lesion. The aim of this study was to specifically analyse the reliability of MRI reported findings in predicting the stability of OCL's in symptomatic patients.
Methods: A single centre, single surgeon consecutive series of patients who had undergone an ankle arthroscopy procedure preceded by an MRI scan for symptomatic ankle pathology were included in this retrospective clinical study. All MRI scans were reported by a musculoskeletal radiologist. MRI reports and arthroscopic findings were extracted and analysed. Arthroscopy findings were taken as the gold standard.
Results: Between April 2012 and July 2016, 48 patients who fulfilled the above criteria were included. There were 27 male and 21 female patients, the average age was 43.4 (SD 14.1). The average time interval between MRI scan and arthroscopy was 9 months (2-49 months), 28 patients (58.3%) had a right sided pathology. There was a significant negative relationship between OCL's reported as stable on MRI to arthroscopic findings,

r=-.31, p=0.03. Of the 21 patients who had OCL's reported as stable on the MRI scan, all had unstable lesions on arthroscopic evaluation (100%). One patient had an unstable OCL reported on the MRI scan and it was also found unstable arthroscopically. In 27 patients, where there was no mention of the stability of the reported OCL on the MRI, 22 patients (81.5%) had unstable lesions and 5 patients (18.5%) had stable lesions on intra-operative arthroscopic findings.
Conclusion: This study demonstrates that MRI has a poor predictive value for the stability of OCL's of the ankle. Therefore we recommend that in the symptomatic patient an arthroscopy is indicated irrespective of MRI findings.
Evidence: retrospective case review, level IV.

FP6
Are ankle dislocations being diagnosed and reduced in a timely manner?

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Introduction: Standard teaching of dislocated ankles was always reduce then x-ray. However the 2016 BOAST guidelines stated "Reduction and splinting should be performed urgently for clinically deformed ankles. Radiographs should be obtained before reduction unless this will cause an unacceptable delay". We aimed to audit our practice against the BOAST guidelines and look at time from attendance to reduction.
Methods: We retrospectively reviewed all case notes of patients admitted via A&E at the Northern General Hospital with a fractured ankle between August 2016 and January 2017. Time of arrival, time to x-ray and time to reduction were recorded in a database for analysis.
Results: 65 patients with acute ankle fractured dislocations were identified from 140 acute fractured ankle referrals to the orthopaedic on-call team. 55 of these had a pre-reduction x-ray. Time from arrival to a radiograph of a reduced ankle in cast was 3hrs 59 minutes for those who had a pre-reduction radiograph compared with 1hr 3 minutes for those who didn't have a pre-reduction radiograph. 12.5% of those with no pre-reduction radiograph required re-manipulation compared with 31% of those who did have a pre-reduction radiograph.
Conclusion: Having a pre-reduction x-ray significantly increases the time until there is radiological evidence of a reduced ankle. There was an associated higher risk of requiring a further manipulation in those who had a pre-reduction radiograph. A larger review is currently being undertaken to better understand the possible reasons for this.

FP7
Assessing the risk factors in the management of diabetic ankle fractures: can rigid-long segment fixation (RISF) improve outcomes

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Diabetes is a poor prognostic indicator after an ankle fracture. Many surgeons avoid operating due to concerns regarding complications.
We performed a retrospective analysis of complication rates for acute ankle fractures in diabetics with a control non-diabetic patient treated by all surgeons in our unit and assessed factors for success including long-segment fixation.
Patient records were cross-referenced with departmental databases and a review of all ankle fractures managed in our department was conducted from 2012. All patients subjected to a retrospective-review of their follow-up for at least 6-months. Radiographs were assessed of the ankle before and at completion of treatment being reviewed independently (RA & FR).
We identified the HB1Ac (diabetic-control) and systematic co-morbidities. Fractures were classified into unimalleolar, bi malleolar and trimalleolar and surgery grouped into standard or long-segment-rigid fixation. Statistical analysis was conducted using absolute/relative risk (RR); numbers needed to treat (NNT) were calculated. We compared a control-group, a diabetic group managed conservatively, and undergoing surgery; comparing the concept of rigid fixation and prolonged imobilisation in isolation or combined.
Further sub-analysis conducted assessing diabetic neuropathy, retinopathy and nephropathy. Ethics approval was granted as per our institutional policy by our governance lead.
We identified 154 diabetic ankle fractures, seventy-six had conservative-treatment; 78 had operative fixation of which 23 had rigid-long-segment-fixation.
The diabetic-groups had a higher risk-relative-risk of complication - 3.2 ($P< 0.03$) being linked to systematic complications of diabetes e.g. neuropathy 5.8 ($P< 0.003$); HBA1c 4.6 $P< 0.004$); and neuropathy or retinopathy 6.2 ($P< 0.0003$).
Relative-risk reduction of complications occurred following surgery with prolonged immobilization (0.86) and rigid-fixation (0.65). The Number-Needed-to-Treat required to see a benefit from rigid fixation was 7.
Diabetics have a higher risk for complications, however the risk is not as great as previously reported. We provide evidence of rigid-long-segment-fixation with prolonged-immobilization improving-outcomes.

FP8

Do stable Weber B ankle fractures pose an unnecessary load on fracture clinics? A prospective review of 100 patients

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Introduction: The conservative management of stable Weber B fibula fractures remains variable. We thought that the current trend in our institution poses an unnecessary burden on fracture clinics.
Methods: We reviewed patients referred with Weber B ankle fractures over an 18 month period. Our inclusion criteria were non-diabetic adults, with isolated stable Weber B fractures. Fractures were deemed stable if they had no evidence of talar shift on initial radiographs (< 5mm medial clear space and < 1mm variation between superior and medial clear spaces).
Exclusion criteria were unstable fractures on radiographs, or no local follow-up.
Management was reviewed from case notes and radiographs. Primary outcome was the stability of the fracture by the end of treatment. Secondary measures were duration of treatment, number of follow up appointments and radiographs, and complications.
Results: 182 cases were reviewed. 82 were excluded leaving 100 patients for follow-up. Mean age was 53 (18-99). Mean number of outpatient appointments was 2.63 (1-6), follow up radiographs was 2.34 (0-6). 74 were treated in a walking boot and 15 in a walking cast for a mean of 6 weeks (4-9) and allowed to full weight-bear. 10 were kept non weight-bearing in a cast for 6 weeks and 1 was partially weight-bearing. Mean follow-up time was 7.3 weeks (1-30).
No fractures displaced and one patient developed an ulcer from a cast.
Conclusion: Our study suggests that in isolated Weber B fractures, with no radiographic instability on initial presentation, further displacement is unlikely. We propose that these injuries can be treated safely in a removable boot with full weight-bearing for 6 weeks then clinical and radiologic assessment if required. Casting or restricted weight-bearing does not confer any additional advantage.
We question the necessity and rationale behind weekly clinical and radiological follow-up for such cases.

FP9

Low risk of delayed talar shift with functional management of the isolated Weber B fracture - results of a new treatment protocol.

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Introduction: Isolated Weber B fractures usually heal uneventfully but traditionally require regular review due to the possibility of medial ligament injury allowing displacement. Following recent studies suggesting delayed talar shift is uncommon we introduced a functional treatment protocol and present the early results.
Methods: 141 consecutive patients presenting acutely with Weber B fractures without talar shift between January and December 2015 were included. Patients were splinted in a removable boot and allowed to weight bear. ED notes and radiographs were reviewed by an Orthopaedic consultant. Patients without signs of medial injury were discharged with an information leaflet and advice. If signs of medial ligament injury were noted or the medial findings were not documented the patient was reviewed in fracture clinic at 4 weeks post-injury. If talar shift developed the patient was to be converted to operative treatment. Olerud and Molander scores were collected between 6 and 12 months post-injury..
Results: 65 of 89 patients with signs of medial ligament injury or no documented medial findings attended fracture clinic. Of 51 patients without signs of medial ligament injury 23 were discharged according to protocol and 28 patients attended fracture clinic. One discharged patient re-accessed care. Of 93 patients reviewed in the fracture clinic none developed delayed talar shift. One underwent delayed ORIF for ongoing fibula discomfort and the remainder continued with non-operative treatment. 99 (70%) patients provided outcome scores. The mean score at a minimum of 6 months follow-up was 87 and the median score was 100. No significant difference was found between treatment arms. The scores were comparable to those in the published literature.
Conclusion: We conclude the risk of delayed talar shift is low and satisfactory outcomes can be safely achieved with our functional protocol. Additional tests/imaging to establish the integrity of the medial ligament may be unnecessary.

FP10

The development of a test for fibular reduction after syndesmosis injury - a

cadaveric study

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Introduction: Injury to the syndesmosis is not always clearly demonstrated on radiographs and different tests have been described to assess for injury. In the presence of a significant injury to the syndesmosis, surgical fixation is often indicated and various fixation methods have been described. If the result of surgery is any mal-reduction of the fibula, this may result in ongoing ankle pain. Assessing how well the fibula has been reduced intra-operatively is currently limited to image intensifier views. We have previously developed a simple assessment, which has been shown to give accurate intra-operative demonstration of an injury to the syndesmosis. Our objective was to ascertain if the same test could demonstrate any malreduction of the fibular after repair of a syndesmosis injury.
Methods: Seven fresh frozen cadavers had complete sydesmosis disruption performed before fixation using a well-recognised technique with a single 3.5 mm small fragment screw. Purposeful malreduction was performed in three ankles and standard reduction in the remaining four. 2-5mls of contrast medium was then injected into the ankle joint.
Results: When there had been a malreduction, an obvious 'blush' of dye leaked superiorly into the surrounding soft tissues, whereas a normal ankle arthrogram was shown when the fibular had been anatomically reduced into the incisura and well fixed.
Conclusion: This cadaveric study showed the test to be an easy and reliable adjuct to assess for acute malreduction of a syndesmosis injury.

FP11
Posterior malleolar ankle fractures - an effort in improving outcomes

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Background: There is an increasing acceptance that the clinical outcomes following posterior malleolar fractures are less than satisfactory. In our previous multicenter study (Powell, BOFAS 2016) we showed that the Olerud-Molander Ankle Score (OMAS) was 79 for unimalleolar fractures and 65 for bi malleolar fractures, however it dropped significantly to 54 in trimalleolar fractures. In creating a treatment guiding classification, we report our results in a system change in management of posterior malleolar fractures in our unit.
Method: All fractures were classified according to Mason and Molloy classification (BOFAS 2015, FAI 2017) based on CT scans obtained pre-operatively. This dictated the treatment algorithm. Type 1 fractures underwent syndesmotic fixation. Type 2A fractures underwent ORIF through a posterolateral incision, and type 2B and 3 fractures underwent ORIF through a posteromedial incision. The patient remained NWB for 6 weeks postoperative. Data was collected from December 2014 to July 2017.
Results: Patient related outcome measures were obtained in 50 patients with at least 6 month follow up (mean 18 months). According to Mason and Molloy classification there were 17 type 1, 12 type 2A, 10 type 2B and 11 type 3. The mean OMAS for type 1 was 75.9 (Range 30-100, SD 18.4), type 2A 75.0 (range 35-100, SD 21.3), type 2B 74.0 (range 55-100, SD 13.7) and type 3 70.5 (Range 35-100, SD 17.1). An increase in OMAS of 4 is clinically significant.
Conclusion: We have been able demonstrate an improvement in OMAS for all posterior malleolar fractures with the treatment algorithm applied using the Mason and Molloy classification. Compared to our previous study we have successfully increased our OMAS scores to what would be expected from unimalleolar fractures. Mason and Molloy type 3 fractures have marginally poorer outcomes, which correlates with a more significant injury, however this does not reach statistical significance.

FREE PAPERS 2

FP12
Beware the hallucal interphalangeal joint sesamoid in first ray arthrodesis

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Introduction: Orthopaedic and trauma surgeons not infrequently encounter the hallucal interphalangeal joint sesamoid (HIPJS) in irreducible traumatic dislocations. However, patients with the classic triad of plantar keratoma beneath a hyperextended interphalangeal (IP) joint associated with stiffness of the first metatarsophalangeal joint tend to present to podiatrists rather than orthopaedic surgeons.
Methods: We present our experience with the HIPJS following first metatarsophalangeal joint (MTP1) arthrodesis in 18 feet of 16 women, aged 42 to 70 years old. Where CT scan was available, volume of the HIPJS was determined using Vitrea Software.
Results: Two groups of patients were identified. Group 1 consisted of 12 feet in 11 women, who developed a painful keratoma beneath a gradually hyperextending IP joint of the great toe, at varying intervals (range 6 to 75 months) following MTP1 arthrodesis.
Group 2 comprised 6 feet in 5 women who had undergone MTP1 arthrodesis but reported no symptoms in relation to an undetected and/or recognized, but unexcised HIPJS (range 15 to 97 months).
We found no difference in average size of the HIPJS between Groups 1 and 2 (190.42 mm^3 and 196.47 mm^3, respectively).
Clinically, all toes had been fused in good position and no difference existed in the post-operative angle subtended by the proximal phalanx of the arthrodesed big toe with the first metatarsal between the 2 groups.
A good outcome followed removal of metalwork and excision of the HIPJS in the symptomatic patients.
Conclusion: Think of a HIPJS in the patient who presents with a painful plantar keratoma beneath a hyperextended interphalangeal joint following MTP1 arthrodesis.
Do not rush into a Moberg osteotomy as this will only push the big toe higher against the toe-box.
Consider prophylactic excision of a HIPJS prior to MTP1 arthrodesis.

FP13
'The Myerson 'Rollmop' Interpositional Arthroplasty a Novel Surgical Technique for Severe Freiberg's Disease: Medium-term functional outcomes, return to fashion footwear and sports'

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Freiberg's Infraction; osteonecrosis of the metatarsal head, is the fourth most common intra-articular osteonecrosis in the body. Surgical intervention is usually reserved for late stage of the disease process (III-V) or failure of conservative management. We evaluated the outcomes of patients treated with primary Interpositional Arthroplasty technique using periosteum and fat for adequate surfacing and as a spacer for Freiberg's Disease.
Twenty-three cases (21 patients) were performed from February 2009 - March 2016 (18 women, 5 men). Mean age at surgery was 51.1 years (range 19 - 70.5 years) with 91% affecting the second metatarsal. Twenty-one cases were primary and two cases were revision. Five cases were stage III, 10 were in stage IV and 8 were stage V. All patients underwent Interpositional Arthroplasty using periosteum and fat graft from affected metatarsal inserted as joint spacer and secured with sutures. Patients were followed up by postal questionnaires using two validated questionnaires; MOXFQ and AOFAS. Mean follow-up was 3.7 years (0.6 - 7.6 years). Paired two-tailed student t tests were used to assess clinical significance.
The left and right foot was affected in 12 and 11 cases respectively. There were no postoperative infections, non-unions or transfer metatarsalgia. Surgery allowed 8 patients to wear normal footwear, 9 wearing fashion shoes, 5 wearing dress shoes and 5 patients returned to sporting activities.Mean pre-operative and post-operative VAS pain scores were 6.7 (range 4-10) and 3.2 (range 0-10) ($p< 0.05$). Mean peri-operative AOFAS scores were 43.8 (range 14-73) and 71.3 (range 10-100) ($p< 0.05$). Mean peri-operative MOXFQ scores were 62.9 (range 23-89) and 31.8 (range 0-98) ($p< 0.05$).
We recommend our novel Interpositional Arthroplasty using periosteum and fat spacer for late stage Freiberg's disease as it can result in significant improvement in pain, prevents donor site morbidity and produces significant functional improvement and patient satisfaction.

FP14
New technique to treat severe crossover toe deformity

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Introduction: Crossover and claw toe deformity has traditionally been a very difficult condition to manage surgically, with high recurrence rates. Multiple methods have been used to treat this condition. Plantar plate "repair" has recently been advocated, with sutures used to repair an assumed tear. Based on clinical experience and anatomical studies (Deland et al. 1995), we believe the main pathology is a distal migration of the plantar plate complex resulting in exposure of the metatarsal to the thin posterior synovial attachment of the plate. The downward forces on the metatarsal head results in herniation of the head inferiorly. Accordingly we have developed a technique using full cuff release of the plantar plate complex that includes complete release of the collateral ligaments, repositioning the plantar plate anatomically and reinforcing the hernial defect with a synthetic mesh graft.
Methods: 12 cases of severe crossover toe deformity have undergone plantar plate reconstruction using synthetic mesh graft in addition to other bony procedures (e.g. Weil's osteotomy, PIPJ fusion) since 2015 operated upon by the lead author. We collated data regarding patient satisfaction using Coughlin's Score (Coughlin 1991). We have also evaluated the sustainability of correction and any complications.
Results: All patients reported "excellent" outcomes using Coughlin's score, with no cases of recurrence of any significance or complications, and a mean time to follow up of 180 days (range 23-653).
Conclusions: Our understanding of the pathology of this condition is somewhat different from the conventional wisdom. Our technique of using a synthetic mesh graft to reconstruct the plantar plate complex shows promising results in terms of safety and decreased recurrence rate compared to traditional techniques. Further long term prospective results are required to confirm this pilot data.

FP15
Unstable metatarsal-phalangeal joints (MTPJ): what went wrong? A description of a novel technique to stabilize it

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MTPJ instability is very common yet there is no consensus of best surgical technique to repair it. The current techniques range from extensive release, K-wire fixation or plantar plate repair, which requires release of remaining intact plantar plate and all collaterals. Such varieties reflect a controversy regarding its aetiology. The aim of this study was to assess how much each structure contributes towards the stability of MTPJ and describing a simple technique designed by the senior author that can anatomically reconstruct all contributing structures to the pathology.
Eleven cadaveric toes in two groups (five in group 1 and six in group 2) were included. Dorsal displacement (drawer test) was used to measure instability in an intact MTPJ followed by two different series of sequential sectioning of each part of collateral ligament (PCL and ACL) and part or complete plantar plate.
Group 1 result showed that after incising PCL dorsal displacement was 0.51mm, PCL+ACL was 0.8mm and PCL+ACL+50% plantar plate was 2.39mm. Group 2 results showed that after incising 50% plantar plate dorsal displacement was 0.48mm, after full plantar plate 0.62mm, plantar plate +PCL was 0.74mm and plantar plate +PCL+ACL was 1.06mm.
To produce significant instability, both collaterals on one side with combination of 50% plantar plate tear was needed. An isolated 50% tear of plantar plate caused less displacement of MTPJ compared to isolated collaterals. PCL contributed more towards the stability of MTPJ when the plantar plate was intact. Whereas, ACL contributed more stability when plantar plate was sectioned. The current practice of releasing the collaterals to gain access for repairing plantar plate by indirect method should be re-evaluated. A new technique of proximal tenotomy of extensor digitorum brevis tendon looped around the transverse ligament and attached to the neck of metatarsal reconstructs both structures (plantar plate and collaterals).

FP16
Increased recurrence in Scarf osteotomy for mild & moderate hallux valgus with Meary's line disruption

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This paper tests the null hypothesis that there is no difference in recurrence for mild and moderate hallux valgus treated with Scarf osteotomy in the presence of a disrupted Meary's line compared to an intact line.
At a minimum of 3 months follow up we retrospectively analysed radiographs, theatre and clinic notes of 74 consecutive patients treated with Scarf osteotomy for mild and moderate hallux valgus at a single centre. The patients were divided into Group A (n=30) - patients who on pre-operative weight bearing radiographs had a disrupted Meary's line, and Group B (n=44) - those with a normal Meary's line on pre-operative weight bearing radiographs.

Our results demonstrate a statistically significant higher recurrence in group A compared to Group B with an odds ratio of 5.2 p = 0.006 [95% CI 1.6-17]. The association between a disrupted Meary's line and increased risk of recurrence for Scarf osteotomy remains valid and strengthened to an odds ratio of 7.1 p = 0.015 [95% CI 1.46 -34.4] when adjusted for confounding variables of age, sex and pre-operative IMA. On this basis we reject the Null hypothesis.
In group A two out of 30 patients required revision surgery whilst none of the 44 patients in group B needed revision. In Group A the degree of IMA correction achieved equalled 8.1 degrees with a pre and post IMA of 16.0 and 7.9 degrees respectively. For Group B the degree of correction was 8.0 degrees with a pre and post IMA of 14.3 and 6.3 degrees respectively. Eight complications were reported in Group A and 9 in Group B.
Our results demonstrate a statistically significant increased risk of recurrence when scarf osteotomy is performed for mild and moderate hallux valgus in the presence of a disrupted Meary's line.

FP17

Current review of midterm outcomes of synthetic cartilage implant hemiarthroplasty of the first metatarsophalangeal joint in advanced hallux rigidus

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Introduction: A randomized clinical trial of first metatarsophalangeal (MTP) joint hemiarthroplasty with a synthetic cartilage implant demonstrated equivalent pain, function and safety outcomes to first MTP joint arthrodesis at 2 years. The implant cohort continues to be followed under an extension of the original study and we report on prospectively determined 5+ year outcomes for subjects assessed to date.
Methods: Patients treated with hemiarthroplasty implant as part of the previously mentioned trial are eligible for enrollment in the extended study (n=135). At the time of this report, 57 patients had reached the 5+ years postoperative time point, of which 5 were lost to follow-up. The remaining 52 patients with mean age of 58.5 (range, 38.0-72.0) underwent physical examination, radiographic evaluation, assessment of implant survivorship and collection of patient completed VAS pain, and Foot and Ankle Ability Measure (FAAM) sports subscale and activities of daily living (ADL) subscale scores. Mean follow-up is 5.8 (range, 4.8-7.4) years.
Results: Patient reported pain and function outcome measures showed clinically and statistically meaningful improvements over baseline at 5.8 years. Mean VAS pain scores decreased 57.9 points (86% pain reduction). The mean FAAM Sports and ADL subscale scores increased from baseline 47.9 points (126%) and 32.7 points (55%) respectively. Patients maintained first MTP joint motion with mean active peak MTP dorsiflexion of 25.9° (range, 0-54°) which was a 3° improvement from baseline. Implant survivorship at 5.8 years was 92%; four were converted to fusion because of persistent pain at mean time 42 months post-operation (range, 26-52 months). These results are equivalent to the outcomes reported at 2 years follow-up.[1]
Conclusion: The synthetic cartilage hemiarthroplasty implant continues to demonstrate safety and efficacy for the treatment of advanced first MTP joint osteoarthritis with mid-term evidence of a therapeutic effect and an acceptable safety profile at 5.8 years.

FP18

Silastic 1st metatarsal phalangeal joint replacement for the treatment of end stage hallux rigidus: analysis of a consecutive series of 108

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Introduction: Arthroplasty for treatment of end stage hallux rigidus is controversial. Arthrodesis remains the gold-standard, but this procedure is not without complications, with up to 10% non-union, 14% re-operation and 10% transfer metatarsalgia rates reported.
The aim of this study was to analyse the outcome of the double-stemmed silastic implant (Wright-Medical) for end stage hallux rigidus.
Method: We conducted a retrospective review of a consecutive series of 108 silastic 1st MTPJ implanted in our Unit (January 2005 - December 2016). Data was collected from our research databases, patient notes, PACS and PROMS. No patient was lost to follow-up.
Results: Average age was 60.1 years (range 42-84 years; 104F; 4M). Results show a 98.1% survivorship at an average 5.1 years follow up (range 6 months-12 years). Average pre- and post-operative MOXFQ scores were 78.8/100 and 11.0/100 respectively and VAS scores improved from 7/10 to 1.3/10, with an average post-operative range of movement of 26.3°. Overall satisfaction rate was 90.6%.

2 patients (1.9%) required revision; 1 for early infection (2 months) and 1 for stem breakage (10 years). There were 15 complications (13.9%) in the group, 5 lateral metatarsalgia, 7 patients stiffness and ongoing pain in the index joint occurred in 2.7%. There was a 20% incidence of radiological cyst formation or demarcation, but this was neither progressive, symptomatic, nor affected clinical outcome.
Conclusions: The authors believe these results are superior to results of other published implants for hallux rigidus (BioPro and Cartiva). Additionally, these results do not confirm progressive osteolysis, previously reported for this implant in other series, as being a mechanism of failure. Finally, these results suggest the double stemmed silastic 1st MTPJ replacement provides a reliable alternative, with at least comparable outcomes, to that of fusion, for the treatment of end stage hallux rigidus.

FP19

Association between patient factors and outcome of synthetic cartilage hemiarthroplasty (Cartiva) versus first metatarsophalangeal joint arthrodesis in advanced hallux rigidus

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Introduction: Studies have compared outcomes of first metatarsophalangeal joint (MTPJ1) implant hemiarthroplasty and arthrodesis, but there is a paucity of data on the influence of patient factors on outcomes. We evaluated data from a prospective, RCT of MTPJ1 implant hemiarthroplasty (Cartiva) and arthrodesis to determine the association between patient factors and clinical outcomes.
Methods: Patients ≥18 years with Coughlin hallux rigidus grade 2, 3, or 4 were treated with implant MTPJ1 hemiarthroplasty or arthrodesis. Pain VAS, Foot and Ankle Ability Measure (FAAM) Sports and ADL, and SF-36 PF scores were obtained preoperatively, and at 2, 6, 12, 24, 52 and 104 weeks postoperatively. Final outcomes, MTPJ1 active peak dorsiflexion, secondary procedures, radiographs and safety parameters were evaluated for 129 implant hemiarthroplasties and 47 arthrodeses. Composite primary endpoint criteria for clinical success included pain reduction ≥30%, maintenance/improvement in function, and no radiographic complications or secondary surgical intervention at 24 months. Predictor variables included: grade; gender; age; BMI; symptom duration; prior MTPJ1 surgery; preoperative hallux valgus angle, ROM, and pain. Two-sided Fisher's Exact test was used ($p < 0.05$).
Results: Patient demographics and baseline outcome measures were similar. Success rates between implant MTPJ1 hemiarthroplasty and arthrodesis were similar when stratified by hallux rigidus grade, gender, age, BMI, symptom duration, prior MTPJ1 surgery status, and preoperative VAS pain, hallux valgus and ROM ($p > 0.05$).
Conclusion: Synthetic cartilage implant hemiarthroplasty (Cartiva) is an appropriate treatment for patients with hallux rigidus grade 2, 3 or 4 and is a reasonable choice in hallux rigidus in patients with < 20 degrees HVA, with a high degree of preoperative stiffness, irrespective of gender, age, BMI, hallux rigidus grade, preoperative pain, or duration of symptoms, in contrast to what might have been expected.

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FP20

Differential gene expression in ankle cartilage chondrocytes compared to knee: might this explain the difference in prevalence of osteoarthritis in these joints and identify a potential treatment target?

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Introduction: The prevalence of symptomatic osteoarthritis (OA) in the knee is 11-19% compared to 3.4-4.4% in the ankle. In addition to this, 70% of ankle arthritis is post-traumatic while the vast majority of knee arthritis is primary OA. Several reports have previously implicated biochemical differences in extracellular matrix composition between these joint cartilages; however, it is unknown whether there is an inherent difference in their transcriptome and how this might affect their respective functionality under load, inflammatory environment etc. Therefore, we have analysed the transcriptome of ankle and knee cartilage chondrocytes to determine whether this could account for the lower prevalence and altered aetiology of ankle OA.
Methods: Human full-depth articular cartilage was taken from the talar domes (n=5) and the femoral condyles (n=5) following surgical amputation. RNA was extracted and next generation sequencing (NGS) performed using the NextSeq®500 system. Statistical analysis was performed to identify differentially regulated genes (p adj < 0.05). Data was analysed using Integrated Pathway Analysis software and genes of interest validated by quantitative PCR.
Results: 809 genes were differentially expressed in this NGS study: 781 genes were significantly up-regulated and 27 significantly down-regulated in ankle cartilage with respect to knee. Preliminary analysis has identified several pathways which are differentially regulated including 'inflammation mediated by cytokines', 'glutamate receptor pathway, 'heterotrimeric-G-protein signalling pathways', 'WNT signalling' and 'integrin signalling'.
Discussion: This is the first report identifying genes that are differentially expressed in ankle cartilage compared to the knee. Validation is currently being performed to ascertain the importance of these gene changes and correlation with their protein expression in the different joints. An understanding of the inherent biological differences in the cartilage between these two joints will provide invaluable insight into why the ankle is relatively spared from primary OA and the majority of ankle arthritis occurs following trauma.

FP21

Augmented debridement in implant infection with absorbable, gentamycin loaded calcium sulfate/hydroxyapatite biocomposite

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Aim: To evaluate the clinical outcome of a new absorbable, gentamycin loaded calcium sulfate/hydroxyapatite biocomposite (CERAMENT™/G) as cavity filler after debridement and removal of infected metalwork in chronic osteomyelitis.
Methods: We report the retrospective study of prospectively collected data from 36 patients with chronic osteomyelitis from implant infection. Treatment included a single stage protocol with removal of the metalwork, debridement augmented with application of CERAMENT™/G, stabilization, culture-specific antibiotics and primary skin closure or flap. The biocomposite was used for dead space filling after resection of Cierny-Mader (C-M) stage III and IV chronic osteomyelitis. Data were collected on patient age, comorbidities, operation details, microbiology, postoperative complications and type of fixation or plastic surgery. Primary measure of outcome was recurrence rate.
Results: According to the C-M classification 22 patients (63%) were defined as Type III and 13 (37%) as Type IV. A total of 26 (72%) patients were Class B hosts. In 9 cases (25%), there was an infected non-union and 1 patient had septic arthritis. Mean age was 52 years (range 22 to 81). Patients were followed for a mean of 20 months (range 6 to 36). Infection was eradicated in 32 patients. There were three (8.3%) recurrences (two cases of osteomyelitis and one of soft tissue/flap infection). Two of them were successfully managed with repeat surgery (one Class B and one Class A host) and one (Class B host) with suppressive antibiotic therapy as per patient's choice. In one infected nonunion the infection was eradicated but the nonunion persisted. Thirteen patients (36.6%) had a local or free fascio-cutaneus flap. Staphylococci (50%) and Enterococci (15%) were the most common microorganisms. Pseudomonas aeruginosa was more common in polymicrobial infection usually with Staphylococcus aureus.
Conclusions: A multidisciplicary approach including augmented debridement with CERAMENT™/G is effective for treatment of chronic osteomyelitis with infected metalwork.

FP22

The results of arthroscopic and open FHL tendon transfers

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Introduction: Flexor Hallucis Longus (FHL) tendon transfer is a well-recognised salvage operation for irreparable tendon Achilles (TA) ruptures and intractable Achilles tenonopathy. Several case series describes the technique and results of arthroscopic FHL tendon transfers. We present a comparative case series of open and arthroscopic FHL tendon transfers from Southmead Hospital, Bristol, UK.
Methods: For the arthroscopic FHL transfers in most cases the patients were positioned semi prone with a tourniquet. A 2 or 3 posterior portal technique was used and the tendon was secured using an RCI screw. The rehabilitation was similar in both groups with 2 weeks in an equinus backslab followed by gradual dorsiflexion in a boot over the following 6 weeks. Anticoagulation with oral aspirin for 6 weeks was used. A retrospective case note review was performed.
Results: There were 12 arthroscopic (8 males, 4 female) and 16 open procedures (9 male, 7 female). Both had a mean age of 56. 1 arthroscopic FHL was lost to follow up. There were no concomitant procedures in the arthroscopic group. In the open group the TA was repaired in 7 cases (3 of these involved z-shortening). There was 1 plantaris interposition, 1 V-Y advancement and 1 gastrocnemius advancement. Degenerate tendon was excised in 1 severe re-rupture of a calcified tendinopathic achilles. There was no difference in tourniquet time between the groups (arthroscopic 69mins vs open 64 mins, p=0.64). There were no complications in the arthroscopic group. In the open group there was 1 superficial wound infection, 1 nerve injury & 1 delayed DVT at 3 months.
Conclusion: Arthroscopic FHL transfer is a safe and effective surgical option when no other achilles procedures are required. The soft tissue insult is minimal, making it a good option for patients with poor soft tissues or neurovascular compromise.

FP23

The Scottish Arthroplasty Project: outcomes of 601 total ankle replacements over a 20 year period

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Introduction: Total ankle replacement (TAR) is performed for post-traumatic arthritis, inflammatory arthropathy, osteoarthritis and a range of other indications. The Scottish Arthroplasty Project (SAP) began collection of data on TAR in 1997. In this study, using data from the SAP, we examined the annual incidence of TAR between 1997 and 2015. Implant survivorship and the rate of general and joint-specific complications were also analysed.
Methods: We identified 601 patients from a national arthroplasty database who had undergone total ankle replacement between 1997 and 2015 and followed up these patients to a maximum of 20 years. We used established methods of linkage with national hospital episode statistics, population and mortality data to examine the incidence of complications and implant survivorship.
Results: There were 601 primary TAR procedures with an overall incidence of 0.6 per 10^5 population per year. Indications for ankle replacement included: posttraumatic arthritis/osteoarthritis 63%; inflammatory arthropathy 25% and other diagnoses including: haemophilia; haemochromatosis; psoriatic arthritis and avascular necrosis in 12%. The peak incidence was in the 6th decade. There was a female to male ratio of 1:1. The incidence of TAR increased over 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 with ankle replacement and the evolution of implant design. The overall 10 year survivorship was 90%. The rate of general and implant specific complications was comparable to published literature.
Conclusion: This study examines a large number of ankle replacements from an established arthroplasty dataset. The prevalence of TAR has increased over 19 years. Overall survivorship was similar to other published registry data on ankle replacements. Further work will look at the effect of surgeon volume on rate of complications, reoperation and survivorship.

FP24

What is the effect of BMI on total ankle replacement and the effect of ankle replacement on BMI?

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The effect of BMI on patient-reported outcomes following total ankle replacement (TAR) is uncertain and the change in BMI experienced by these patients in the 5 years following surgery has not been studied. We report a

series of 106 patients with complete 5-year data on BMI and patient-reported outcome scores.
Patients undergoing TAR between 2006 and 2009, took part in the hospital joint registry, which provides routine clinical audit of patient progress following total joint arthroplasty; therefore, ethics committee approval was not required for this study. Data on BMI, Foot and Ankle Score (FAOS) and SF-36 score were collected preoperatively and annually postoperatively.
Patients who were obese (BMI >30) had lower FAOS scores pre-operatively and at 5 years, however this did not reach significance. Both obese ($p = 0.0004$) and non-obese ($p < 0.0001$) patients demonstrated a significant improvement in FAOS score from baseline to 5 years. This improvement was more marked for the non-obese patients. No significant differences were seen for SF36 scores between obese and non-obese patients either at baseline or 5 years. There was a trend for improved score in both groups.
Mean pre-operative BMI was 28.49. Mean post-operative BMI was 28.33. The mean difference between pre- and post-operative BMI was -0.15, which was not statistically significant ($p=0.55$). There were no significant differences in revisions in the obese (2) and non-obese (1 and one awaited) groups at 5 years.
This data supports use of TAR in the obese population, as significant increases in mean FAOS score were seen in this group at 5 years. Obesity did not have a significant influence on patients' overall health perceptions, measured by the SF36 and a trend for improvement was seen in both obese and non-obese patients. TAR cannot be relied upon to result in significant post-operative weight-loss without further interventions.

FP25

Total ankle replacement: 6 year survivorship of 118 consecutive Zenith Ankle replacements from a non-designer centre

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Introduction: Traditional treatment for end-stage ankle arthritis has been ankle arthrodesis, however ankle arthroplasty is becoming an accepted alternative.
The Zenith Ankle (Corin, UK) is 3rd generation implant with a mobile bearing design. In the NJR 2016 report, the Zenith was the commonest ankle prosthesis implanted in the UK. However, compared to other ankle implants, there's little published data on its performance and survival. The aim of this study was to analyse outcome in a consecutive series from a non-designer centre.
Method: We conducted a retrospective review of a consecutive series of 118 Zenith Ankle replacements implanted in our Unit (December 2010 to May 2016). Data was collected from our National Joint Registry entries, research databases, patient notes, PACS and PROMS.
Results: Average age was 68.2 years (range 46-86 years; 75M:43F; 97 Osteoarthritis, 20 inflammatory arthritis, 1 haemophilia). Results show a 95.8% survivorship at average 3.5 years follow up (range 0.6-6.3 years). 5 patients (4.2%) required revision. Average pre- and post-op MOXFQ scores were 85.0/100 and 32/100 respectively with improvements in VAS from 7.0/10 to 3.6/10, with an average range of movement of 20.4 degrees. Overall satisfaction rate was 89%.
There were 65 complications in 55 patients, but only 7.7% of these led to detrimental effects on the implant. The commonest were malleolar fracture (14.4%), wound problems (13.6%) and superficial infection (12.7%), medial gutter pain (10.2%). There were no cases of deep infection. Five patients required revision (all were revised to revision arthroplasty), for component loosening, or pain and stiffness.
Conclusions: This is largest non-designer centre series examining the outcomes of the Zenith implant. Survival figures for this implant are comparable to NJR averages (6.8% revision at 5 years), with high levels of patient functional outcome and satisfaction. The data highlights the risks associated with this procedure.