Free Papers
Wednesday 11th November

FP1
Is Stimulan (synthetic calcium sulphate tablets impregnated with antibiotics) superior in the management of diabetic foot ulcers with osteomyelitis compared to standard treatment?

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Background: Diabetes is bad, common and diabetic foot ulcers (DFU) once established lead to high rates of amputation. In Nottingham our standard management for infected diabetic foot ulcers is surgical debridement, microbiological sampling, packing with gentamicin beads and targeted antibiotic therapy. Recently we have switched to packing with Stimulan, which is a purified synthetic calcium sulphate compound that can be mixed with patient appropriate antibiotics, is biodegradable and delivers better elution characteristics compared to gentamicin beads.
Aim: To assess the efficacy of Stimulan compared to Gentamicin beads in the surgical management of infected diabetic foot ulcers.
Methods: In 2012/13 the department audited its results of DFU surgical management with gentamicin beads. In 2014/5 the audit was repeated but Stimulan was used instead due to the perceived advantages Patients with infected DFU that could comply with treatment were included. Patients who had other sources of sepsis, non-compliant or moribund were excluded. Treatment pathways were identical apart for the use of Stimulan in 2014/5. The primary outcome measure was ulcer healing. The secondary outcome measure was length of stay and recurrence.
Results: Each group had 23 patients. The gentamicin group had a DFU for 12.3 months(3weeks-5 years) before presentation for surgery compared to the Stimulan group 6.1 months(2weeks-5years). Both groups had failed non-surgical management. The majority of the ulcers were located on the forefoot. In the stimulan group 70% (16/23) of ulcers had healed with an average of 4 months(2-7 months) compared to 57% (13/23) in the Gentamicin group within 6months(1-12). The length of stay was shorter in the Stimulan group 7 days (1-70) compared to 28days(1-70) in the Gentamicin group.
Conclusion: In our review Stimulan was superior to Gentamicin beads in the management of infected diabetic foot ulcers. We believe it has a role to play in limb salvage.

FP2
Minimally invasive surgical techniques for diabetic foot and ankle pathology

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Introduction: Diabetes is increasing on a global scale. By 2030, 10% of the global population , ½ billon people, are predicted to have diabetes. Potentially there will be a corresponding increase in number of patients referred for surgery.
Traditional surgical management of these patients is challenging.
Presented is a case series utilizing Minimally Invasive Surgical Techniques of percutaneous metatarsal neck osteotomies, metatarsal head debridement, mid-foot closing-wedge osteotomies and hind-foot arthrodesis, for the surgical management of diabetic foot pathology.
The potential socio-economic benefits analysis with regards to reduction in out-patient and theatre time, patient length of stay and time to healing are also postulated.
Methods: Minimally Invasive Surgical Techniques of metatarsal neck osteotomy, metatarsal head debridement, closing wedge osteotomy, mid-fusion and hind-foot arthrodesis nailing are described.
Procedures are preformed as day cases with fluoroscopic guidance. Low speed, high torque burrs and wedges, create the osteotomies, which can be held with percutaneous fixation.
Comparative cost analysis of conservative treatment, including clinic visits, out-patient debridement, dressings, intravenous and oral antibiotics, versus Minimally Invasive Surgical Techniques is presented.
Results: Six patients had metatarsal osteotomies for mechanical ulceration. Five reported good outcome. One patient required revision to forefoot arthroplasty due to mal-union. Five patients had debridement of metatarsal heads, which healed on average at six to eight weeks. Eight patients had mid-foot arthrodesis. Two infected cases required removal of metalwork. Three patients had hind-foot arthrodesis for arthritis following ankle fracture with degeneration and deformity.
Patients had good short and early medium term outcomes, with no reports of below-knee amputation. This technique is reproducible once the initial learning curve is mastered.
Comparative cost analysis, suggests significant financial savings by reducing inpatient admissions, clinic visits and theatre time.
Conclusion: Minimally Invasive Surgical Techniques may provide an alternative surgical management for diabetic patient with foot and ankle pathology.

FP3
The lisfranc push-up stress-test

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The diagnosis of Lisfranc ligament disruption is notoriously difficult. Radiographs and MRI scans are often ambiguous therefore a stress-test examination under anaesthesia is commonly required. Two midfoot stress-tests are in current practice, namely the varus first ray stress-test and the pronation abduction test. The optimal type of stress-test is not however evaluated in the literature. We hypothesised that after the loss of the main plantar stabiliser (the Lisfranc ligament) the patient would demonstrate dorsal instability, not the classic $1^{st}/2^{nd}$ metatarsal diastasis commonly described. We therefore devised a push-up test (placement of a force under the 2^{nd} metatarsal in an attempt to elevate the base away from the middle cuneiform on the lateral radiograph). We aimed to initially test our hypothesis on a cadaveric model.
Twelve fresh frozen cadaveric specimens without previous foot injury were used. The 2^{nd} tarsometatarsal joint was exposed and the Lisfranc ligament and dorsal capsule were incised. An image intensifier was positioned and standard anteroposterior (AP) and lateral views were obtained. Two previously reported AP stress-tests (varus first ray stress test, pronation abduction test) and the novel test under investigation ('Lisfranc Push-Up' test) were duly performed. Images were obtained once the investigator felt the appropriate views were achieved.
All twelve of the Lisfranc Push-Up tests showed dorsal subluxation of the 2^{nd} metatarsal on the middle cuneiform of greater than 2mm on the lateral radiograph. No diastasis of the $1^{st}/2^{nd}$ metatarsals was seen in any of the specimens on the AP radiograph for either of the other two stress-tests.
The authors have described a novel way of demonstrating the dorsal instability associated with the ligamentous Lisfranc injury. Our results support the Lisfranc Push-Up test as a reproducible and sensitive method for assessing ligamentous Lisfranc injuries. In our cadaveric model the previously described stress-tests do not work.

FP4
Percutaneous versus open treatment of unstable tarsometatarsal injuries

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Lisfranc fracture dislocations of the midfoot are uncommon but serious injuries, associated with posttraumatic arthrosis, progressive deformity, and persistent pain. Management of the acute injury aims to restore anatomic tarsometatarsal alignment in order to minimise these complications. Reduction and stabilisation can be performed using image-guided percutaneous reduction and screw stabilisation (aiming to minimise the risk of wound infection) or through open plating techniques (in order to visualise anatomic reduction, and to avoid chondral damage from transarticular screws). This retrospective study compares percutaneous and open treatment in terms of radiographic reduction and incidence of early complications.
Case records and postoperative radiographs of all patients undergoing reduction and stabilisation of unstable tarsometatarsal joint injuries between 2011 and 2014 in our institution were reviewed. Dorsoplantar, oblique and lateral radiographs were assessed for accuracy of reduction, with malreduction being defined as greater than 2mm tarsometatarsal malalignment in any view. The primary outcome measure was postoperative radiographic alignment. Secondary outcome measures included the incidence of infection and other intra- or early postoperative complications.
During the study period, 32 unstable midfoot injuries were treated, of which 19 underwent percutaneous reduction and screw stabilisation and 13 underwent open reduction and internal fixation. Of the percutaneous group, no wound infections were reported, and there were four (21.1%) malreduced injuries. Of the open group, two infections (15.4%) were observed, and no cases of malreduction.
In conclusion, our study shows a strong trend towards increased risk of malreduction when percutaneous techniques are used to treat midfoot injuries, and an increased risk of infection when open surgery is used. Whilst conclusions are limited by the retrospective data collection, this study demonstrates the relative risks to consider when selecting a surgical approach.

FP5
Closing the gap on Achilles tendon rupture: a cadaveric study quantifying the tendon apposition achieved with commonly used immobilisation practices

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Operative and non-operative treatment regimens for Achilles tendon ruptures vary greatly but commonly involve rigid casting or functional bracing. The aim of our study was to investigate the extent of tendon apposition following such treatments.
Twelve fresh-frozen, adult below knee lower-extremity cadaveric specimens with intact proximal tibiofibular joints were used. Each was prepared by excising a 10cm x 5cm skin and soft tissue window exposing the Achilles tendon. With the ankle in neutral position, the tendon was transfixed with a 2mm k-wire into the tibia, 8cm from its calcaneal insertion. A typical post-rupture gap was created by excising a 2.5cm portion of tendon between 3.5cm and 6cm from its calcaneal insertion.
The specimens were then placed into a low profile walker boot (SideKICK^{TM}, Procare) without wedges and a window cut into the back. The distance between the proximal and distal Achilles tendon cut edges was measured and repeated with 1, 2 and 3 (10mm) wedges. Subsequently the specimens were placed into a complete below knee cast in full equinus which was also windowed.
The Achilles tendon gap (mean +/- SD) measured: 2.7cm (0.5) with no wedge, 2.3cm (0.4) with 1, 2.0cm (0.4) with 2, 1.5cm (0.4) with 3 wedges and 0.4cm (0.3) in full equinus cast.
The choice of treatment had a significant effect on tendon gap ($p< 0.0001$ - repeated measures ANOVA), and all pairwise comparisons were significantly different (Bonferroni), with all $p< 0.001$, apart from 0 wedge vs. 1 wedge ($p< 0.01$) and 1 wedge vs. 2 wedges ($p< 0.05$).
Our results showed that each wedge apposed the tendon edges by approximately 0.5cm with the equinus cast achieving the best apposition. Surgeons should consider this when planning appropriate immobilisation regimes for Achilles tendon ruptures.

FP6
Anatomy of the posterior malleolar fracture

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There is an increasing acceptance that the clinical outcomes following posterior malleolar fractures are less than satisfactory. Current ankle classification systems do not account for differences in fracture patterns or injury mechanisms, and as such, the clinical outcomes of these fractures are difficult to interpret. The aim of this study was to analyse our posterior malleolar fractures to better understand the anatomy of the fracture.
In a series of 42 consecutive posterior malleolar, who all underwent CT imaging, we have described anatomically different fracture patterns dictated by the direction of the force and dependent on talus loading. We found 3 separate categories. Type 1 - a rotational injury in an unloaded talus resulted in an extraarticular posterior avulsion of the posterior ligaments. This occurred in 10 patients and was most commonly associated with either a high fibular spiral fracture or a low fibular fracture with Wagstaffe fragment avulsion. The syndesmosis was usually disrupted in these patients. Type 2 - a rotational injury in a loaded talus resulting in a posterolateral articular fracture, of the posterior incisura. This occurred in 16 patients and was most commonly associated with a posterior syndesmosis injury, low fibular spiral fracture and an anterior collicular fracture of the medial malleolus. Type 3 - axially loaded talus in plantarflexion causing a posterior pilon. This occurred in 16 patients and was most commonly associated with a long oblique fracture of the fibular and a Y shape fracture of the medial malleolus. The syndesmosis was usually intact in these patients.
In conclusion, the anatomy of the posterior malleolar should not be underestimated and requires careful consideration during treatment and categorisation in outcome studies to prevent misinterpretation.

FP7
Rationalising the use of distal fibula locking plates in ankle fracture fixation

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Introduction: Despite costing up to 5X more than a one-third tubular plate (TTP) and no absolute indications, distal fibula locking plates (DFLP) are becoming increasingly popular in the fixation of ankle fractures, particularly in the elderly. We reviewed all our distal fibula fracture fixations, over the course of one year, in order to rationalise DFLP use.
Methods: Patient demographics, Weber classification, use of DFLP or TTP and the mode of fixation were recorded. Open fractures and tibial plafond fractures were excluded.
Results: 51/84 (61%) of patients had DFLP fixation of their distal fibula fracture, the majority (44/51) of which were for Weber B fractures. The DFLP was used in bridge mode for 12 Weber B fractures and in neutralisation mode for remaining 32.
There was a significant difference in age between the DFLP and TTP groups for all fractures ($p< 0.005$) and for Weber B fractures treated in bridge mode ($p=0.036$), but not for Weber B fractures treated with a lag screw/ neutralisation plate ($p=0.09$).
Discussion: In 32/44 of our cases, we used the DFLP to neutralise a lag screw. However DFLP are only of mechanical benefit when adequate fracture compression is not obtained either due to fracture comminution or due to osteoperotic bone, often seen in the elderly.
All 32 of these Weber B fractures were amenable to a lag screw and were not comminuted. There was also no

significant age difference between this group and the group of Weber B fractures that were treated with a lag screw/ neutralisation plate. In these cases therefore, the DFLP did not offer any mechanical advantage.
Conclusion: We propose limiting the use of the DFLP to fibula fractures where intra-fragmentary compression cannot adequately be obtained, thus reducing our use by over 60% and significantly reducing our implant costs for such injuries.

FP8
Fibula rod fixation in unstable ankle fractures, experience at level one major trauma centre

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Introduction: Different techniques for fixation of lateral malleolus have been described. We report our results of using fibula rod for unstable ankle fractures in level one major trauma centre.
Methods: We reviewed the results of 40 ankle fractures (14 open and 26 closed) with significant soft tissue injuries and open fractures that were treated with a fibula rod between 2012 and 2015. The median age of patients was 60 (17-98 years).
Results: Satisfactory fracture reduction was achieved in all of these patients Two patients had loss of syndesmosis fixation. All fibula fractures healed but 3 medial malleolus non unions occurred which did not need further surgery. 1 patient developed post-operative deep infection and had removal of metalwork.
The median physical component Short-Form 12 (PSF12), Olerud and Molander score (OMS), and American Academy of Orthopaedic Surgeons Foot and Ankle outcome scores (AOFAS) were 40 (19 to 52), 57 (0 to 85) and 75 (20 to 95), respectively.
The median PSF12, OMS and AOFAS were 33, 35 and 47 for open fractures and 42, 60 and 78 for closed fractures respectively.
Conclusion: Using the fibula rod resulted in good radiological and satisfactory functional outcomes with minimal complications. In spite of lower scores in the open fracture group, only one patient needed removal of metal work for deep infection. We recommend using the fibula rod in unstable ankle fracture in patients with significant soft tissue injuries and consider its use in open injuries.

FP9
Development of an intraoperative radiographic measure to assess syndesmotic reduction in ankle fractures

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During surgical reduction of ankle injuries with syndesmotic instability surgeons often use the anteroposterior (AP) and mortise radiographs to assess reduction. Current literature predicts 50% are malreduced mainly in the sagittal plane. Our aim was to develop a radiographic measure based on the lateral view to assess both the normal and abnormal fibula/tibia relationship after simulated syndesmotic malreduction and to evaluate the effect on commonly used AP and mortise measurements.
Nine fresh-frozen cadaveric specimens were dissected to the level of the syndesmosis. AP, mortise and talar dome lateral radiographs were obtained before and following syndesmosis division and posterior fibula displacement. On the lateral radiograph a line was drawn (Orthoview) from the anterior border of the fibula bisecting a line drawn from the anterior to posterior lips of the distal tibia. The ratio of the anterior-posterior segments was calculated. Also a line was drawn from the posterior border of the fibula and the distance was measured to the posterior lip of the tibia.
At 0, 2, 4 and 6mm of displacement the ratio measured 1.3±0.2, 1.1±0.2, 0.9±0.2 and 0.7±0.2 respectively with all pairwise comparisons being significantly different. Inter- and intra-observer variability varied from substantial to perfect. The only significant medial clear space (MCS) difference was on the mortise view between 0mm (2.0±0.3mm) and 6mm (2.4±0.4mm) displacement.
Our new measure of syndesmotic reduction is reproducible and can detect from 2mm of saggital fibular displacement. At maximum fibular displacement the increase in MCS was less than 1mm. This demonstrates standard mortise radiographs are poor at detecting syndesmotic reduction. An interesting observation was in all specimens prior to any displacement, the posterior fibular line always bisected the posterior lip of the tibia or lay just anterior to it, never posterior. This could serve as a useful adjunct for surgeons when assessing syndesmotic reduction intra-operatively.

FP10
Stable versus unstable grade II high ankle sprains - a prospective study

predicting the need for surgical stabilization and time to return to sports

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This study investigated athletes presenting with grade II syndesmosis injuries and identified the clinical and radiological factors important in differentiating a stable from dynamically unstable injury and those findings associated with a longer recovery and return to sport.
Sixty-four athletes were prospectively assessed with an average follow-up of 37 months (range 24-66 months). Athletes with an isolated distal syndesmosis (+/- medial deltoid ligament) injury were included. Those athletes with a concomitant ankle fracture were excluded. Those considered stable (grade IIa) were treated conservatively with a boot and progressive rehabilitation. Those with clinical signs of instability underwent arthroscopy and if instability was confirmed (grade IIb) the syndesmosis was stabilized surgically. The clinical assessment of injury to individual ligaments of the ankle and syndesmosis were recorded along with MRI findings, complications and time to return to play.
All athletes returned to the same level of professional sport - 28 with IIa injuries returned at a mean of 45 days whereas the 36 with grade IIb injuries returned to play at a mean of 64 days ($p< 0.001$). Clinical assessment of injury to the ligaments of the syndesmosis correlated well with MRI findings. Those with a positive squeeze test were 9.5 times as likely and those with a deltoid injury 11 times more likely to have an unstable syndesmosis confirmed arthroscopically. The combination of injury to the AITFL and deltoid ligament was associated with a delay in return to sport. Concomitant injury to the ATFL indicated a different mechanism of injury with the syndesmosis less likely to be unstable and was associated with an earlier return to sport.
Clinical and MRI findings may differentiate stable from dynamically unstable grade II injuries and identify which athletes may benefit from early arthroscopic assessment and stabilization. It also suggests the timeframe for expected return to play.

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FP11
Patient reported outcome measures for common foot and ankle conditions - the effect of disease and the benefit of surgery

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Introduction: The aim of this study was to identify the effects of first MTPJ arthritis, ankle arthritis and hallux valgus on patient reported outcomes, and to assess the efficacy of surgery.
Methods: Patients who underwent first MTPJ fusion, ankle fusion or hallux valgus correction from July 2013 to October 2014 were included in the study. Exclusion criteria included revision or simultaneous bilateral surgery, inflammatory arthropathy, or arthritis of a proximal joint awaiting arthroplasty. Subjects completed the Manchester-Oxford Foot Questionnaire (MOX-FQ), EQ-5D index, and EQ-5D health scale on presentation and at least six months post-operatively. Between group statistical analysis was carried out using one-way ANOVA, pre- and post-operative scores were compared using a paired t-test.
Results: Eighty-two patients completed pre-operative questionnaires. Seventy-four (22 male, 52 female) of these (90%) completed post-operative questionnaires at a median of 10 months (range 6-17 months). The median age was 64 years (range 36-85 years). Pre-operative MOX-FQ and EQ-5D scores differed significantly between the groups (both $p< 0.001$) with ankle fusion patients reporting the worst scores and hallux valgus patients the best. Post-operative MOX-FQ and EQ-5D did not differ between groups ($p=0.52$, $p=0.06$ respectively). MOX-FQ significantly improved in all groups from pre-operatively (MTPJ $p=0.0001$; Ankle $p=0.0002$; Hallux Valgus $p< 0.0001$). EQ-5D only statistically improved following surgery for arthritic conditions (MTPJ $p< 0.001$; ankle $p< 0.001$; Hallux valgus $p=0.06$). The EQ-5D health scale did not show any differences between the groups either pre- or post-operatively, nor between pre- and post-op scores for each type of surgery.
Conclusions: MOX-FQ and EQ-5D scores differ between patients with different foot and ankle pathologies. Both scores significantly improve following surgery for arthritic conditions, but only the more specific MOX-FQ improves following hallux valgus correction. These results will be of benefit when consenting patients pre-operatively, and potentially for prioritisation of healthcare provision.

FP12
The Beagle Böhler Walker - reduction of load transmission in a below knee cast

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Background: The current 'gold standard' method for enabling weightbearing during non-invasive lower limb

immobilisation is to use a Patella Tendon-Bearing (PTB) or Sarmiento cast. The Beagle Böhler Walker™ is a non-invasive frame that fits onto a standard below knee plaster cast. It is designed to achieve a reduction in force across the foot and ankle.
Our objective was to measure loading forces through the foot to examine how different types of casts affect load distribution. We aimed to determine whether the Beagle Böhler Walker™ is as effective or better, at reducing load distribution during full weightbearing.
Methods: We applied force sensors to the 1st and 5th metatarsal heads and the plantar surface of the calcaneum of 14 healthy volunteers. Force measurements were taken without a cast applied and then with a Sarmiento Cast, a below knee cast, and a below knee cast with Böhler Walker™ fitted.
Results: Compared to a standard below knee cast, the Böhler Walker™ reduced the mean peak force through the first metatarsal head by 58.9% ($p < .0001$); 73.1% through the fifth metatarsal head ($p < .0001$); and by 32.2% ($p < .0001$) through the calcaneum. The Sarmiento cast demonstrated a mean percentage reduction in peak force of 8.6% ($P = .39$) and 4.4% ($P = .87$) through the 1st and 5th metatarsal heads respectively, but increased the mean peak force by 5.9% ($P = .54$) through the calcaneum.
Conclusions: Using a Böhler Walker™ frame applied to a below knee cast significantly reduces loadbearing through the foot compared to a Sarmiento cast or a standard below knee cast.
Implications: This could mean early weightbearing is safer and better tolerated in patients with a wide variety of foot and ankle pathologies, which can in turn improve quality of life and reduce the incidence of immobility dependent morbidity.

FP13
Arthroscopic subtalar arthrodesis through the two portal sinus tarsi approach: a series of 77 cases

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Traditional open approaches for subtalar arthrodesis have reported nonunion rates of 5-16% and significant incidence of infection and nerve injury. The rationale for arthroscopic arthrodesis is to limit dissection of the soft tissues in order to preserve blood supply for successful fusion, whilst minimising the risk of soft tissue complications. The aim of this study was to determine the outcomes of sinus tarsi portal subtalar arthrodesis.
Case records of all patients undergoing isolated arthroscopic subtalar arthrodesis by two senior surgeons between 2004 and 2014 were examined. All patients were followed up until successful union or revision surgery. The primary outcome measure was successful clinical and radiographic union. Secondary outcome measures included occurrence of infection and nerve injury.
Seventy-seven procedures were performed in 74 patients, with successful fusion in 75 (97.4%). One (1.3%) superficial wound infection and one (1.3%) transient sural nerve paraesthesia occurred. Fixation with a single screw provided sufficient stability for successful arthrodesis.
To our knowledge this is the largest reported series of isolated arthroscopic subtalar arthrodeses to date, and the first series reporting results of the two portal sinus tarsi approach. This approach allows access for decortication of all three articular facets, and obviates the need for a posterolateral portal, features which may explain the high union rate and low incidence of sural nerve injury in our series.

FP14
Supramalleolar osteotomy: a joint-preserving option for advanced ankle osteoarthritis

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Background: Until recently, surgical treatments for advanced ankle osteoarthritis have been limited to arthrodesis or ankle replacement. Supramalleolar osteotomy provides a joint-preserving option for patients with eccentric osteoarthritis of the ankle, particularly those with varus or valgus malalignment.
Aim: To evaluate radiological and functional outcomes of patients undergoing shortening supramalleolar osteotomy for eccentric (varus or valgus) osteoarthritis of the ankle.
Method: Prospective review of patients from 2008 onwards. Osteotomy was the primary surgical procedure in all patients after failure of non-operative measures.
Pre-operative standing antero-posterior and Saltzman view radiographs were taken to evaluate degree of malalignment requiring correction. Radiological and clinical outcomes were assessed at 3, 6 and 12 months post-operatively. Radiographs were reviewed for time to union.
Patients were assessed on an outpatient basis for ankle range of motion as well as outcomes using AOFAS scores.
Results: 33 patients over a 7 year period. Mean follow-up was 25 months (range 22-30).
Mean time to radiological union was 8.6 weeks (range 8-10); there were no cases of non-union. There was a statistically significant improvement in functional scoring ($P< 0.001$); mean AOFAS score improved from 34.8

(range 15-40) pre-operatively to 79.9 (range 74-90) at 12 months post-operatively. There was no significant change in pre- and post-operative range of motion.
2 patients required revision surgery at 12 months; one to arthrodesis and one to ankle replacement.
Conclusion: Supramalleolar osteotomy is a viable joint preserving option for patients with eccentric osteoarthritis of the ankle. It preserves motion, redistributes forces away from the affected compartment and corrects malalignment, providing significant symptomatic and functional improvement.

FP15
The Zenith total ankle replacement: early to mid-term results in 155 cases

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The Zenith™ total ankle replacement (Corin, Cirencester) is a mobile-bearing implant based on the Buechal Pappas design. Key features are the simple fully-jigged instrumentation aiming to improve accuracy and reproducibility of implant positioning, cementless calcium phosphate coated surfaces for improved early osseointegration, and titanium nitride-coated bearing surfaces to resist wear. We present early to mid-term survival data for 155 total ankle replacements implanted by three surgeons in our institute.
Case records of all patients undergoing Zenith™ Total Ankle Replacement by three senior surgeons, including a member of the design team, between 2007 and 2014 were examined. Patients were examined clinically and radiographically annually after the early postoperative period. The primary outcome measure was implant survival. Secondary outcome measures included complication rates, parameters of radiographic alignment, and radiographic evidence of cysts and loosening.
One hundred and fifty-five cases were performed for a mixture of primary pathologies, predominantly primary or posttraumatic arthrosis. Mean follow-up was 50 months. Implant survival was 99.0% at 3 years (n=103), 94.0% at 5 years (n=50), and 93.8% at 7 years (n=16). One patient was revised to arthrodesis for aseptic loosening, one arthrodesis was performed for periprosthetic infection with loosening, and one below-knee amputation was performed for chronic pain. Three cases underwent further surgery to address cysts, and 7 malleolar fractures were reported. Medial gutter pain was experienced by 9% of patients.
Overall, our data show excellent early and mid-term survivorship for the Zenith™ Total Ankle Replacement. Simple fully-jigged instrumentation allows accurate and reproducible implant alignment.

FP16
Continuous popliteal sciatic nerve blockade after major ankle and hindfoot surgery using elastomeric pumps leads to shorter hospital stay and high patient satisfaction

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Purpose: Ankle and hindfoot surgery is associated with severe post-operative pain, leading to a reliance on opiate analgesia and its side effects, longer hospital stays, and patient dissatisfaction. Popliteal sciatic nerve blockade has the potential to resolve these issues. We present our experience with using a continuous local anaesthetic nerve block delivered by an elastomeric pump in patients undergoing major foot and ankle surgery.
Methods: All patients undergoing major ankle or hindfoot surgery during a one-year period under a single surgeon were eligible for a continuous popliteal block. An ultrasound-guided popliteal nerve catheter was inserted immediately before surgery and a bolus of bupivacaine infiltrated. Using a 250ml elastomeric pump, a continuous infusion was started immediately post operatively and terminated 48 hours later. Prospective data including post-operative analgesia, nausea and vomiting (PONV), length of stay (LOS), pain scores, and patient satisfaction were recorded daily for 48 hours post operatively.
Results: Eighty-one patients (53 male, 28 female) with a mean age 60 years (24-84 years) were included. 66 patients received spinal anaesthesia with 15 having general anaesthetics. There were no complications associated with the nerve catheters. At day 1 post op, 49 (60%) patients reported having no or mild pain. 68 (84%) patients had no PONV. 27 (33%) patients did not require any opiate analgesia during their post op period. Average LOS for all patients was 54 hours, with 41 (51%) discharged within 48 hours. 74 (91%) reported good or excellent pain management in the post operative period.
Conclusions: Continuous popliteal sciatic nerve blockade is a safe and effective method for controlling post-operative pain, reducing opiate-induced side effects, and optimising length of stay. Patient-reported outcomes support its use in major ankle and hindfoot surgery. Furthermore, reduced costs from early discharge in combination with a daycase tariff uplift can bring significant financial savings.

FP17
Surgical management of failed total ankle replacements in a tertiary referral

centre

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Background: Management of failed total ankle replacements (TAR) remains a difficult challenge. Ankle arthrodesis, revision TAR, debridement and amputation are all utilized as surgical options. The purpose of the study was to review a series of failed TAR surgically managed in our tertiary referral centre.
Methods: A retrospective review of 18 consecutive failed TARs, either within or referred to our institution, which required surgical management were reviewed. The average age was 58.2 (range 25-77) with 11 males and 6 females.
Results: The failed implants included eight Mobility TARs, five BOX TARs, four Salto Mobile TARs and one Biomet Ankle Replacement System. Reasons for failure of implant include aseptic loosening (8/18, 44%), talus collapse (3/18, 17%), poor function (3/18, 17%), heterotopic ossification (2/18, 11%), component migration (1/18, 6%) and infection (1/18, 11%). The average duration between index procedure and second procedure was 43 months (range 6-120). Five patients further required a third surgical procedure. Definitive surgical management included tibio-talar arthrodesis (7/18, 39%), revision TARs (5/18, 28%), debridement (4/18, 22%) and a below knee amputation (1/18, 6%). All the fusions subsequently went on to unite.
Conclusions: The number of TARS being performed is increasing, so there is a need to successfully manage failed implants. Surgical options depend on the reason for implant failure, patient factors and surgical expertise. Salvage ankle arthrodesis remains favorable with high fusion rates. However revision TARs are evolving into a reliable treatment option. Further studies are required to directly compare these two modes of surgical management for failed primary TARS.

FP18
Medium term follow-up of the Corin Zenith total ankle replacement in an independent non-inventor cohort

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Background: Total ankle replacement (TAR) design has evolved greatly in recent years and offers a reasonable alternative to ankle arthrodesis in a select patient population with end-stage arthritis. Originator series' report good longevity and excellent patient reported outcomes (PROMs). We report our outcomes in an independent, non-inventor cohort.
Method: We collected prospective data on consecutive patients undergoing total ankle replacement between April 2008 and March 2012, under the care of one Consultant Orthopaedic surgeon. The primary outcome measure was time to revision. Secondary outcomes measures included American Orthopaedic Foot and Ankle Society (AOFAS) scores, Visual Analogue Score (VAS) for pain, and complications.
Results: 70 patients underwent TAR with a mean follow-up of 64 months (39-86). Three patients underwent revision of TAR to ankle arthrodesis, two for aseptic loosening and one for infection, equating to survivorship of 96%.
Three patients sustained intra-operative fractures, one of the lateral malleolus and two of the medial malleolus. The patient who sustained the lateral malleolus fracture later went on to develop aseptic loosening requiring revision. One patient developed a late stress fracture of the medial malleolus. Two patients underwent open exploration, grafting of bone cysts and fixation for ongoing pain at a mean time of 4.5 years following the primary TAR. At the most recent review all patients reported improved AOFAS scores from 39.55 (21-52) to 82.10 (57-100) and VAS from 9.11 (6-10) to 1.79 (0-6) respectively.
Conclusions: Longevity of the Zenith TAR in our non-inventor series is comparable to that of originator outcomes. Fractures are a recognized complication of TAR and when affecting the medial malleolus, do not appear to have an adverse effect on outcome. We feel that TAR offers an effective alternative solution to ankle arthrodesis with satisfactory relief of pain whilst preserving movement at the ankle joint.

FP19
Revision total ankle replacement to a hind-foot fusion with a nail; the experience from leeds

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We present a series of 23 total ankle replacements revised for balloon osteolysis and aseptic loosening with a hind-foot fusion nail without the use of bone graft. This is the largest series of total ankle replacements revised to a hindfoot fusion with a nail presented in the literature.
Initial assessment involved investigations to rule out infection and a CT scan of the ankle to assess the size of cysts. Patients underwent surgery in a single stage procedure. The surgery involved excision of the fibula and preparation of the sub-talar joint through a lateral incision; removal of the implant and preparation of the talar

and tibial surface with flat cuts through an anterior incision and safe excision of the medial malleolus aided by a medial incision. The prepared surfaces were then compressed and fixed using a Biomet Phoenix Nail. Patients were then followed up to assess for clinical and radiographic union.
This study involved 18 male and 4 female patients with an average age of 67. All patients had AES ankle replacements (Biomet) in-situ, undergoing revision surgery for aseptic loosening with balloon osteolysis. At a mean follow up of 13.9 months, 96% (22/23) of ankles achieved osseous union across the tibio-talar joint with 1 patient achieving a partial union. 91% (21/23) of patients achieved union across the subtalar joint with 2 patients identified as having a non-union.
1 patient with a subtalar non-union suffered a broken nail and required revision surgery. The only other identifiable complication was a single patient sustained a stress fracture at the proximal tip of the nail, which was treated conservatively.
We believe this method is a reliable and reproducible method of achieving osseous union following a failed total ankle replacement without using graft. Although patients may have a leg length discrepancy, none have requested leg lengthening.

Free Papers
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FP20
Platelet rich plasma versus corticosteroid injection for plantar fasciitis: a comparative study

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Background: We compared platelet rich plasma (PRP) injection to cortisone (40mg triamcinolone) injection in the treatment of chronic plantar fasciitis resistant to traditional nonoperative management. The aims were to compare early and long term efficacy of PRP to that of Steroid (3, 6 and 12 months after injection).
Methods: 60 heels with intractable plantar fasciitis with failed conservative treatment were randomized to either PRP or Steroid injection. All patients were assessed with Roles-Maudsley (RM) Score, Visual Analogue Score (VAS) for pain and the American Orthopaedic Foot and Ankle Society (AOFAS) score. Data was collected prospectively on the cohort, pre-treatment, at 3, 6 and 12 months post injection. The mean scores of the two groups were compared using Student t test.
Results: Pre-injection, the two groups were well matched with no statistically significant difference in the values. At 3 months, all three outcome scores in both groups had significantly improved from their pretreatment level with no significant difference between the groups (PRP: RM 3.7 to 2.0, VAS 8.3 to 3.5, AOFAS 58 to 84; Steroid: RM 3.6 to 1.9, VAS 8.3 to 2.8, AOFAS 57 to 86).
At 6 months, improvement was maintained in both groups with no significant difference between groups (PRP: RM 2.1, VAS 3.7, AOFAS 89; Steroid: RM 2.2, VAS 3.3, and AOFAS 84).
At 12 months, all outcome measures were significantly better for the PRP group as response in the steroid group had deteriorated (PRP: RM 1.9, VAS 3.3 and AOFAS 89; Steroid: RM 2.6, VAS 5.1 and AOFAS 77: p = 0.008, 0.02 and 0.002 respectively).
Conclusions: PRP is better for the treatment of chronic plantar fasciitis as compared to steroid. It shows no statistical difference in effectiveness early on, but unlike steroid, its effectiveness does not wear off with time, making it more durable.

FP21
Malignant bone tumours of the foot: a 30 year experience

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Introduction: Bone tumours of the foot are rare, representing 3-6% of all bone tumours. Of these 15-25% are thought to be malignant. Obtaining clear surgical margins remains an important factor in improving outcome from tumours. However, the anatomical complexity of the foot can lead to an inadequate resection, particularly if the operating surgeon is attempting to preserve function. The aim of this paper is to identify the clinical course of patients suffering from malignant bone tumours of the foot.
Method: A prospective tumour registry over a 30 yr period was used to identify patients with a malignant bone tumour of the foot. Patient demographics along with the site of primary malignancy, region of the foot involved and clinical management were recorded.
Results: 70 patients with a malignant foot tumour were identified. 25(35%) were chondrosarcomas, 20 Ewings Sarcoma, 10 Osteosarcoma and 15 were metastatic lesions. Of those diagnosed with a primary bone tumour, 8(14.5%) were referred following a "whoops" procedure. The median length of symptoms prior to diagnosis was 52 weeks. The most common regions affected were the 1st Ray (31%) and Calcaneus (22%). The mainstay of treatment involved either Ray or Below Knee Amputation in 70% of cases. 11 patients developed either local recurrence or metastatic disease.
Conclusion: We present the largest single centre review of malignant bone tumours affecting the foot. Our series confirms that patients often have to suffer with protracted symptoms prior to the establishment of the

correct diagnosis. The variety of differential diagnoses may explain the long delay in diagnosis. Worryingly, 14.5% of the primary bone malignancies in our series underwent a "whoops" procedure. This highlights further that physicians need to maintain a high index of suspicion when treating a patient with foot symptoms, even when the symptoms may be protracted.

FP22

Gastrocnemius tightness in persons with and without foot and ankle pathology

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This study used the lunge test to measure the difference between ankle dorsiflexion with the knee flexed and extended in persons with and without foot and ankle pathology. This may help us devise a weight bearing test for GT. **Rationale:** There is little credible research comparing GT in people with and without foot and ankle pathology. There is no normative data for ankle dorsiflexion range measured using a Lunge test and prevalence of GT in the normal population.
Methodology: 97 ankles with foot and ankle (FA) pathology and 89 ankles of healthy volunteers (HV) without FA pathology were recruited from the royal national orthopaedic hospital (RNOH). Degrees of ankle dorsiflexion range were measured using an inclinometer and a version of the lunge test with the knee flexed and extended. These findings were then compared between groups.
Results: The difference between FA vs HV for knee flexed: Ankle dorsiflexion with the knee flexed was lower in the FA group (mean=27.56 degrees, SD=8.10) than the HV group (mean=29.95 degrees, SD=6.37) however, the mean difference (2.39 degrees) between the groups was not statistically significant (p=0.30 [CI 2.40-4.54]).
The difference between FA vs HV for knee extended: Ankle dorsiflexion was lower in the FA group (mean=22.02 degrees, SD=8.27) than the HV group (mean = 26.25 degrees, SD=6.04) with the knee extended. The mean difference (4.23 degrees) between the groups was statistically significant (p=< 0.001 [CI 2.11-6.34]); Cohens d=0.58.
The difference in ankle dorsiflexion between knee positions in FA vs HV: The difference in ankle dorsiflexion between knee positions was higher in the FA group (mean=5.62 degrees, SD=4.41) than the HV group (mean=3.62 degrees, SD=3.12). The mean difference (1.996 degrees) between the groups was statistically significant (p=0.001 [CI 0.88-3.11]); Cohens d=0.52.
Conclusion: FA patients have significantly lower ranges of ankle dorsiflexion with the knee extended when compared to controls using the lunge test. The difference in ankle dorsiflexion between knee positions is significantly higher in FA patients when compared to controls; this may be attributable to GT. We aim to continue recruiting healthy controls, patients with FA pathology and patients with other musculoskeletal pathology to show the prevalence of GT in the general population. These findings could improve both conservative and surgical management of GT in associated musculoskeletal pathology.

FP23

Investigating patient reported outcomes and experience for first metatarsal scarf+/- akin osteotomy for hallux-valgus

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Background: Patient reported outcome and experience measures have been a fundamental part of the NHS. We used PROMS2.0, a semi-automated web-based system, which allows collection and analysis of outcome data, to assess the patient reported outcome/experience measures for scarf+/- akin osteotomy for hallux valgus.
Methods: Prospective PROMs/PREMs data was collected. Scores used to asses outcomes included EQ-5D VAS, EQ-5D Health Index, and MOxFQ, collected pre-operatively and post-operatively (Post-op follow-up 6-12months) Patient Personal Experience (PPE-15) was collected postoperatively.
Results: 40 patients (35Female/5Male) (19Left +21Right)**.** Average age- 60.7 years (Range 29-88). No bilateral procedures.
Pre-op average MOXFQ scores for pain, walking and social interaction: 51.6 (range 5-100), 51.4 (range 0-96) and 48.8 (range 0-100) respectively. Post-operatively improved to 24.4 (range 0-100), 22.9 (range 0-86) and 23.1 (range 0-88). Corresponding P values for all < 0.00001 and statistically significant.
32/40 (80%) patients showed improvement in all three domains. Of 8 who worsened- 6 worse with pain, 4 with walking and 5 with social-interaction.
EQ5D improved; pre-op index average- 0.70 and pre-op VAS score average- 79.3. Post-op index average- 0.80. VAS score average- 82.9. Index improvements were significant, P-value < 0.0023 (significant). EQ5D improvements in line with those found in hip/knee replacements. No differences between 6/12m follow-up. Patients stratified according to age-groups for analysis, 11 patients under 54 years old, 15 between 55-64, and 14 over 65. Greatest improvement in over 65s for MOxFQ and under 55s for EQ5D. 27/35 women improved in all MOxFQ domains, whilst 5/5 men did. P-value for age and sex both < 0.05 therefore significant. Age/sex EQ5D showed results of no statistical significance. 65 patients filled post-op PPE questionnaire. Average overall

satisfaction of 72.9%.
Conclusion: The procedure is very effective with high PROMs/PREMs. Older sub-group have best outcomes and highest satisfaction.
Level of evidence: Prospective case series- Level 3

FP24

Mid-term results of a first generation metatarsophalangeal hemiarthroplasty system for the treatment of hallux rigidus

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Background: Hallux rigidus is a degenerative condition of the first metatarsophalangeal joint (MTPJ) of the great toe, which can result in significant pain and stiffness. Treatment using joint replacement, either by means of hemiarthroplasty or total arthroplasty of the metatarsophalangeal joint is becoming an increasingly popular option for patients with severe disease.
Aim: To evaluate mid-term functional and radiological outcomes of a widely used first generation resurfacing arthroplasty system in the treatment of hallux rigidus.
Method: Prospective review of patients from 2009 onwards. All patients were operated on by the senior author using the same first generation hemiarthroplasty prosthesis (HemiCAP®, Arthrosurface, USA) and surgical technique.
Radiological and clinical outcomes were assessed at 3, 6, 12 and 24 months post-operatively. Patients were assessed pre- and post-operatively on an outpatient basis for MTPJ range of motion as well as outcomes using AOFAS and visual analogue scale scores.
Results: 20 prostheses in 19 patients over a two year period. Mean follow-up was 18 months (range 12-24). Mean AOFAS score improved from 38.66 pre-operatively to 74.93 at 12 months post-operatively. Mean VAS score improved from 9.95 pre-operatively to 4.05 post-operatively.
There was radiological subsidence in one patient. 5 patients (26%) required revision to arthrodesis due to ongoing pain and stiffness.
Conclusion: Despite significant improvements in functional scores and positive radiological outcomes in most patients, we have seen high revision rates with this first generation prosthesis due to ongoing pain and stiffness. Since this study, there has been a redesign of this implant with the addition of a dorsal flange, but the first generation prosthesis still remains in use. Following our results, we have discontinued our use of this product in favour of either the newer generation hemiarthroplasty or total arthroplasty system for patients with severe hallux rigidus.

FP25

Metallic hemiarthroplasty for the treatment of end stage hallux rigidus: mid-term implant survival, functional outcome and cost analysis

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We present a review of 97 consecutive BioPro® metallic hemiarthroplasties performed in 80 patients for end-stage hallux rigidus, with a minimum of five years follow-up.
The mean age of the cohort was 55 (22 to 74) years. No patient was lost to follow-up. There were 15 revisions performed, one for infection, two for osteolysis, and 12 for pain. The all cause survival rate at five years was 85.6% (95% confidence interval (CI) 83.5 to 87.9). Younger age was a significant predictor of revision (odds ratio 1.09, 95% CI 1.02 to 1.17, p=0.014) on excluding infection and adjusting for confounding variables (Cox regression). Significant improvements were demonstrated at 5 years in the Manchester Oxford foot questionnaire (13.9, 95% CI 10.5 to 17.2) and in the physical component of the short form 12 score (6.5, 95% CI 4.1 to 8.9). The overall satisfaction rate was 72%. The cost per quality-adjusted-life-year at 5 years, accounting for a 3% per year revision rate, was £3,714.
The BioPro offers good short to mid-term functional outcome and is a cost effective intervention. The relative high revision rate is associated with younger age and the use of this implant may be limited to older patients.
Keywords: BioPro, metallic, hemiarthroplasty, survival, outcome, failure

FP26

Prospective, randomized, multi-centered clinical trial assessing safety and efficacy of a synthetic cartilage implant versus first metatarsophalangeal arthrodesis in advanced hallux rigidus

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Patients with advanced stage hallux rigidus from 12 centers in Canada and the UK were randomized (2:1) to treatment with a small (8/10 mm) hydrogel implant (Cartiva) or 1st MTP arthrodesis. VAS pain scale, validated outcome measures (FAAM sport scale), great toe active dorsiflexion motion, secondary procedures, radiographic assessment and safety parameters were evaluated.
236 patients were initially enrolled, 17 patients withdrew prior to randomization, 17 patients withdrew after randomization and 22 were non-randomized training patients, leaving 152 implant and 50 arthrodesis patients. Standard demographics and baseline outcomes were similar for both groups.
Mean VAS pain scores decreased from 6.8 and 6.9 respectively for the implant and arthrodesis groups from baseline to 1.4 and 0.7 at 24 months. Similarly, the FAAM sports score improved significantly from baseline levels of 37 and 36 to 24 months level of 77 and 82 respectively for the implant and arthrodesis groups. First MTP active dorsiflexion motion improved an average of 4° at 3 months after implant placement and was maintained at 24 months.
Secondary surgeries occurred in 17 (11.2%) implant patients and 6 (12.0%) arthrodesis patients. Fourteen (9.2%) implants were removed and converted to arthrodesis and 6 (12.0%) arthrodesis patients had painful hardware requiring removal. There was no case of implant fragmentation, wear, or bone loss. Analysis of a single composite endpoint utilizing the three primary study outcomes (pain, function, and safety) showed statistical equivalence between the2groups.
Conclusion: In patients requiring surgery for advanced stage hallux rigidus, treatment with a small synthetic cartilage implant resulted in comparable clinically important pain relief and functional outcomes compared to 1st MTP arthrodesis while preserving and often improving great toe motion. Secondary surgical intervention was similar in the implant and arthrodesis groups. Revision from a small implant plug to arthrodesis can be performed if needed.

FP27

Outcomes following surgical excision of interdigital Morton's neuroma: a prospective study

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Current knowledge regarding outcomes following surgical treatment of Morton's neuroma remains incomplete. This is the first prospective study to report the pre- and post-operative patient reported outcomes and satisfaction scores following excision of interdigital Morton's neuroma.
Over a seven year period, 99 consecutive patients (112 feet) undergoing surgical excision of Morton's neuroma were prospectively studied. 78 patients were female with a mean age at operation of 56 years. Patient recorded outcomes and satisfaction were measured using the Manchester-Oxford Foot Questionnaire (MOXFQ), Short Form-12 (SF12) and a supplementary patient satisfaction survey three months pre and six months post-operatively.
Statistically significant differences were found between the mean pre- and post-operative MOXFQ and physical component of the SF-12 ($p < 0.05$). No difference in outcome was identified in patients in whom multiple neuromas were operated compared to single site surgery. However, revision surgery proved to statistically worsen MOXFQ outcomes post-operatively $p < 0.004$. Overall satisfaction was reported as excellent (49%) or good (29%) by the majority of patients but 10% were dissatisfied with poor (8%) or very poor (2%) results expressed. Only 64% were pain free at the time of follow-up and 8% of patients MOXFQ scores worsened.
These findings illustrate that overall, patient reported outcomes following resection of symptomatic Morton's neuroma are acceptable but may not be as favourable as earlier studies suggest. Caution should be taken when considering revision surgery which has shown to be a poor prognostic indicator. Contrary to current knowledge, multiple site surgery can be safely undertaken.

FP28

Plantar plate reconstruction of the metatarsophalangeal joint using the EDL tendon

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Introduction: The attachment of the plantar aponeurosis to the proximal phalanx of the toe, through the plantar plate (PP), forms the main flexor of the toe during gait by the reversed windlass mechanism. Disruption of the plantar plate is a common cause of pain, instability and toe deformity. Surgical techniques have recently been described to repair tears but long term results are awaited. This study aims to review the results of a technique designed to reconstruct and reinforce the failed plantar plate and restore the reversed windlass.
Methods: Through a dorsal extra-articular approach the EDL tendon of the affected toe is used to restore the mechanical link between the proximal phalanx and the plantar aponeurosis on the plantar aspect of the joint. 42 PP reconstructions in 39 patients (36 female) aged 44-72 were undertaken, most frequently on the 2nd toe. 25 required correction of hallux valgus and four had undergone this previously. Follow up was 2-81 months.
Results: Normal alignment and joint stability was obtained in 33 toes (81%). These patients reported no pain and were completely satisfied with the final result.
Recurrence of the deformity with an unstable joint occurred in 8 toes, requiring revision surgery. Failure was more likely with pre-operative dislocation, lateral subluxation, or multiple toe involvement. Minor complications occurred in 5 patients.
Conclusions: Repair or reconstruction of the plantar plate for lesser claw toe deformity is a logical option for correcting the deformity, and restoring toe function and the reversed windlass mechanism. The extra-articular approach may reduce the risk of joint stiffness, avoid scarring of the plantar tissues, and avoid toe elevation associated with metatarsal shortening. This approach is designed to reinforce the weakened plantar plate and may be a satisfactory alternative and more durable technique than direct plantar plate repair.

FP29

The use of the Smart Toe implant for proximal interphalangeal arthrodesis in the lesser toe: a case series

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Introduction: Lesser toe proximal interphalangeal joint arthrodesis is a common forefoot procedure for correction of claw toe deformities. The most common method of fixation is with k-wires. Although this is a very cost-effective method of fixation, well-known disadvantages include pin site infection, non union, wire migration and the inconvenience to the patients of percutaneous wires for up to six weeks. For these reasons, intramedullary devices for joint fixation without crossing the distal IP joint have been developed. Many different designs are currently available. The Smart Toe prosthesis which has appeared as a type I and II, is one such implant. In two recent studies using type I, the use of this implant is advocated. We wish to present our experience with the use of the Smart Toe II.
Methods: In this retrospective study we present a radiological review of 46 consecutive cases in 25 patients who underwent lesser toe interphalangeal arthrodeses using the Smart Toe II implant between July 2010 and November 2014 by the senior author. There were 7 (28%) male and 18 (72%) female patients. Post operative radiographs, taken at a mean follow up of 6 months, were reviewed for non-union, migration and implant failure.
Results: There were 9 (20%) implant fractures, 10 (22%) radiological non- unions and 5 (11%) implant migrations. 4 toes (9%) were sufficiently symptomatic to require revision.
Conclusion: In contrast to two previous studies, our series showed a high rate of implant fracture and non-union, sometimes leading to the need for revision surgery. We recommend caution in use of the Smart Toe II and welcome further reports of results. If our experience is replicated, we suggest the device's use is withheld pending appropriate studies to identify and address the reasons for implant failure, especially if more of the radiological failures come to require revision.