

FP1

Outcomes of spring ligament reconstruction for idiopathic flexible flatfoot deformity

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Introduction: Traditional treatment of idiopathic flatfoot in the adult population include calcaneal neck lengthening or fusions. These surgical methods result in abnormal function with significant complication rates. Our prospective study aimed to quantify the functional and radiological outcome of a new technique for spring ligament reconstruction using a hamstring graft, calcaneal osteotomy and medial head of gastrocnemius recession if appropriate.

Methods: 22 feet were identified from the senior authors flatfoot reconstructions over a 3 year period (Jan 2013 to Dec 2015). 9 feet underwent a spring ligament reconstruction . The control group were 13 feet treated with standard tibialis posterior reconstruction surgery. Follow up ranged from 8 to 49 months. Functional assessment comprised VAS health and pain scales, EQ-5D and MOXFQ scores. Radiographic analysis was performed for standardised parameters.

Results: Each group contained two bilateral procedures. The spring ligament patients had a mean age of 43, BMI of 29 and a male to female ratio of 4;1 There were no statistical differences between groups starting point functional scores or pre-operative radiological deformity. Post-operatively there was a statistically significant improvement of all domains and overall MOXFQ, EQ5d and VAS in the spring ligament patients. There was a statistically significant improvement in all radiological parameters with all patients being returned to normal. Functional scores were not significantly better than the control group [MOXFQ components, Control vs spring ligament group, Pain: 42 vs 45 (p=0.71), Walking: 50 vs 56 (p=0.43), Social: 35 vs 39 (p=0.72), EQ-5D: 0.64 vs 0.70 (p=0.72)]. Spring ligament reconstruction produced statistically better deformity correction for 4 of 5 measured radiological parameters (p< 0.05).

Conclusion: Our new method of spring ligament reconstruction restores normal anatomy. In comparison to traditional procedures our method provides equivalent functional results and improved deformity correction.

FP2

Foot and ankle injections - are they worth it?

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Introduction: Injections are used to treat a wide variety of pathologies. Our aim was to evaluate the efficacy and safety of foot and ankle injections in our clinic.

Materials and methods: We performed a retrospective review of notes and a telephone questionnaire audit into the clinical outcome of all patients who underwent an injection of the foot or ankle in a year. All procedures were performed in an out-patient setting by a consultant musculoskeletal radiologist using either ultrasound or X-ray guidance, with a minimum of two year follow-up. According to the pathology treated, the type of injection included depomedrone, hyaluronic acid and high volume saline injections.

Results: Overall 410/446 (92%) patients reported a significant improvement in symptoms and 227 (62%) reported complete resolution of their pain, with 127 (28%) remaining asymptomatic at two year follow-up. The mode time of recurrence of pain was three months. 59 (13%) underwent a further injection and 102 (23%) underwent operative intervention within the follow-up period. There were no reported infections. Complications occurred in two percent of patients, including steroid flare, pain and plantar plate ruptures.

Conclusion: Injections are a safe and effective option for treating a variety of foot and ankle conditions and reduce the need for surgery. They are particularly effective for the treatment of ankle soft tissue impingement. They appear ineffective in providing significant improvement in pain for longer than three months in conditions such as plantar fasciitis and hallux rigidus.

FP3

The indications and management of Müller Weiss disease with valgus calcaneus osteotomy

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Müller Weiss disease (MWD) is characterized by lateral navicular necrosis which is associated with a varus alignment of the subtalar joint, varying degrees of arthritis of the talonavicular-cuneiform joints and a

paradoxical flatfoot deformity in advanced cases. Although arthrodesis of the hindfoot is commonly used, we present the results of a previously unreported method of treatment using a calcaneus osteotomy incorporating a wedge and lateral translation.

Fourteen patients with MWD who were treated with a calcaneus osteotomy were retrospectively reviewed. There were seven females and seven males with an average age of 56 years (range 33-79), and included one grade 5, five grade 4, four grade 3 and four grade 2 patients. Patients had been symptomatic for an average of eleven years (range 1-14), and all underwent initial conservative treatment with an orthotic support that posted the heel into valgus. The primary indication for surgery was a limited but positive response to the use of the orthotic support, and a desire to avoid an arthrodesis of the hindfoot.

Results: Patients were followed for an average of three years following the procedure (range 1 - 7 years). Patients rated their pain on a visual analogue pain scale as an average of 8 (range 6-9) prior to surgery and an average of 2 postoperatively (range 0-4). The AOFAS scores improved from a mean of 29 (range 25 - 35) preoperatively to a mean of 79 (range 75-88) postoperatively. Hindfoot range of motion remained and the extent of arthritis of the navicular complex was unchanged. No patient has since required an arthrodesis. Since the majority of MWD patients respond to an orthotic support which changes the load of the hindfoot and forefoot, we believed that patients would respond positively to a calcaneal osteotomy as an alternative treatment.

FP4

Functional outcomes and sporting ability after cheilectomy and first metatarsophalangeal joint arthrodesis for hallux rigidus: a comparative study

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Background: Cheilectomy and arthrodesis are accepted procedures for symptomatic hallux rigidus. Although good functional outcomes have been reported, there is little data available on post-operative sporting ability for these patients.

Aims: We investigated sporting ability and functional outcomes of two cohorts of patients, the first underwent dorsal cheilectomy and the second arthrodesis.

Methods: Physical and sporting ability was assessed using the Foot & Ankle Ability Measure (FAAM) sports questionnaire. Functional outcomes were assessed using MOXFQ. Radiological assessment was done according to Hattrup and Johnson classification. (HJ)

Results: Group A (cheilectomy) consisted of 38 feet (35 patients) with a mean age of 57.2 (31-84) and mean follow-up 21.4 months (6-43). 21.6% were HJ1, 43.2% HJ2 and 35.1% HJ3. Group B (arthrodesis) consisted of 49 feet (47 patients) with a mean age of 64.1 (41-81) and mean follow-up 18.5 months (5-41). 6.8% were HJ1, 40.9% HJ2 and 52.3% HJ3.

Mean FAAM score for group A was 78.89% (28.1%-100%). Mean FAAM score for group B was 81.55% (28.1%-100%). Mean MOXFQ score for group A was 14.89/64 (0-41). Mean MOXFQ score for group B was 10.43/64 (0-50). Pain, walking/standing and social domains were 29.74 (0-70), 21.8 (0-96.4) and 17.76 (0-68.8) in group A respectively. In group B, it was 14.79 (0-75), 16.54 (0-78.6), and 17.76 (0-100) respectively. FAAM was higher for group B in comparison to group A, but not statistically significant (P=0.425). Mean MOXFQ score was better in group B compared to group A (P< 0.05). Pain domain in particular was better in group B (P< 0.05).

Conclusion: Our results suggest that both cheilectomy and arthrodesis for hallux rigidus result in similar post-operative sporting ability. Arthrodesis is superior to cheilectomy in overall functional outcomes, particularly in the pain domain.

FP5

Mid-term implant survival, clinical and patient reported outcomes following silastic arthroplasty for the treatment of end stage Hallux rigidus

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Aim: To examine the mid-term survival, clinical and patient reported outcomes of the silastic 1st metatarsophalangeal joint replacement for the treatment of end stage hallux rigidus.

Methods: We reviewed 83 consecutive silastic arthroplasties performed in 79 patients for end stage hallux rigidus. There were 3 men and 76 women; mean age 63 years (range 45-78 years). No patient was lost to follow up. Average follow-up was 5.3 years (1.1-11.3 years). The EQ 5D-5L Health index, Manchester-Oxford Foot Questionnaire (MOXFQ), visual analogue scale (VAS) of pain and overall satisfaction rate (Likert scale) were collected for patient reported outcomes.

Results: 2 patients required revision; 1 for early infection (2 months) and 1 for stem breakage (10 years 1 month). 5 patients reported lateral metatarsalgia, 2 patients reported neuropathic pain, 6 patients developed superficial infection which fully responded to oral antibiotics, and 1 patient developed interphalangeal joint pain. 2 patients died in the cohort. Pre-operative mean MOXFQ was 44, mean EQ5D Index was 0.564 and VAS was

6.97. At mean follow-up of 5.3 years, the mean MOXFQ was 12.7 (0-57), the mean EQ5D Index was 0.851 (-0.02-1) and the mean VAS was 1.67 (0-8). The mean range of motion was 35° (30° dorsiflexion and 5° plantarflexion). The overall satisfaction rate was 90.2%. The implant survival rate was 97.6%.

Conclusions: The silastic big toe arthroplasty offers excellent clinical mid term survival and functional outcomes and could be considered as an attractive alternative to traditional fusion for end stage hallux rigidus.

FP6

Adjuvant antibiotic calcium sulphate bio composites for implant related bone sepsis in foot and ankle - a single stage approach

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Aim: We describe a case series using adjuvant calcium sulphate bio composites with antibiotics in treating infected metalwork in the foot and ankle.

Method: 11 patients aged 22-81 (9 males, 2 females) were treated with clinical evidence of infected limb metal work from previous orthopaedic surgery. Metal work removal with intra osseous application of either cement in 8 cases (10-20ml including 175mg- 350mg gentamycin) or stimulan in 3 cases (5-12ml including 1g vancomycin) into the site was performed. Supplemental systemic antibiotic therapy (oral/intravenous) was instituted based on intraoperative tissue culture and sensitivity.

Results: 7 patients had infected ankle metalwork, 2 had infected foot metalwork and 2 had infected external fixators. Metal work was removed in all cases. Mean pre operative CRP was 25.4 mg/l (range 1-137mg/l). Mean postoperative CRP at 1 week was 15.4mg/l (range 2-36mg/l) and at 1 month was 16.1mg/l (range 2-63mg/l). Mean pre op WCC was 8.5×10^9 (range 6.2-10.6x10⁹). Mean post op WCC at 1 week was 8.8×10^9 (range 5.1-12.7 x10⁹) and 1 month was 7.1×10^9 (range 3.7-10.4 x10⁹). Organisms cultured included enterobacter, staphylococcus species, stenotrophomonas, acinetobacter, group B streptococcus, enterococcus, escherichia coli, pseudomonas, morganelia morganii and finegoldia magna. Infection eradication as a single stage procedure with primary wound closure and healing was achieved in 10 out of 11 cases (90.9 %). No additional procedures were required in these cases.

Conclusions: Our results support the use of a calcium sulphate bio composite with antibiotic as an adjuvant for effective local infection control in cases with implant related bone sepsis. The technique is well tolerated with no systemic or local side effects. Our results show that a single stage implant removal, debridement and local antibiotic delivery can achieve over 90% success rates. We theorise that it could minimise the need for prolonged systemic antibiotic therapy in such cases.

FP7

Correction of ankle and hind foot deformity in Charcot neuroarthropathy using a retrograde hind foot nail

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Introduction: Corrective fusion for the unstable deformed hind foot in Charcot Neuroarthropathy (CN) is quite challenging and is best done in tertiary centres under the supervision of multidisciplinary teams.

Patients and methods: We present our results with a series of 42 hind foot deformity corrections in 40 patients from a tertiary level teaching hospital in the United Kingdom. The mean patient age was 59 (33-82). 16 patients had type1 diabetes mellitus, 20 had type 2 diabetes and 4 were non-diabetic. 18 patients had chronic ulceration. 17 patients were ASA 2 and 23 were ASA grade 3. All patients had acute single stage correction and Trigen hind foot nail fusion performed through a standard technique by the senior author and managed peri-operatively by the multidisciplinary team. Our outcome measures were limb salvage, deformity correction, ulcer healing, weight bearing in surgical shoes and return to activities of daily living (ADL).

Results: At a mean follow up of 37 months (7-79) we achieved 100% limb salvage initially and 97% healing of arthrodesis. One patient with persisting non-union has been offered amputation. Deformity correction was achieved in 100% and ulcer healing in 89%. 72.5% patients are able to mobilize and manage independent ADL. There were 11 patients with one or more complications including metal failure, infection and ulcer reactivation. We performed nine repeat procedures including one revision fusion and one vascular procedure.

Conclusion: Single stage corrective fusion for hind foot deformity in CN is an effective procedure when delivered by a skilled multidisciplinary team.

FP8

Corrective mid foot fusion for Charcot neuroarthropathy - the Kings' experience

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Introduction: The mid foot joints are usually the first to be affected in Charcot neuroarthropathy (CN). Reconstruction is technically demanding and fraught with complications.

Patients and methods: We present our experience of mid foot fusion in CN from a tertiary diabetic foot centre. We undertook mid foot corrective fusion in 27 feet (25 patients). Twelve of these had concurrent hind foot fusion. Eleven patients had type 1 diabetes, 12 had type 2 and 2 were non-diabetics. 23 patients were ASA grade 3 and 2 were ASA 2. 21 feet had ulcers preoperatively and mean HbA1c was 8.2. 13 patients had diabetic retinopathy and 6 had nephropathy.

Results: Average patient age was 59 (43 to 80) and our mean follow up was 35 months (7 to 67). One patient was lost to follow up and 2 patients died. Complete follow up data was available for 26 feet in 24 patients. Satisfactory correction of deformity was achieved in all patients. The mean correction of calcaneal pitch was from 0.6 preoperatively to 10.6 degrees postoperatively, mean Meary angle from 22 to 9 degrees, talo-metatarsal angle on AP view from 33 to 13 degree. Bony union was achieved in 21 out of 26 feet and at least one joint failed to fuse in 5. 19 out of 24 patients were able to mobilize fully or partially weight bearing. We had 6 patients with persisting and 3 with recurrent ulceration. Seven repeat procedures were carried out which included 2 revision fixations.

Conclusion: With our technique and a strict protocol 100% limb salvage and 81% union was achieved. 80% patients were mobile and ulcer healing was achieved in 72%. Corrective mid foot fusion is an effective procedure in these complex cases but require the input of a multidisciplinary team for perioperative care.

FP9

Functional outcomes of conservatively managed acute tendo Achillis ruptures

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Aims: This prospective cohort study aimed to determine if the size of the tendon gap following acute tendo Achillis rupture influences the functional outcome following non-operative treatment.

Patients and methods: All patients presenting with acute unilateral tendo Achillis rupture were considered for the study. Dynamic ultrasound examination was performed to confirm the diagnosis and measure the gap between ruptured tendon ends. Outcome was assessed using dynamometric testing of plantarflexion and the Achilles tendon rupture score (ATRS) six months after the completion of a rehabilitation programme.

Results: 38 patients (mean age 52 years, range 29-78 years) completed the study. Patients with a gap ≥ 10 mm with the ankle in the neutral position had significantly greater peak torque deficit than those with gaps < 10 mm (mean 23.3% vs 14.3%, $P=0.023$). However, there was no overall correlation between gap size and torque deficit ($\tau=0.103$), suggesting a non-linear relationship. There was also weak correlation between ATRS and peak torque deficit ($\tau=-0.305$), with no difference in ATRS between the two groups (mean score 87.2 vs 87.4, $P=0.467$).

Conclusion: This is the first study to identify tendon gap size as a predictor of functional outcome in acute tendo Achillis rupture, although the precise relationship between gap size and plantarflexion strength remains unclear. Large, multi-centre studies will be needed to clarify this relationship and identify population subgroups in whom deficits in peak torque are reflected in patient-reported outcome measures.

FP10

Early protected weight-bearing for acute ruptures of the Achilles tendon: do commonly used orthoses produce the required equinus?

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Introduction: The dichotomy between surgical repair and conservative management of acute Achilles tendon ruptures has been eliminated through appropriate functional management. The orthoses used within functional management however, remains variable. Functional treatment works on the premise that the ankle/hindfoot is positioned in sufficient equinus to allow for early weight-bearing on a 'shortened' Achilles tendon. Our aim in this study was to test if 2 common walking orthoses achieved a satisfactory equinus position of the hindfoot.

Methods: 10 sequentially treated patients with 11 Achilles tendon injuries were assigned either a fixed angle walking boot with wedges (FAWW) or an adjustable external equinus corrected vacuum brace system (EEB). Weight bearing lateral radiographs were obtained in plaster and the orthosis, which were subsequently analysed using a Carestream PACS system. The Mann-Whitney test was used to compare means.

Results: Initial radiographs of all patients in cast immobilization showed a mean tibio-talar angle (TTA) of 55.67° (SD1.21) and a mean 1st metatarsal-tibia angle (1MTA) of 73.83° (SD9.45). There were 6 Achilles tendons treated in the FAWW. Their measurements showed a mean TTA of 27.67° (SD7.71) and 1MTA 37.00

(5.22). 5 tendons were treated using an EEB; there was a statistically significant ($p < .05$) increase in both the TTA 47.6° (SD5.90) and 1MTA 53.67 (SD5.77) compared to the FAWW group.

Discussion: Plantar-flexion at the ankle was significantly greater in the EEB comparative to the FAWW, and very similar to the initial equinus cast. The use of wedges produced an equinus appearance through the midfoot, without producing equinus in the hindfoot as the heel pad rests on the top wedge. We express caution in the use of wedges for Achilles treatment as they do not shorten the Achilles tendon and may result in a lengthened tendon and reduced plantar-flexion power in the long-term.

FP11

A large single centre series assessing the Achillon® suture system for repair of acute midsubstance achilles tendon ruptures

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Introduction: Active patients may benefit from surgical repair of the achilles tendon with the aim of preserving functional length and optimising push-off power. A mini-open device assisted technique has the potential to reduce wound complications, but risks nerve injury. We present the largest published series of midsubstance achilles tendon repairs using the Achillon® device.

Methods: A prospective cohort study was run at the Princess Royal Devon & Exeter Hospital between 2008 and 2015. We included all patients who presented with a midsubstance Achilles tendon rupture within 2 weeks of injury, and device assisted mini-open repair was offered to a young active adult population. All patients in the conservative and surgical treatment pathway had the same functional rehabilitation protocol with a plaster for 2 weeks, and a VACoped boot in reducing equinus for a further 8 weeks.

Results: 354 patients presented with a midsubstance achilles tendon rupture over a 7-year period, of which 204 had conservative treatment and 150 patients had surgical repair with the Achillon device. Patients were assessed clinically for a minimum of 10 weeks, with long-term notes surveillance for late complications. The rerupture rate for conservative treatment was 1.5%, with no reruptures in the Achillon group. Infections in the surgical group were superficial in 2 cases (1.3%) and deep in 3 cases (2%). Pulmonary embolus occurred in 2 Achillon cases (1.3%), and 1 conservatively managed case (0.5%). There was 1 case of temporary sural nerve irritation in each group.

Discussion: Our series show encouraging results for the Achillon® repair with no reruptures and a low complication profile. Functional rehabilitation is likely to have contributed to the low rerupture rate. Studies are emerging that show earlier and improved calf muscle strength in those having surgical repair, suggesting a role for device assisted mini open repair in a selected population.

FP12

Percutaneous repair versus conservative management of Tendo-Achilles rupture. Outcomes following a functional rehabilitation programme

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Background: Patients presenting with an acute tendoachilles (TA) rupture are managed in a dedicated clinic led by a Foot & Ankle Consultant and specialist physiotherapist. The diagnosis is made clinically and no ultrasound scan is performed. All management, rehabilitation and follow-up is undertaken within this clinic by the specialist physiotherapist, with Consultant support as required. Patients are offered a choice of conservative or surgical management (percutaneous TA repair). Both groups undergo a standardised functional rehabilitation regimen.

Methods: All patients treated through our dedicated clinic between May 2010 and April 2016 were identified. Patient outcomes were reported using the validated Achilles Tendon Repair Score (ATRS). ATRS scores were collected at 3, 6 and 12 months post-injury. Re-rupture and complication rates were also documented.

Results: 167 patients were identified. 79 patients underwent a percutaneous repair and 88 patients opted for conservative management.

Mean age of patients undergoing percutaneous repair was 46 years (21-77 years) and 52 years (19-88 years) in the conservatively managed group. Male to female ratios were equal between both groups. Mean ATRS scores at 3, 6 and 12 months were 41.6, 69.5 and 85.3 respectively for the percutaneous repairs and 45.4, 69.0 and 77.1 respectively for the conservatively managed group.

The re-rupture rate was 4.2% (3 patients) in the conservative group and 0% in our surgical group. In the surgical group, 1 patient developed a PE and 1 had a wound complication.

Discussion: Our dedicated clinic for managing TA ruptures has proved popular with patients, with a patient satisfaction score of 98.7%. By standardising our rehabilitation regimen we believe our outcomes have improved. Our percutaneous repair group has an improved ATRS score compared to our conservative group at 12 months post injury. We believe that any fit active individual should be offered a percutaneous repair irrespective of age.

FP13

The influence of gap distance on clinical outcome in acute tendo Achilles rupture treated with accelerated functional rehabilitation

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Aim: To determine the influence of tendo achilles (TA) rupture gap distance and location on clinical outcome managed with accelerated functional rehabilitation.

Methods: Twenty six patients with acute complete TA ruptures underwent ultrasound (US) within a week of injury. Measurements included the distance of the rupture from the enthesis and the gap distance between the tendon edges in three positions -

(1) foot plantigrade,

(2) maximum equinus and

(3) maximum equinus with 90° knee flexion.

All patients were managed non-operatively in functional weightbearing orthoses. Nineteen patients were followed up at a mean of 6.1 years (range 5.8-6.5). Outcomes included ultrasound confirmation of healing, Achilles Tendon Rupture Score (ATRS) and Modified Lepilahti score (MLS).

Results: The mean distance of the rupture from the enthesis was 52mm (range: 40-76mm). The mean gap distance with the foot plantigrade was 11.4mm (95%CI: 9.9, 12.9) which reduced to 4.8mm (95%CI: 3.3, 6.4) in equinus and 1.5mm (95% CI: 0.8, 2.2) with 90° knee flexion. At follow up, no re-ruptures had occurred. US demonstrated continuity in all healed tendons. Mean ATRS was 86 (95%CI: 78.8, 93.9). There was a significant correlation between the distance of the rupture with the MLS ($p = 0.015$) and the ATRS domains of strength ($p = 0.037$) and fatigue ($p = 0.017$). There was no significant correlation between the measured gap distance in the three positions with respect to the MTLs, ATRS or individual ATRS domain scores. There was no significant difference when comparing outcomes between left and right TAs or comparing gaps less than 1cm with those greater than 1 cm.

Discussion: The distance of the gap from the enthesis may be more predictive of mid term clinical outcome in patients with TA rupture managed with accelerated functional rehabilitation compared with the magnitude of the gap and extent of closure with equinus and knee flexion.

FP14

Outcomes of a transtendinous flexor hallucis longus transfer for reconstruction of chronic Achilles tendon ruptures

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Introduction: Patients with neglected rupture of the Achilles tendon typically present with weakness and reduced function rather than pain. Shortening of the musculotendinous unit and atrophy of the muscle belly in chronic rupture potentially leads to poorer recovery following tendon transfer. Few papers have looked at the outcomes of FHL reconstruction specifically in neglected TA rupture. Of those that have none report functional outcomes following a transtendinous repair.

Methods: Twenty patients with irreparable unilateral tendoachilles ruptures treated with transtendinous FHL reconstruction between 2003 and 2011 were reviewed. Achilles Tendon Rupture Score (ATRS), AOFAS hindfoot score, Tegner score and SF12 were recorded. Standard isokinetic assessment of ankle plantarflexion was performed with a Cybex dynamometer. Great toe flexion strength was tested clinically.

Results: The mean age at surgery was 53 years (22-83 years). Mean time from rupture to surgery was 7 months (1-36 months). Follow up ranged from 29-120 months (mean 73 months).

Sixteen patients were completely satisfied and four moderately satisfied. The mean ATRS was 80 (range 25-100) and AOFAS 94 (range 82-100). Postoperative Tegner score showed a reduction by one level from pre-injury (mean 5.1 pre injury to 4.3 post surgery). No cases of re-rupture were encountered. Six patients had wound issues.

The mean maximal strength of ankle plantar flexion on the operated leg 95Nm (41-163) was less than the non-operated leg 123 Nm (50-190Nm). The average difference in strength was 24%.

The operated hallux had only 40% of strength in flexion of the contralateral toe. There were no floating toes.

Conclusion: Transtendinous FHL transfer for late presenting Achilles tendon ruptures provides reliable long term function and reasonable ankle plantar flexion strength. Long FHL harvest has little morbidity and lack of a distal tenodesis did not result in any notable functional loss or alignment issues to the great toe.

FP15

Ankle fractures; getting it right first time

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Introduction: Ankle fractures are common injuries presenting to trauma departments and ankle open reduction and internal fixation (ORIF) is one of the first procedures targeted in early orthopaedic training. Failure to address the fracture pattern with the appropriate surgical technique and hardware may lead to early failure resulting in revision procedures or premature degenerative change. Patients undergoing revision ORIF are known to be at much greater risk of complications, and many of these secondary procedures may be preventable.

Method: A retrospective analysis of all patients attending our unit for ankle ORIF over a two year period was undertaken. Patients were identified from our Bluespier database and a review of X rays was undertaken. All patients undergoing re-operation within eight weeks of the primary procedure were studied. The cause of primary failure was established and potential contributing patient and surgical factors were recorded.

Results: 236 patients undergoing ankle ORIF were identified. 13 patients (5.5%) returned to theatre for a secondary procedure within eight weeks. Within this group, 7 (54%) patients returned for treatment of a neglected or under treated syndesmotic injury, 3 (23%) for complete failure of fixation, 2 (15%) with wound problems and 1 (8%) for medial malleolus mal-reduction. Of the patient group, 5 (38%) were known type 2 diabetics. Consultants performed 2 (15%) of procedures, supervised registrars 5 (39%) and unsupervised registrars 6 (46%) operations.

Conclusion: Errors are being made at all levels of training in applying basic principles such as restoring fibula length and screening the syndesmosis intra-operatively. Appropriate placement and selection of hardware is not always being deployed in osteopenic bone resulting in premature failure of fixation and fracture patterns are not being fully appreciated. Patients are undergoing preventable secondary procedures in the operative treatment of ankle fractures.

FP16

Mid term functional outcomes of reduced and malreduced fractures in two university teaching hospitals

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Introduction: We performed a longitudinal outcome study involving the operative management of ankle fractures at two university teaching hospitals. This was a retrospective review of the quality of reduction and a prospective study into the functional outcome.

Methods: All patients undergoing open reduction internal fixation of the ankle between November 2006 and November 2007 at one centre, and January to December 2009 at the other were included. Adequacy of reduction was assessed on the initial post-operative radiographs using Pettrone's criterion. The post-operative functional outcome was recorded using the Lower Extremity Functional Scale (LEFS), completed by postal or telephone follow-up at 64 months post injury (60-74 months).

Results: There were 261 patients in the cohort, with a mean age of 47 years (17-91). Weber B fractures were sustained in 193 patients compared to 68 Weber C fractures. The medial malleolus was fractured in 43 cases, and a large posterior malleolar fragment (>20%) was found in 13 cases. Malreduction of the Weber B cohort was identified in 61 ankles (31%): Malreduction of the Weber C cohort was identified in 25 cases (37%): At time of follow-up 26 patients were not traceable or had died. Of the surviving 235 patients, 139 responded to the LEFS questionnaire (60%). The mean LEFS was 58 (out of 80) in the Weber B cohort and 61 in the Weber C cohort. Significantly lower LEFS were found in patients who had a malreduction in 2 or more criteria.

Conclusion: Our study shows that there is high incidence of malreduction in the operative treatment of ankle fractures which leads to a significantly poorer functional outcome. We strongly recommend that adequate care and supervision are used in theatre together with post-operative independent review of intra-operative fluoroscopy images.

FP17

Fixation of Haraguchi type 2 posterior malleolar fractures using a two window posteromedial approach

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Introduction: Fixation of posterior malleolar fragments associated with ankle fractures aims to stabilise the syndesmosis and prevent posterior subluxation. Haraguchi described 3 types of posterior malleolar fractures, with type 2 being a medial extension injury, these fractures often involve medial and posterior fragments. We describe the techniques and outcomes for a double window posteromedial approach allowing optimal reduction and stabilisation.

Methods: A retrospective review was performed at 2 units, Bristol Royal Infirmary and QE Hospitals Birmingham, between August 2014 and April 2016. Inclusion criteria were all patients having this posteromedial approach for closed ankle fracture fixation. Patients were assessed for complications and postoperative ankle function with the Olerud and Molander scoring system.

Results: We identified 9 patients treated over an 18 months with average follow up 9 months (range 4-18 months). All had an ankle dislocation reduced on scene or in ED, with 5 having posterior subluxation of the talus on the original films. None were open injuries. All had fixation of a posteromedial malleolar fragment, with 7 requiring a further direct lateral incision. Olerud and Molander ankle function score averaged at 72 (range 60-85) at short term follow up.

Discussion: Approaches to the posteromedial fragments have been previously described in 2 ways. One utilises a window just medial to the Achilles tendon taking the neurovascular bundle medially, while the other approaches between tibialis posterior and FDL taking the neurovascular bundle laterally. Neither delivers complete access to an injury that often has sagittal and coronal splits needing individual reduction and fixation. Our approach over the neurovascular bundle allows 2 safe corridors through a single incision facilitating fragment specific fixation of both the medial and posterior components of the injury. Early results suggest this to be a safe and reliable technique to reduce and stabilise complex posteromedial ankle fractures.

FP18

The use of weight-bearing CT scan in the evaluation of hindfoot alignment

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Background: There have been multiple techniques described to determine hindfoot alignment radiographically. The 2-dimensional nature of radiographs fails to take into account the contribution of the remainder of the foot to overall alignment. A new radiographic technique has been published in which the hindfoot alignment is calculated using the Ground Reaction Force Calcanea Offset. This technique accounts for the individual forefoot contribution to alignment, but is still limited by its 2-dimensional nature. The purpose of this study was to compare the hindfoot moment arm (HMA) described by Saltzman and the hindfoot alignment angle (HAA) described by Williamson, with a technique determining the ground reaction force calcaneal offset (GRF-CT) using 3-dimensional weight bearing CT Scans.

Methods: The HMA, HAA, and GRF-CT 3-D weight bearing CT scans were measured by three different investigators. Each of these measurements were calculated twice on separate occasions by each investigator to determine the intra- and inter-observer reliability.

Results: 104 patients underwent weight bearing hindfoot alignment radiographs and 3-dimensional weight bearing CT scans including 33 patients with varus and 71 patients with valgus hindfoot deformities. There was excellent intra- and inter-observer reliability with all three measurement techniques ($P < 0.01$), however the GRF-CT showed the best intra- and inter-observer reliability with the lowest standard deviation ($P < 0.01$).

Conclusions: The GRF-CT technique is more reliable than traditional radiographic techniques for measuring the hindfoot alignment. While the intra- and inter-observer reliability is good for all three techniques, the GRF-CT technique resulted in the best intra- and inter-observer reliability with the lowest standard deviation. This technique provides the most accurate hindfoot alignment as it takes into account the effect of forefoot on overall alignment, preventing inaccuracies of projection and foot orientation in contrast to traditional radiographic techniques, which may be valuable in surgical decision making.

FP19

The long term outcomes of arthroscopic ankle arthrodesis and the prevalence of adjacent degenerative joint disease

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Introduction: Arthroscopic ankle fusion is an effective treatment for end stage ankle arthritis. It reliably improves pain but at the expense of ankle motion. Development of adjacent degenerative joint disease in the foot is thought to be a consequence of ankle fusion due to altered biomechanics. However, it has been reported to be present on pre-operative radiographs in many patients. There is very little evidence reporting the long-term outcomes of patients undergoing arthroscopic ankle fusion and particularly those requiring secondary procedures for adjacent joint disease.

Material and methods: We reviewed the operative records of 149 patients who had undergone arthroscopic ankle fusion under the care of two consultant foot and ankle surgeons between 2002 and 2006. We contacted patients by telephone to determine whether they had required further investigation or surgery on the same foot after their index procedure. Secondary outcome measures included a Manchester Oxford Foot Questionnaire (MOQFQ) score and a patient satisfaction score.

Results: 149 patients underwent 151 arthroscopic ankle fusions. Nine had died or developed dementia and 30 patients had incomplete hospital records leaving 111 available for follow-up with a response rate of 55% (65

ankles). The average time to follow-up was 12.0 years (9.5-16.6 years). 14 patients (22%) had undergone a secondary procedure including injections on the foot or ankle of the same side as the index procedure. Four of these procedures were arthrodeses and three of these were of the subtalar joint. Mean MOQFQ score was 18.0 (0-55). Overall 83% (54) patients were very satisfied or satisfied with their ankle fusion.

Conclusions: Arthroscopic ankle arthrodesis results in high patient satisfaction rates at long-term follow-up. The number of patients requiring a secondary procedure due to ongoing pain and adjacent degenerative joint disease in their foot following ankle arthrodesis is low.

FP20

Management of a failed total ankle replacement with a revision prosthesis. A multi center study of the indications, surgical challenges and short term outcomes of the Salto XT prosthesis

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Background: Revision total ankle arthroplasty (TAA) can be extremely challenging due to bone loss and deformity. We present the results examining the preliminary indications and short term outcomes for the use of the Salto XT revision prosthesis.

Material and methods: We conducted an IRB approved prospective review revision TAA performed in two institutions using the Salto XT. There were 40 patients (24 females and 16 males with an average age of 65 years (45-83), who had undergone previous TAA (Agility 27, Salto 4, STAR 4, Buechal Pappas 1), and 4 patients who underwent staged procedures for infection. The primary indications for the revision were loosening and subsidence (34), malalignment (17), cyst formation (8), infection (4).

Results: Severe bone loss of the talus (30) and distal tibia (5) caused by erosion or cysts (8) were treated with cancellous bone graft (33), cement (7), or a combination (12). A press fit of the tibial component was obtained in 25 cases, and of the talus in 17. The talar component was seated directly onto the calcaneus in 4 cases supplemented anteriorly by cancellous bone graft. Patients were followed up for an average of 24.2 months (range 12-36 months). The overall complication rate was 25%. An 85% survivorship of the revision TAA was achieved (4 cases of postoperative infection and 2 cases of implant loosening). At the last follow-up visit, the remaining 34 implants were stable and none had loosened nor failed.

Conclusion: Revision ankle replacement with bone loss is a technically challenging procedure with acceptable outcomes for the patient but an 85% survivorship even in the short term. We noted the complexity yet feasibility of performing revision TAA, and determined that the stability of the prosthesis was important. The short term survivorship indicates a likely higher rate of failure in the longer term.

FP21

Management of nonunion following subtalar arthrodesis. An analysis of the methods of revision surgery, and the risk factors in achieving arthrodesis

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Background: Subtalar nonunion has a detrimental effect on patients' function, and pose a significant challenge for surgeons particularly in the setting of higher risk factors.

Methods: We retrospectively analyzed a consecutive series of 49 subtalar nonunions between October 2001 and July 2013. Patient records and radiographs were reviewed for specific patient demographics and comorbidities, subsequent treatments, revision fusion rate, use of bone graft, complications, and clinical outcome.

Results: Forty-nine patients with a mean age of 49 years (range 23-80) were included. Sixteen (32%) were heavy smokers (>1 pack per day) and five (10%) had diabetes. Forty one (84%) of the nonunions were symptomatic and underwent a revision procedure at a mean of 16 months (range 2.8 to 57) from the time of the primary arthrodesis. Four of these patients required a triple arthrodesis at the time of revision. Bone graft was used in all cases, and in 25 cases (61%) additional adjuvant orthobiologics. Thirty-two (78%) of the patients achieved a solid arthrodesis at a mean of 3.4 months (range 1.4 to 7.6). Patients who were diabetic and smokers as a group had a 68% rate of union. Of the nine nonunions following a revision arthrodesis, five were in the setting of a prior ankle arthrodesis, three were complicated by a deep infection, and one had no obvious risk factors. Four of the repeat nonunions elected to not undergo an additional procedure, two had a successful third attempt at arthrodesis, one had an additional nonunion followed by a successful fourth attempt at arthrodesis, one had a successful tibiotalar arthrodesis, and one ultimately required a below-knee amputation.

Discussion: Management of subtalar nonunions pose a significant challenge with a low rate of arthrodesis at 78% fusion rate, but which can be achieved with rigid fixation and utilization of bone graft and orthobiologics.

FP22

Extracorporeal shockwave therapy for refractory heel pain: a prospective study

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Background: Previous studies have individually shown extracorporeal shockwave therapy (ESWT) to be beneficial for mid-substance Achilles tendinopathy, insertional Achilles tendinopathy or plantar fasciitis. The purpose of this pragmatic study was to determine the efficacy of ESWT in managing the three main causes of refractory heel pain in our routine clinical practice.

Methods: 236 patients (261 feet) aged between 25 - 81 years (mean age 50.4) were treated in our NHS institute with ESWT between April 2014 and May 2016. They all underwent a clinical and radiological assessment (ultrasonography +/- magnetic resonance imaging) to determine the primary cause of heel pain. Patients were subsequently categorized into three groups, mid-substance Achilles tendinopathy (55 cases), insertional Achilles tendinopathy (55 cases) or plantar fasciitis (151 cases). If their symptoms were recalcitrant to compliant first line management for 6 months, they were prescribed three consecutive ESWT sessions at weekly intervals. All outcome measures (foot & ankle pain score, EQ-5D) were recorded at baseline and 3-month follow-up (mean 18.3 weeks, range 11.4 to 41).

Results: Complete data sets were obtained for 41% of the ESWT treatments (107/261). EQ-5D scores showed a statistically significant improvement between baseline and follow-up in all three-treatment groups; mid-substance Achilles tendinopathy 0.681 to 0.734, insertional Achilles tendinopathy 0.687 to 0.742 and plantar fasciitis 0.684 to 0.731 ($p < 0.05$). The foot & ankle pain scores grouped for all causes of heel pain also showed a statistically significant reduction from 6.78 at baseline to 5.36 at follow-up ($p < 0.05$).

Conclusion: Overall our results showed that ESWT is an effective tool for the management of all refractory heel pain in an NHS foot & ankle clinical practice.

FP23

Pilot randomised controlled trial of platelet rich plasma versus normal saline for plantar fasciitis

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Platelet rich plasma has been advocated for the treatment of plantar fasciitis but there are few good quality clinical trials to support its use. We report a pilot double blind randomised controlled trial of platelet rich plasma versus normal saline.

Methods: Patients with more than 6 months of MRI proven plantar fasciitis who had failed conservative management were invited to participate in this study. Patients were block randomised to either platelet rich plasma injection (intervention) or equivalent volume of normal saline (control). The techniques used for the injection and rehabilitation were standardised for both groups. The patient and independent assessor were blinded. Visual analogue scale for pain (VAS) and PainDETECT were recorded pre-op and at 6 months.

Results: Twenty-eight patients (19 females, mean age 50 years) were recruited, with 14 randomised to each arm. At 6 month follow-up, 8 patients (28.6%) were lost to follow-up. There was a significant change in VAS score from baseline to follow-up in both intervention (mean change 37.2, $p = 0.008$) and control (mean change 42.2, $p = 0.003$) groups. However there was no difference between the arms in terms of the change in VAS score from baseline to follow-up ($p = 0.183$). There was no correlation between pre-op PainDETECT score and change in VAS.

Conclusion: This pilot study has failed to show a significant benefit of platelet rich plasma compared to saline injection, although both treatments have shown a significant improvement in symptoms. This may be due to the needling effect of injections. A larger study is required to demonstrate a meaningful change. Loss to follow in this patient group should be considered.

FP24

Hallux valgus: the main risk factor for non union in first MTPJ fusion treated with a dorsal plate

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Introduction: We aimed to retrospectively identify risk factors for delayed / non-union for first metatarsophalangeal joint fusion.

Methods: Case notes and radiograph analysis was performed for operations between April 2014 and April 2016 with at least 3 months post-operative follow up. Union was defined as bridging bone across the fusion site on AP and lateral radiographic views with no movement or pain at the MTPJ on examination. If union was not certain, CT scans were performed. All patients operations were performed/supervised by one of three consultant foot surgeons. Surgery was performed through a dorsal approach using the Anchorage compression plate. Blinded pre-operative AP radiographs were analysed for the presence of a severe hallux valgus angle equal or above 40 degrees. Measurement intra-observer reliability was acceptable (95% CI:1.6-2.3 degrees). Smoking and medical conditions associated with non-union underwent univariate analysis for significance.

Results: 73 patients, 9 male, 64 female with a mean age of 61 years (range, 29 to 81) comprised the patient group. Mean follow up time was 13 months for both union vs non-union groups (range 3 to 24 months). 7 patients were identified as non / delayed union (9.6%). All smokers healed (n = 17), age, diabetes, COPD and rheumatoid arthritis did not show significant associations with non-union. Pre-operative hypothyroidism (relative risk 6.9, p = 0.05) and severe hallux valgus (relative risk 9.9, p = 0.002) were significantly associated with non / delayed union.

Conclusion: Although overall bone mineral density is unaffected, studies have demonstrated abnormal bone remodelling in patients with hypothyroidism which may account for this unexpected finding. A dorsally placed locking plate with a dorsal to plantar placed compression screw is at a biomechanical disadvantage to resist lateral force when trying to hold a corrected severe hallux valgus. These patient groups may benefit from supplementary fixation techniques.

FP25

Successful treatment of advanced Freiberg's disease with a dorsal closing wedge osteotomy: 5 year follow up

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Treatment for Freiberg's disease is largely conservative. For severe disease and refractory cases, there are various surgical options. Most studies are from the Far-Eastern population and have short follow-up. The purpose of this study was to report the 5 year clinical outcomes of a dorsal closing wedge osteotomy in the treatment of advanced Freiberg's disease in a Caucasian population.

Twelve patients (12 feet), with a mean age of 30.7 years (range 17-55), were treated with a synovectomy and a dorsal closing wedge osteotomy of the affected distal metatarsal. There were 10 females and 2 males. All patients were born in the United Kingdom. Clinical outcomes were independently evaluated pre and postoperatively using the American Orthopaedic Foot and Ankle Society (AOFAS) scoring system and a subjective satisfaction score. Nine (75%) feet involved the 2nd metatarsal and 3 feet (25%) involved the 3rd metatarsal. According to the Smillie classification, 6 feet were Grade IV and 6 feet were grade V. Radiological union was evaluated postoperatively.

No patients were lost to follow up and the mean follow-up time was 5.2 years (4-7). AOFAS scores improved from 48.1 +/- 7.4 to 88.9 +/- 10.1 postoperatively (p < 0.001) giving a mean improvement of 40.8. 92% of patients were satisfied with their operation at latest follow-up, reporting excellent or good results. All patients had postoperative radiological union. One patient had a superficial postoperative infection that was successfully treated with oral antibiotics.

A dorsal closing wedge osteotomy is an effective treatment of advanced Freiberg's disease in a Caucasian population, with good outcomes and few complications.

FP26

Management of hallux valgus deformity in patients with severe metatarsus adductus. A proposed treatment algorithm

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Introduction: Metatarsus adductus (MA) increases the risk of recurrence following surgery for hallux valgus (HV). The goal of this study was to analyze patients with severe MA and identify clinical/surgical factors that are associated with a lower rate of recurrent deformity.

Methods: 587 patients underwent correction of HV deformity. The rate of recurrence of HV was 15% (63 out of 414 patients) in patients without MA (MA angle < 20°) and 29.6% (50 out of 173 patients) in patients with MA. 19 patients with severe MA (>31°) were identified; 8 of 19 had associated tarsometatarsal arthritis, and two patients had a skew foot deformity. Ten patients had severe valgus lesser toe deformities. Clinical information collected included associated diagnoses, the presence of arthritis of the tarsometatarsal joints, the presence and degree of lesser toe valgus deformities and surgical procedures performed. Radiographic recurrence was defined as a postoperative HVA > 20°.

Results: 9/19 patients were treated with a modified Lapidus procedure and 10 patients underwent a distal first metatarsal osteotomy. Of the 9 patients who were treated with a modified Lapidus procedure, 6 patients underwent simultaneous realignment lesser metatarsal osteotomy or arthrodesis of the 2nd/3rd TMT joints. 1/9

of these patients had radiographic recurrence of deformity. Of the 10 patients who underwent a distal first metatarsal osteotomy without realignment proximal osteotomy or arthrodesis, 5 had recurrence of deformity. Of the 11 patients with severe valgus lesser toe deformity, those who were treated with simultaneous additional distal lesser metatarsal osteotomies, did not have recurrence of hallux valgus.

Conclusion: The use of a modified Lapidus procedure led to a lower rate of HV deformity recurrence in comparison to isolated distal first metatarsal osteotomies. Treatment of lesser toe deformity with distal osteotomy should be included as part of the treatment algorithm.