

## **ABSTRACTS FROM BOFSS MEETING 2008**

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Editorial Secretaries: N. Geary and A.H.N. Robinson

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## **Total Ankle Replacement: a systematic review of the literature.**

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**Introduction:** The use of total ankle arthroplasty for the management of end stage arthritis of the ankle is gaining in popularity. We performed a review of the literature on Total Ankle Arthroplasty to assess the methodology of studies and to detect possible variation in the reported surgical outcomes.

**Material and Methods:** All relevant articles in peer-reviewed journals were retrieved except those not mentioning outcomes, case reports, review of literature and letters to editors. Studies reporting on implants presently used, with at least 20 subjects followed for a mean of at least two years were included. Two authors independently scored the quality of the studies using the Coleman Methodology Score (CMS). We collected data for type of study, patient numbers, length of follow-up, complications, outcome and prosthesis survival with revision or fusion as an endpoint. Where appropriate, pooling of data was performed.

**Results:** Twenty-one level IV studies, published from 2003 to 2008, reporting on 2167 ankle replacements followed for a mean of 5.6 years, were included. The CMS was 65 (SD 15), with substantial agreement between the two examiners. Inflammatory arthropathy was present in 31% of ankles. The intra-operative fracture rate was 10.5%. Superficial wound healing complication rate was 6.4%, and deep infections occurred in 1.2% of ankles. Patients' satisfaction rate was 94%. The failure rate of the primary ankle prosthesis was 11.6% (Agility: 12.2% at 4 years, STAR: 11.7% at 4.6 years and Buechel-Pappas (BP): 12.8% at 7.3 years). Pooling the data the six-year survivorship for the Agility was 0.70 (CI 95%, 0.50-0.90), whereas the 10-year survivorship for the STAR was 0.79 (CI 95%, 0.56-1.00) and for the BP 0.87 (CI 95%, 0.69-1.00).

**Conclusions:** Studies reporting on total ankle arthroplasty are of overall moderate quality. Survivorship analysis revealed superior results for mobile-bearing implants. Patients' satisfaction rate was high.

## **Bone mineral density in the malleoli one year after total ankle replacement: a DEXA scan analysis**

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**Introduction:** There is limited literature looking into the circumstances surrounding the development of stress fractures of the medial and lateral malleoli after ankle replacement. We present the preliminary results of a prospective study examining the effect of total ankle replacement (TAR) upon local bone mineral density (BMD) and the phenomenon of stress shielding.

**Aim:** To assess the effect of TAR loading of the medial and lateral malleoli, by analysing the BMD of the medial and lateral malleoli before and after Mobility TAR.

**Methodology:** Ten consecutive patients undergoing Mobility total ankle replacement for osteoarthritis had pre-operative bone densitometry scans of the ankle, repeated at 6 and 12 months after surgery. The bone mineral density of a 2 cm square area within the medial and lateral malleoli was measured. The pre-operative and post-operative bone densitometry scans were compared. The relation between the alignment of the tibial component and the bone mineral density of the malleoli was also analysed.

**Results:** The mean preoperative BMD within the medial malleolus increased from a mean of  $0.57\text{g/cm}^2$  to  $0.58\text{g/cm}^2$  at six months and  $0.60\text{g/cm}^2$  at 12 months postoperatively. The mean preoperative BMD within the lateral malleolus decreased from  $0.39\text{g/cm}^2$  to  $0.34\text{g/cm}^2$  at six months postoperatively. However the BMD over the lateral malleolus increased to  $0.356\text{g/cm}^2$  at 12 months. The mean alignment of the tibial component was  $88.5^\circ$  varus (range  $85^\circ$  varus to  $94^\circ$  valgus). There was no correlation between the alignment of the tibial component and the bone mineral density on the medial malleolus ( $r = 0.09$ ,  $p = 0.865$ ).

**Conclusion:** The absence of stress shielding around the medial malleolus indicates that ankle replacements implanted within the accepted limits for implant alignment, load the medial malleolus. However, there was stress shielding over the lateral malleolus resulting in decreased BMD in the lateral malleolus.

## **Complications and early prognosis of simultaneous total ankle replacement and bony hindfoot surgery**

D. Hinsley, P. Rice, P. Cooke, R. Sharp

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**Background:** Total ankle replacement (TAR) has become an established surgical procedure for the management of end-stage ankle arthropathy offering an alternative to ankle fusion. Controversy exists over whether to correct concomitant hindfoot arthropathy or malalignment as a separate procedure or simultaneously with TAR. Simultaneous surgery confers the advantage of one operation and recovery period, however, many authors believe complication rates may be higher and long-term function compromised.

**Method:** A retrospective review of all patients, between January 2003 and January 2007, who had undergone simultaneous bony hindfoot or midfoot corrective surgery and TAR, at our institution was performed. A matched group of primary TAR patients were included as controls. Mean follow-up was 38 and 39 months respectively. Data collected included demographics and indications, details of operative procedure, and complications with outcomes assessed by patient satisfaction, range of movement, walking distance and Visual Analogue Score (VAS) for pain.

**Results:** The two groups were matched for age, sex, follow-up, prostheses and diagnosis. The underlying pathology was predominantly osteoarthritis. Mean VAS improved by 7.66 points in the TAR alone group and 8 points in the TAR and adjuvant surgical procedure group. There was no statistical difference in infection, delayed wound healing, malleolar fracture or re-operation rates between the two groups.

**Conclusion:** We believe that an experienced Foot and Ankle surgeon can perform corrective hindfoot or midfoot surgery simultaneously with TAR without significantly compromising outcome.

## **Mobility total ankle replacement - early results**

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Advances in implant design and instrumentation have led to total ankle replacement (TAR) becoming an attractive alternative to ankle fusion in selected cases. We present the short-term results for Mobility TAR with clinical and radiological findings.

**Methods:** Prospective study from Dec 2004 to Dec 2007. Single surgeon, anterior approach to the ankle. Patients assessed clinically, radiologically and with pre and post-operative visual analogue (VAS) and American orthopaedic foot and ankle society (AOFAS) hindfoot score.

**Results:** 34 patients, 36 TAR, 2 bilateral. Male 25, female nine. Mean age 66.9 years, range 43 to 89 years. 26 osteoarthritis, four rheumatoid arthritis, four post-traumatic osteoarthritis. Follow up 6 months to 3.5 yrs, mean 22months. VAS pre-operative mean 8, post-operative mean 1.5. AOFAS score mean pre-operative 30, post-operative mean 85. No deep infections, 3 superficial infections, which settled with antibiotics. No nerve damage. Two medial malleolar fractures. Two lateral malleolar fractures. One talar malposition - one of first six cases, no surgery required outcome not affected. Three unexplained painful TAR. No revisions. 90% patients satisfied and would have operation again

**Conclusion:** Short-term results for TAR are encouraging. Implants and instrumentation are improving and patients are satisfied with the results. There is a steep learning curve of at least six cases. Surgical skill, technique and careful patient selection are paramount in achieving satisfactory results. With patient demands increasing TAR is a realistic alternative to ankle fusion.



## **Total ankle replacement - four to six year follow up of the Ankle Evolution System**

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**Introduction:** We present the results of 35 patients following Ankle Evolution System (AES) total ankle replacements (TAR) with a minimum follow up of four years.

**Methods:** We retrospectively reviewed 39 consecutive total ankle replacements. Two patients died, and two emigrated. Thirty-five patients were available for clinical and radiological assessment. All patients underwent standardised radiographs. Complications and failures were recorded. Patient satisfaction and functional outcome of all patients was determined using the American orthopaedic foot and ankle society (AOFAS) score.

**Results:** All ankles were examined at a mean of 4.7 years postoperatively. The mean age at operation was 64 years. In 18 ankles the indication for the operation was primary osteoarthritis (OA), in 13 ankles post-traumatic OA, in three ankles rheumatoid arthritis and in one ankle psoriatic arthropathy. One patient had revision of the tibial component because of loosening. Sixteen patients recorded their satisfaction as excellent postoperatively, 15 patients as much better, three as better and only one patient recorded that he was worse off. The mean AOFAS score was 88.9 (confidence interval 85.7-92.1). The mean walking distance for our cohort is two miles. Thirteen ankles had radiological osteolysis; in two ankles this was more than 2cms.

**Conclusion:** The medium term results after implantation of the AES ankle prosthesis are encouraging. With the correct indication, a high rate of pain reduction and patient satisfaction can be achieved. The long-term benefit of this procedure has yet to be determined. The rate of osteolysis is of some concern.

## **Total Ankle Replacement - A Survey of Current Practice of Foot & Ankle Surgeons in the United Kingdom**

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**Introduction :** Surgical treatments for ankle arthritis include arthrodesis and total ankle replacement (TAR). Whilst arthrodesis has reasonable midterm results, longer term data has identified concerns, such as progressive arthritis of adjacent joints. There are more than 10 TAR designs available in Europe alone, each with limited published outcomes. In order to understand current practice and perceptions in relation to ankle replacement, a questionnaire based survey was carried out by email and post to all Consultant members of BOFAS based in the UK (n=180).

**Results:** 123 completed questionnaires were returned (68%). Thirty Seven (30%) respondents said they were not currently carrying out joint replacement. There was wide variation amongst surgeons in the types of prosthesis used. A small number of surgeons were responsible for the majority of the volume of TAR surgery carried out in the UK. The median number of ankle replacements carried out per year, by surgeons who are performing ankle replacement was 8 (range 1-55) compared to 13 (range 3-55) for ankle arthrodesis. 97.5% of respondents supported the creation of a national joint register for ankle replacements.

**Conclusion:** This is the first report of the current status quo in the UK with regards the use of total ankle replacement. It is estimated that at least 1281 ankle replacements are carried out per year in the UK. 72% of surgeons that are performing ankle replacements in the UK carry out less than 8 ankle replacements per year. Single surgeon reported series with such small numbers is unlikely to yield meaningful data. An increase in the number of surgeons performing ankle replacements coupled with a rapid proliferation in the number of available implants might lead to early failure and poor outcomes and this would point to the necessity for a National Joint Register for ankle replacements.

## **Tibialis Posterior reconstruction using the Cobb technique with an updated classification**

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**Introduction:** Adult acquired flat foot deformity is recognised as a spectrum of pathology related to tibialis posterior dysfunction (TPD) and plantar ligament insufficiency. Cobb has described a method of reconstruction in pure Johnson and Strom type II TPD using a split Tibialis Anterior musculo-tendinous graft.

**Methods:** We describe a prospective study of 32 patients treated by the Cobb technique and a medial displacement translational os calcis osteotomy for Johnson and Strom type II TPD. There were 28 females and four males (age range 44-66, average 54) each with unilateral disease. The average follow up was 5.1 years, range 3 to 7.2 years. Each patient had failed conservative management and the staging was confirmed clinically and radiologically (ultrasound scanning and MRI). The surgery was performed as described by Cobb but with a bone tunnel in the navicular rather than the medial cuneiform. Postoperative immobilisation in plaster was for eight weeks followed by orthotics and physiotherapy.

**Results:** All the os calcis osteotomies healed uneventfully. 29 of the 32 patients were able to perform a single heel rise test (none prior to surgery) at twelve months follow-up. These patients had grade 5 power of the tibialis posterior tendon. The others had grade 4 power and were also happy with the result. The mean American orthopaedic foot and ankle society (AOFAS) hindfoot score was 82. There was one superficial wound infection successfully treated by antibiotics and a temporary dysaesthesia in the medial plantar nerve in another.

**Discussion:** This prospective study confirms that the Cobb technique is an excellent method of treating pure Johnson and Strom type II TPD after failed conservative management. The procedure is performed with a medial displacement os calcis osteotomy but in selected cases may be combined with spring ligament repair and lateral column lengthening. An updated classification will be presented designed to facilitate the decision making process in this difficult condition.

## **Controlled randomized trial of a popliteal block for pain relief in ankle and hindfoot surgery**

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**Introduction:** We present the results of a controlled randomized trial of the use of a popliteal block for pain relief in ankle and hindfoot surgery.

**Materials and methods:** We studied 47 patients over period of nine months in 2007 to 2008. Patients undergoing an ankle or hindfoot procedure were included in the trial. The trial was explained to the patients. Written information leaflets were also used in the preoperative clinics. Patients were randomized on the day of surgery. A sealed envelope randomizing the patient to block (A), or no block (B) was opened in the anaesthetic room before the patient was anaesthetised. Patients subjective pain scores were recorded at 30 min, 6, 12 and 24 hours after surgery. The amount of analgesia required and time to first dose was documented. One foot and ankle consultant and one trained fellow gave the popliteal blocks. The block was administered in the lateral position at 0.8 mAmp stimulus to detect the nerve. Group A and B data was compared statistically.

**Results:** The average pain scores in group A were reported to be 1.2 at 30min, 1.23 at 6, 2.1 at 12 and 3 at 24 hours. In group B it was 1.2 at 30min, 7.2, 8.1 and 4 at 6, 12 and 24 hours. There was a statistical significant difference in the pain scores at 6 and 12 hours. There was no statistical significant difference in the pain scores at 30 min and 24 hours.

**Conclusion:** Popliteal block gives effective pain relief in ankle and hindfoot surgery. We believe that it may reduce anaesthetic and analgesic drug requirement as well.

## **The variability of joint communications as shown by contrast enhanced injections around the foot and ankle.**

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**Background:** Accurate history and examination is often supported by radiological imaging and diagnostic injection to diagnose joint pathology. In the foot and ankle communications have previously been reported which may reduce the sensitivity of this technique.

**Method:** We analysed the findings of 389 arthrograms of the foot and ankle, identifying any joint communications noted on imaging. A single consultant radiologist using local anaesthetic and contrast performed all injections.

**Results:** Observed results were similar to those previously reported for joint communications, with 13.9% of cases showing a communication between the ankle and subtalar joints (10% reported incidence), and a 42.3% communication rate between the talonavicular and calcaneocuboid joints. We also identified previously unreported communications between the anterior subtalar and naviculocuneiform joints (8%), anterior subtalar and calcaneocuboid joints (9%) and the naviculocuneiform and tarsometatarsal joints (1.1%).

**Conclusion:** This study confirms the presence of multiple joint communications within the foot, and highlights the potential importance of arthrography in the diagnosis of foot and ankle pathology. These communications must be appreciated when considering joint fusion within the foot and ankle, especially where local anaesthetic injection has been used to aid diagnosis.

## **BMP-7 in revision hindfoot arthrodesis.**

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**Introduction:** Non-union following hindfoot arthrodesis remains a significant risk in foot and ankle surgery. In the reported series of revision hindfoot arthrodeses non-union rates range from 9 to 25% with approximately half these patients going on to a transtibial amputation. Bone morphogenetic proteins (BMP) are a group of naturally occurring proteins with strong osteoinductive properties, which have shown promise in the treatment of fracture non-unions and primary hindfoot arthrodesis surgery. This article reports our experiences with rhBMP-7 as an adjunct to revision arthrodesis surgery in this high-risk subset of patients.

**Methods:** Eight patients with at least one previous non-union and two or more risk factors for non-union and one patient on steroids with a failed total ankle replacement were prospectively recruited to the study. A revision arthrodesis procedure with internal fixation was performed according to the senior author's revision protocol with the addition of 3.5mg rhBMP-7 combined with 40mls of bone marrow aspirate. Bone graft was used only if there was structural bone loss. Outcome was assessed clinically and radiologically.

**Results:** Follow-up ranges from 3 to 22 months (average 13 months). Clinically 8 of the 9 patients had a pain free, stable arthrodesis. Seven patients were satisfied with their functional improvement and pain relief. Radiologically two patients have united, six patients have partial unions with ongoing progression towards union and one patient has a painless non-union. There was one wound infection and one malunion. No complications related to rhBMP-7 were experienced.

**Conclusion:** Revision arthrodesis with adjuvant rhBMP-7 has led to limb salvage in this group of high-risk patients. However, rhBMP-7 is not a panacea for achieving union and does not replace meticulous surgical planning and technique. Achieving bony union in this subset of patients remains a high risk and protracted process. No concerns about the short-term safety of rhBMP-7 were raised.

## **Holy cow. Beware of the perils of Tutobone in hindfoot fusion**

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**Introduction:** Tutobone is a solvent-preserved cancellous bovine bone substitute. There is little published about its use in humans. We have been using it as a wedge graft to correct deformity in hindfoot fusion surgery.

**Aim:** To review the outcome following the use of Tutobone in hindfoot fusion and compare it with a control group without Tutobone.

**Method:** We performed a retrospective review of all hindfoot fusion performed by the senior author (AG) from 1 Sep 2004 to 31 Jan 2008. We excluded all revision procedures for non-union or malunion. A CT or MRI scan was performed to assess union and graft incorporation in the Tutobone patients at more than six months postoperatively. In the control group fusion was assessed with plain radiographs. The difference in proportion of fusion with complete fusion by six months post-operatively was assessed with a Fisher's exact test

**Results:** There were eleven patients in the Tutobone group (1 ankle, 7 subtalar and 3 triple fusions) and 35 in the control group (15 ankle, 11 subtalar, 3 pantalar and 6 triple fusions). All Tutobone patients had partial union on CT/MRI scans. The Tutobone graft had not incorporated at a mean time interval of 14 months post surgery. 30 out of 35 control patients had fused by six months and 33 out of 35 controls were fused by 12 months. The rate of complete fusion between the two groups at six months was statistically significant ( $p < 0.0001$ ). Two Tutobone patients developed an inflammatory reaction at more than six months post fusion. This reaction is not infective and appears to be a reaction to the Tutobone.

**Conclusion:** Tutobone should not be used in hindfoot fusion surgery.

## **Operative timing in the management of closed ankle fractures**

S.L.F. Doran, D.T. Loveday, A.H.N. Robinson, N. Rushton.

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The influence of the timing of surgery for closed ankle fractures on complications is unclear. Previous studies have failed to demonstrate any associations with clear statistical support. This is a retrospective review of 221 patients presenting with closed ankle fractures treated with open reduction and internal fixation. The patients were similar in respect to age, gender, fracture type, surgeon grade, American Society of Anaesthesiologists grade, grade of anaesthetist and tourniquet time. Power analysis was performed for sample size. Patients were followed up until fracture union. The mean duration of inpatient care was greater in the delayed group ( $p = 0.0002$ ). There was an increased rate of local ( $p = 0.0451$ ) and total complications ( $p = 0.0116$ ) if surgery was delayed more than 24 hours. This observational study demonstrates that for the management of closed ankle fractures there is an adverse clinical outcome in patients who undergo delayed operative intervention.



## **Operative fixation of unstable ankle fractures in patients over 80 years**

D.G. Shivarathre, P. Chandran, S. Platt

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**Introduction:** Operative fixation of unstable ankle fractures is a well-recognised form of management. However controversy exists in the surgical treatment of unstable ankle fractures in the elderly age group, over 80 years. Operative fixation in these cases is challenging and the postoperative mortality and morbidity has discouraged surgical intervention. The literature regarding the prognosis of surgery in this elderly group is limited. The purpose of this study is to document the results of operative fixation of unstable ankle fractures in patients aged over 80 years of age.

**Methods:** Ninety-two consecutive patients aged above 80 underwent open reduction and internal fixation of unstable ankle fractures during the period of January 1998 to August 2007. Five patients' case records were unavailable for the study and they were therefore excluded. The data was collected retrospectively from the case records and radiographs. The clinical and radiological outcomes following surgery were recorded and analysed in detail. The complications were noted and the risk factors for poor prognosis were analysed

**Results:** The average age was 85.2 (range 80.1 – 95.1 yrs). The minimum duration of follow up was nine months. The superficial wound infection rate was 5.7% (5 cases). The deep infection rate was 4.6% (4 cases), three required surgical debridement. The 30-day postoperative mortality was 4.6 % (4 cases). 88.1 % (74 out of 84 cases) were able to return to their preinjury mobility at the last follow-up. Diabetes and smoking did not statistically influence the outcome of the surgery.

**Conclusion:** The results of operative fixation of unstable ankle fractures in this age group are encouraging with good functional recovery and return to preinjury mobility status in most cases.

## **The cost saving of a discharge and readmit approach to the management of soft tissue swelling in unstable ankle fracture surgery**

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**Introduction:** Surgery to ankle fractures requiring fixation is often delayed due to swelling. Social circumstances and surgeon preference dictate whether these patients are rested in hospital or at home. The aim of this study was to explore the effectiveness of a discharge and readmit policy for surgical fixation of ankle fractures unsuitable for immediate surgery.

**Materials and methods:** The case notes and radiographs of 87 patients' who underwent ankle fracture fixation between January 1st 2007 and December 31st 2007 were reviewed for causes of delayed surgery and details of the admission.

**Results:** The sample comprised 46 male and 41 female patients, average age 43 years (range, 13-80). 43 operations were cancelled within 24 hours of admission. These were considered delayed operations. 31 patients were cancelled due to soft tissue swelling. Lack of operating capacity or awaiting the results of further investigations caused the remaining 12 delays. Twenty-three of the delayed procedures were deemed suitable for discharge and re-admission (safe, previously mobile, not living alone). Seven of these patients were discharged and re-admitted through fracture clinic five to seven days later. The remaining 16 were rested as inpatients. Patients treated with traditional inpatient rest and elevation averaged at total inpatient stay of 13 days (range 8-19 days). Patients discharged for rest and elevation had a significantly ( $p < 0.05$ ) reduced overall inpatient stay of 3.3 days (range, 2-5 days). This approach could have saved our institution an estimated £53,808 (157 inpatient days) for the period January 1st 2007 to December 31st 2007.

**Conclusion:** The re-admission policy for ankle fractures too swollen for early surgery described in this report significantly reduces overall inpatient stay with no identifiable adverse effects. Readmission through outpatient clinics generates administrative costs and as yet un-quantified service pressure which may cause disruption to outpatient services although this approach is undoubtedly a useful practice with careful patient selection.

## **Minimally invasive percutaneous plate osteosynthesis for ankle fracture fixation - a novel surgical technique and early results**

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The timing of surgery in treating closed ankle fractures requiring open reduction and internal fixation is dependent upon soft tissue swelling. At Exeter in 2001 one third of all trauma cases were operated on “out of hours,” in 2007 this was less than 10%, principally as a result of the lack of anaesthetic staff. The senior author has developed a technique of minimally invasive percutaneous plate osteosynthesis for ankle fracture fixation that may be undertaken at an early stage, despite the presence of swelling.

In a retrospective study 25 patients fixed with percutaneous osteosynthesis over four years were compared with a cohort of 25 patients selected at random who had undergone standard open reduction and internal fixation in the same time period. Particular attention was paid to time to surgery, time to discharge and complications. Patients undergoing percutaneous fixation were found from the hospital database. One patient was excluded because of a delay to surgery whilst being treated on the intensive care unit. Admission documentation, operation notes and clinic letters were used to ascertain the outcome. Pre and post-operative imaging was evaluated.

Over a four-year period the senior author performed minimally invasive percutaneous plate osteosynthesis on a total of 25 patients. The mean time to surgery was two days for the percutaneous cohort (range 0-5 days) compared with 4.1 days for the open cohort (range 1-11). Time to discharge was 4.2 days as opposed to 6.2 in the percutaneous group. There were no complications in the percutaneous cohort, as opposed to three in the standard cohort. Preliminary results demonstrate a reduced waiting time for surgery and a quicker discharge when using minimally invasive percutaneous plate osteosynthesis technique for ankle fracture fixation. We believe that our institution is the first to develop this technique. Percutaneous fixation is an option when swelling precludes open surgery.

## **Interventions for treating calcaneal fractures: a Cochrane review**

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**Introduction:** The optimal treatment of intra-articular calcaneal fractures remains controversial.

**Material and Methods:** Electronic databases were searched for randomised trials comparing interventions for treating patients with calcaneal fractures. Two reviewers independently assessed trial quality, using a 12-item scale, and extracted data. Where appropriate results were pooled.

**Results:** Six trials met the inclusion criteria. Two reports reported on the same group of patients at differing follow-up intervals. All six included trials had methodological flaws. Another two trials are ongoing. Four trials (134 patients) compared open reduction and internal fixation (ORIF) with non-operative management. Pooled results showed no difference in residual pain (24/40 versus 24/42; OR 0.90, 95% CI 0.34 to 2.36), but a lower proportion of the operative group was unable to return to the same work (11/45 vs 23/45; OR 0.30, 95% CI 0.13 to 0.71), and was unable to wear the same shoes as before (12/52 vs 24/54; OR 0.37, 95% CI 0.17 to 0.84). One large-scale study showed that the outcomes (SF-36, visual analogue scale (VAS), Bohler's angle) after non-operative treatment were not different to those after ORIF. ORIF gave superior results for return to work, return to normal activities and ability to wear the same shoes. The subtalar fusion rate was reduced after ORIF. Excluding patients receiving Workers' Compensation, the outcomes were significantly better in some groups of surgically treated patients. One trial (23 patients), evaluated impulse compression therapy. At one year there was a mean difference of 1.40 pain VAS units (95% CI 0.02 to 2.82) in favour of the treated group. The impulse compression group had greater subtalar movement at three months, and patients returned to work three months earlier.

**Conclusions:** The relatively poor quality of existing trials means that current evidence is only tentative. It remains unclear whether the possible advantages of surgery are worth its risks.

## **A prospective study of the use of a mini C-arm versus standard fluoroscopy in foot and ankle surgery**

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**Introduction:** The use of mini C-arm systems has become established in hand surgery. Potential advantages of the mini C-arm include decreased radiation exposure by reducing screening time, increased distance from the beam, tighter beam collimation and surgeon control of the C-arm. Little has been written in the literature regarding their use in foot and ankle surgery.

**Aims:** To compare the radiation dose and screening times delivered by the mini C-arm with standard fluoroscopy in elective foot and ankle surgical procedures. A secondary objective was to quantify the cost of both techniques.

**Patients and methods:** We prospectively studied 137 patients who underwent fluoroscopic screening during various elective foot and ankle procedures. Of these 72 were screened using standard fluoroscopy and the remaining 55 using the mini C-arm. During each procedure screening time and radiation dose were prospectively recorded. The Dose Area Product (DAP) meters on both machines for the determination of radiation exposure and scatter to the operating theatre and staff were used. A cost benefit analysis for radiographer attendance and theatre delay was calculated.

**Results:** The mean DAP for standard fluoroscopy was  $7.43 \text{ CGycm}^2$  (sd 9.41) whereas with the mini C-arm it was  $3.46 \text{ CGycm}^2$  (sd 3.51). There was a statistically significant reduction in the DAP ( $P = 0.0013$ ). Mean screening time was 13 seconds (SD 14.7) with standard fluoroscopy and 14.5 seconds (SD 18.1) with the mini C-arm. No statistically significant difference was found between screening times. ( $p = 0.987$ ). The potential total saving of the mini c-arm for 137 procedures was £4086

**Conclusion:** We recommend the use of the mini C-arm in foot and ankle surgery as it reduces radiation exposure and cost when compared to standard fluoroscopy. We acknowledge that there is a learning curve for surgeons to minimise screening time.

## **Comparison of transverse wires and half pins in Taylor spatial frame: a biomechanical study**

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**Introduction:** The Taylor Spatial Frame (TSF<sup>TM</sup>, Smith & Nephew, Memphis) has gained international recognition for the fixation of complex long bone fractures and deformity correction. It's application with transverse wires can be difficult in some anatomic regions, and fixation of frames with half pins is gaining clinical popularity. Half-pins cause minimal transfixion of the surrounding soft tissues and can be inserted into anatomically safe areas.

**Aims:** This study aimed to compare the stiffness characteristics of a TSF frame fixed with transverse wires to fixation with half pins.

**Materials and methods:** Experiments were carried out in the biomechanics laboratory at Cardiff university. All mechanical testing was performed with a servo-hydraulic test frame (MTS-858 Mini Bionix II®, MTS Corp., Minneapolis). Custom built mounts were used to attach the bone rigidly to one end of the machine and TSF ring to the other. Rings were fixed with 1.8mm transverse wires or hydroxyapatite coated 6.5mm half pins with 45°, 60°, 75° and 90° divergence angles. Bone was loaded with axial load to 400N and torque to 20Nm. Load/displacement curve data were analyzed for slope and displacement.

**Results:** For larger diameter rings (180mm) there was no statistically significant difference in axial stiffness between the transverse wires (with 2 rings) and the half pins ( $p > 0.05$ ). For 155mm diameter rings half pins provided statistically higher axial stiffness than transverse wires ( $p = 0.036$ ). Half pins gave significantly more torsional stiffness for both ring diameters when compared to transverse wires ( $p < 0.05$ ). As in axial stiffness, small diameter rings showed increased stiffness in torsion. There was an increase in axial and torsional stiffness as the divergence angle between the wires or pins increased ( $p < 0.05$ ).

**Conclusion and clinical relevance:** Half pins provide greater stiffness to TSF frames and allow axial micromotion as well. This work provides a rationale for clinical decision making in construction of a TSF frame.

## **Physical examination of the foot and ankle by orthopaedic and accident & emergency physicians**

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**Aim:** To test the knowledge of clinicians in orthopaedic clinics and emergency departments of the surface anatomical landmarks, that should be examined during assessment of foot and ankle injuries.

**Methods:** Specifically trained assessors observed 109 clinicians examining 6 anatomical landmarks on uninjured subjects. Each landmark was chosen for its relevance to assessment of foot and ankle injuries. The landmarks were the medial malleolus, lateral malleolus, fibula head, navicular, base of the 5th metatarsal and the anterior talo-fibular ligament (ATFL).

**Results:** 2 participants failed to identify a single landmark. Of 109 assessed, 27% correctly identified all 6 landmarks. The average correctly identified by each clinician was 4.1 (sd: 1.5 and range: 0-6). 107 correctly identified the lateral malleolus, the most consistently identified. The most poorly identified landmark was the ATFL, by 44%.

**Discussion:** The knowledge of surface anatomy of junior orthopaedic and emergency clinicians was found to be poor and only seems to significantly improve once higher specialty training is reached. Despite the potential for subjectivity and bias the authors believe the methodology is sufficient to demonstrate a lack of anatomical knowledge amongst clinicians. Poor anatomical knowledge leads to inaccurate examination. This can lead to incorrect diagnoses or even maltreatment of patients. Clinicians are becoming more reliant on unnecessary and expensive imaging investigations. They have neglected the basic art of physical examination based on sound knowledge of human anatomy. At present, the authors believe that the anatomical teaching in undergraduate medicine is inadequate.

## **Accuracy of MRI scan in the diagnosis of ligamentous and chondral pathology in the ankle**

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The aim of this study was to determine the accuracy of Magnetic Resonance Imaging (MRI) scanning compared to arthroscopic findings in patients presenting with chronic ankle pain and/or instability. We reviewed all patients who underwent arthroscopy of the ankle between December 2005 to July 2008 in our institution.

A total of 105 patients underwent arthroscopy for chronic ankle pain and / or instability.

Twenty-four patients underwent MRI prior to the procedure. We compared the MRI findings with arthroscopic findings. We specifically examined for the anterior talofibular ligament (ATFL), calcaneofibular ligament (CFL) and osteochondral lesions (OCD). Arthroscopic findings were considered as a gold standard. There were 12 female and 12 male patients with an average age 39 years (11-65). The time interval between the MRI scan and arthroscopy was 7 months (2-18). In our study MRI had 100% specificity for the diagnosis of ATFL and CFL tears and osteochondral lesions. However sensitivity was low particularly for CFL tears. The accuracy of MRI in detecting ATFL tear was 91.7%, CFL tear was 87.5% and osteochondral lesion was 83.3%.

We conclude that MRI scanning has a very high specificity and positive predictive value in diagnosing tears of ATFL, CFL and osteochondral lesions. However sensitivity was low with MRI. In a symptomatic patient negative results on MRI must be viewed with caution and an arthroscopy is advisable for a definitive diagnosis and treatment.



## **Localisation of osteochondral lesions of the talar dome**

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**Introduction:** Osteochondral lesions (OCL) of the talar dome are defects of the cartilaginous surface and underlying bone of the superior articular surface of the talus. Their natural history is uncertain, but the association with residual, debilitating ankle pain is strong. Literature describes OCL's as occurring anterolaterally or posteromedially, with associated localising symptoms. Early diagnosis of OCL's may be important in preventing progression. The aim of this study was to investigate the value of clinical findings when compared to MRI scanning.

**Materials and Methods:** Patients with reported OCL's of the talar dome on MRI were asked to indicate the location of their ankle pain. Subsequently they were physically examined to identify the area of maximum tenderness. Direct visual measures were taken of these sites, using modified anthropometry. The patient, examiner and person measuring were blind to the MRI scan. The lesion on MRI was then measured and locations compared for any correlation, distance and association.

**Results:** A series of eighteen OCL's were studied. The strongest correlation was between the subject and the examiner in the axial plane (medial /lateral). The weakest was between MRI and clinical locations in the axial plane. Overall, the greatest difference between locations was between clinical examination and MRI. Euclidean distances showed that clinical predictions of lesion site were only reliable to within approximately 5cm.

**Discussion and conclusion:** Although there was a correlation between some locations, measure reliability negated this as the distances between sites represented the maximal distances within the ankle joint. We suggest that OCL of the talar dome result in pain that is poorly localised with respect to the site of the lesion. Suspicion of OCL must remain high in cases of un-resolving ankle pain, irrespective of specific clinical findings and early evaluation with the use of MRI scanning is justified.

## **The relation of ball release speed to the biomechanics of the ankle in the cricket fast bowler**

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**Introduction:** Ankle injuries in cricketers are of topical interest with a number of elite fast bowlers sustaining injuries. Previous research has concentrated on the injury risk to the bowler's vertebrae with no research focused on the ankle of the fast bowler and exploring the biomechanical basis for its predisposition to injury.

**Materials and methods:** Ten elite level cricket fast bowlers had their ankle biomechanics assessed during their bowling action. Using a nine-camera infra-red Vicon<sup>TM</sup> 612 motion analysis system linked to a Kistler<sup>TM</sup> 9281CA force platform the moments of the subjects leading leg ankle during their delivery stride was calculated and analysed. Each subject performed ten trials at their maximum ball release speed (>97km/hr) and ten trials at less than their maximum ball release speed (<97km/hr) with the velocity of the ball tracked by a SR3600 radar gun.

**Results:** All six joint moments of the ankle were examined in both directions of all three orthogonal planes. Of these results only the difference in the ankle plantar flexion was found to be pertinent. The average ankle plantar flexion peak moment in the maximal ball release speed group was 2.008Nm/kg and in the sub-maximal ball release speed group 1.790Nm/kg. This difference was analysed using the paired Student t-test and was statistically significant ( $p < 0.02$ ).

**Discussion:** This study shows the ankle plays a significant part in the fast bowler's delivery action and suggests a biomechanical reason for ankle injuries in these individuals. It is recommended that in fast bowlers with ankle injuries a graduated return to maximal speed bowling is utilised in rehabilitation to prevent further injury and long term morbidity.

**Conclusion:** The increased ankle plantar moment reflects the important role the ankle plays in the generation of extra ball release speed in the cricket fast bowler.

## **Functional early weight bearing rehabilitation of Achilles tendon rupture. The influence of re-rupture rates and outcome scores**

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**Introduction:** Current evidence for treatment of Achilles tendon rupture suggests that open surgical repair reduces the re-rupture rate compared to conservative treatment, but with a higher risk of infection. Modern non-surgical treatment and surgical aftercare involves early weight-bearing in functional orthoses. It is therefore appropriate to measure the re-rupture rates and outcomes in patients treated in this manner.

**Materials and methods:** Between 2002 and 2008 our unit prospectively collected data on 80 patients treated with a below-knee functional orthoses for complete Achilles tendon rupture. Patients made their own choice of treatment following evidence-based counselling. The patients were treated either surgically or conservatively and entered the appropriate arm of the standard orthotic and early weight-bearing treatment protocol. Patients were contacted by telephone or post for follow-up and completed a VISA-A and Achilles Total Rupture Score (ATRS) questionnaire.

**Results:** There were 61 Males, 19 Females with an age range of 24–80 (median 42). The median time in the functional brace was eight weeks. 51 patients were treated conservatively and 29 patients surgically. The conservative group were a decade older (median age 47y, range 27-80) than the surgical group (median age 37y, range 24-55y). In the non-operative treatment group the re-rupture rate was 3.9% (2/51, 95% confidence interval 0.5-13.5%). In the surgical group it was 3.4% (1/29, 95% confidence interval 0-17.8%), in this group the wound infection rate was 6.8% (2/29, 95% confidence interval 0.9-22.8%) with no nerve injuries reported. The median ATRS was 82 in the conservative group and 95 in the surgical group. The median VISA-A scores were 57 and 92 respectively.

**Discussion:** Our case series shows comparable low re-rupture rates in both groups. Functional scores, using the newly validated ATRS score, were lower in the non-surgical, older group.

**Conclusion:** Functional care after surgical and non-surgical treatment of Achilles rupture produces similar re-rupture rates.

## **Apoptosis - the cause of Achilles tendinosis?**

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**Introduction:** The pathogenesis of chronic tendinopathy is unclear. A role for increased apoptosis of tenocytes has been suggested. Nitric oxide is thought to be a mediator of apoptosis and nitric oxide synthase (NOS) isoforms have been shown to be up regulated in rotator cuff tendons as a result of chronic overuse. We found, the same up regulation of NOS in the Achilles tendon in non-insertional Achilles tendinopathy in a previous study. The purpose of this study was to investigate whether apoptotic cells were present in these tissues with raised endothelial nitric oxide synthase (eNOS) and inducible nitric oxide synthase (iNOS) levels.

**Methods:** Consent was obtained preoperatively from all patients and the research and

ethics committee granted ethical approval. Samples were obtained from the Achilles Tendons of patients with non-insertional Achilles tendinopathy who had failed conservative treatment for at least six months and were undergoing a surgical procedure. Several biopsies were taken of the visibly abnormal tendon tissue. Control samples were taken from macroscopically normal tendon correlating with areas of normal tissue on MRI. Standard immunohistochemical techniques were used to identify the expression of eNOS and iNOS. Apoptotic cells were identified using terminal deoxynucleotidyl transferase-mediated dUTP nick end labelling (TUNEL reaction) with TdT-FragEL and the demonstration of Caspase-3 activation.

**Results:** Significant differences were found between the diseased tendon and the controls for all of the parameters measured. The mean Caspase-3 cell count for diseased tendon was 51.9 compared to 28.3 for the controls ( $p=0.000001$ ). The mean TUNEL cell count for diseased tendon was 24.1 compared to 14.8 ( $p=0.00014$ ). iNOS densitometry revealed a mean of 26.1 for the diseased tissue versus 15.0 for the controls ( $p=0.000009$ ) and the values for eNOS were 48.3 and 23.7 respectively ( $p=0.015$ ).

**Conclusions:** Apoptosis clearly plays a role in the development of non-insertional Achilles tendinopathy and appears to be related to the presence of raised eNOS and iNOS levels. It is possible that, by blocking the apoptotic pathway, the tendinopathic process could be halted. This may lead to the development of treatments strategies for early Achilles tendinopathy.

## **Results of a survey of the use of sciatic nerve blocks amongst foot and ankle surgeons in North America and the UK**

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**Introduction:** Sciatic nerve blocks have been used to reduce post-operative analgesia and allow early discharge for patients undergoing foot and ankle surgery. This study aims to identify utilisation of this procedure and to ascertain if there is a consensus amongst surgeons as to best practise with regards to who performs the block and how it is performed.

**Method:** We surveyed current committee members of the American and members of the British orthopaedic foot and ankle surgery societies (AOFAS and BOFAS).

**Results:** More than half of those who responded perform over 90% foot and ankle surgery. 77% performed sciatic nerve blockade through the popliteal approach (26% used the subgluteal approach). The most common position was supine with 80% being performed by the anaesthetist. 45% never used ultrasonography to detect the position of the nerve and variable levels of nerve stimulation were used. 30% used an infusion catheter with 20% allowing discharge to home with the catheter. 42% of surgeons were happy to have the block performed under full anaesthesia. The commonest complication cited was prolonged anaesthesia, the majority of which resolved. Performing the block awake or sedated did not seem to alter the number of complications seen.

**Discussion:** This study represents a current practice review of sciatic nerve blocks performed in foot and ankle surgery and shows a variety of techniques used. Although this is now a widely used block, no consensus has been reached as to the use of ultrasound, level of nerve stimulation or whether the patient needs to be awake for the procedure. The use of infusion catheters (especially after discharge) has not been widely utilised, especially amongst UK surgeons.

## **Toe miscommunication: a risk for wrong site surgery**

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**Introduction:** Among the pantheon of medical errors, wrong site surgery (WSS) is thankfully rare. However, the results can be devastating particularly if amputation is the proposed surgery. WSS can occur due to simple mistakes in communication between patient and surgeon. This project looks at one particular cause of such miscommunication: toe identification.

**Method:** 100 consecutive patients were asked to label their toes. The first 50 were asked to label their left foot, the subsequent 50 their right. Patients were not asked to number or name their toes as it was felt that this could bias their answers. Instead the patients were asked to imagine a hypothetical situation in which they had pain in their toes. They were asked to explain which toe was painful, as if over the phone so that they were unable to point and thus had to label their toes. No prompting was given.

**Results:** Disagreement between patient and professional terminology was stark. Overall, 3% of patients incorrectly labelled the little toe and a staggering 26% mislabelled the ring toe. 10% gave a contrary label to the middle toe while 17% mislabelled the index toe. The great toe caused least problems with only 2% of patients incorrectly labelling it. Patients who numbered their toes were much more likely to mislabel them than those who named them.

**Conclusions:** There is a huge discrepancy between the terms used by doctors and patients to label toes, increasing the chances of miscommunication and WSS. This study highlights the need for unified terminology amongst the orthopaedic profession. We suggest using the terms great, index, middle, ring and little toes. Numbering the toes should be avoided, as numbers are used in wildly contradictory ways by doctors and patients.

## **Quantitative analysis of bacteria in forefoot surgery: a comparison of skin preparation techniques**

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**Aim:** To assess the effectiveness of povidone-iodine alcoholic tincture and the alcoholic chlorhexidine gluconate solution in the eradication of bacteria in forefoot surgery, and to assess any added benefits with the use of surgical bristles.

**Methods:** Fifty consecutive patients were prospectively enrolled into the study and randomised to receive one of two surgical skin preparations.

**Results:** The use of povidone-iodine with prior surgical scrubbing had a better eradication rate compared to povidone-iodine alone in the interdigital web-spaces. Prior surgical scrubbing with both solutions had a better eradication rate for the skin over the 1<sup>st</sup> metatarso-phalangeal joints. But neither solution with or without the use of surgical scrubbing was superior at eradicating organisms from the medial hallucal fold. However none of these results were statistically significant. None of the patients developed any post-operative wound infection.

**Conclusions:** Our results did not show any statistically significant advantage with either solution nor was there any apparent advantage with the use of the surgical scrub prior to the skin preparation. The authors believe that eradication of bacteria in forefoot surgery is dependant on a meticulous and methodical skin preparation technique and less so on the solution used and method of application.

## **Proximal release of the Gastrocnemius - surgical anatomy**

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**Introduction:** The importance of isolated gastrocnemius contracture in disorders of the foot and ankle has been established in recent years. The aim of this study is to describe the proximal anatomical approach to the medial and lateral heads of gastrocnemius and to compare the sizes of the medial and lateral heads of the gastrocnemius.

**Method:** 15 cadaveric knees were dissected using a posterior approach 1cm below the level of the skin crease. Proximity of cutaneous nerves and major vessels was noted. The heads of the gastrocnemius were dissected from their origin and the cross sectional anatomy was defined.

**Results:** Approach to the medial head of gastrocnemius is safe. Conversely the variable anatomy of the nerves in the approach to the lateral head means that extreme care must be taken if complications are to be avoided. The aponeurosis of the medial head of gastrocnemius was 2.4 times the cross-sectional area compared to the lateral head.

**Conclusion:** In this study we describe a safe posterior approach to the medial aponeurosis of gastrocnemius and also describe the different sizes of the medial and lateral gastrocnemius heads. We propose that the release of the medial head alone is safe and likely to be efficacious in the surgical treatment of isolated gastrocnemius tightness that has failed non-operative treatment.



## **Interpretation of the Scarf Osteotomy by Ten Surgeons.**

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The study evaluated and compared the three-dimensional (3-D) changes in geometry of the first metatarsal following scarf osteotomy. All osteotomies were performed on standardised Sawbone® models by consultant orthopaedic surgeons with a sub-specialist interest in foot and ankle surgery. The study considered the inter-surgeon variances in interpretation and performance of the scarf osteotomy with respect to intra-surgeon variances. The analysis used an accurate digitising system to measure and record points on the Sawbone® models in 3-D space. Computer software performed vector analysis to calculate 3-D rotations and translations of the first metatarsal head as well as the inter-metatarsal angle. Bone cut lengths and displacements were measured using a digital Vernier caliper. One surgeon performed the osteotomy ten times to form an intra-surgeon control dataset, while ten different surgeons each did one scarf osteotomy to form an inter-surgeon test dataset. Both surgical groups produced reductions in the 3-D inter-metatarsal angle with non-significant differences between the groups ( $p > 0.05$ ). In contrast, the test group demonstrated highly significant ( $p = 0.000$ ) greater variance compared with the control dataset for all of the variables (bone cut length, proximal and distal metatarsal displacements plus angulation of the distal fragment) associated with surgical technique. In addition, there were highly significant ( $p = 0.02$  and  $p = 0.002$ ) greater variances in the interpretation of the degree to which the metatarsal head should be translated medially (X) and inferiorly (Z). There was also a significant ( $p = 0.001$ ) increase in variances in the rotations about the dorsi/plantarflexion (X) axis. The only significant differences (all  $p = 0.000$ ) attributable solely to differences in mean values were in proximal-distal (Y) translation, pronation (Y) rotation and medial (Z) rotation. The test group applied greater medial and plantar-flexion rotation of the metatarsal head than the control surgeon and significantly less ( $p = 0.000$ ) shortening of the first metatarsal than the control surgeon. The results of this geometric study demonstrate the versatility of the scarf osteotomy. In addition, it indicated notable out-of-plane metatarsal head rotations and translations effected by the scarf osteotomy. As a result of the multi-planar nature of the osteotomy, there is a potential risk of producing unintended rotational mal-unions in all three planes. These rotational mal-unions may account for some of the poorer outcomes documented within the literature.

## **A prospective study of the scarf and Ludloff osteotomy in the treatment of hallux valgus associated with metatarsus primus varus**

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**Introduction:** This study compares two diaphyseal osteotomies (scarf and Ludloff), which correct moderate to severe metatarsus primus varus. This is a single surgeon, prospective cohort study with clinical and radiological follow up at six and twelve months.

**Material and methods:** Clinical assessment included visual analogue scale questionnaires for subjective assessment and functional activities and the American Orthopaedic Foot and Ankle Society (AOFAS) score. Standardised weight bearing radiographs were analysed.

**Results:** There were 57 patients in each group. Both groups were similar in terms of age, gender and preoperative deformity. There was no statistically significant difference in the two groups at 6 and 12 months in subjective satisfaction, AOFAS forefoot score, improvement in functional activities and range of movements. The improvement in pain (at best) and plantar callosities at 12 months was significantly better in the scarf group ( $p < 0.001$ ). The radiological results at 6 and 12 months including intermetatarsal angle ( $p < 0.001$ ), hallux valgus angle and shortening of the first ray ( $p < 0.01$ ), distal metatarsal articular angle and sesamoid position ( $p < 0.05$ ) were significantly better in the scarf osteotomy group. There were six complications in the Ludloff group with three delayed unions, two dorsiflexion mal-unions and one complex regional pain syndrome. There were two wound complications in the scarf group.

**Conclusion:** Overall the patients who had a scarf osteotomy had a superior outcome at 6 and 12 months.

## **1<sup>st</sup> Metatarsal Head Inlay Resurfacing for Advanced Hallux Rigidus**

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Advanced stages of first metatarsophalangeal joint (MTPJ) arthritis have traditionally been treated with various arthroplasties or arthrodesis. A recent study suggests that the outcomes of arthrodesis are superior to those of metallic hemiarthroplasty; however, complications and poor outcomes still remain with arthrodesis of the first MTP joint. This study reports two year follow-up in patients with advanced MTPJ arthritis who underwent prosthetic inlay resurfacing for the metatarsal side of the MTPJ. From January 2005 to October 2006 patients with stage II or III hallux rigidus underwent inlay resurfacing of the first

MTPJ (ArthroSurface HemiCAP<sup>®</sup> prosthesis). Forty-seven patients (51 implants) were willing to participate at two institutions in a follow-up study comparing preoperative and postoperative radiographs, range of motion, AOFAS scores and SF-36 scores. The average age of the patients was 51 years. At a mean follow-up of 27 months (range: 12–38), the postoperative assessment demonstrated statistically significant improvements in range of motion (passive mean preop: 28<sup>0</sup> – postop: 66<sup>0</sup>), AOFAS scores (mean preop: 51<sup>0</sup> – postop: 94<sup>0</sup>) and SF-36 scores (mean preop: 81, postop: 96) (P<0.05) when compared to baseline. There were no clinical or radiographic failures of the implant with all patients being satisfied and willing to undergo the procedure again. Although longer term follow up is still lacking the two year results are very promising. As minimal joint resection is necessary, conversion to arthrodesis or resection arthroplasty is relatively simple.

## **Mid-term results of the MOJE metatarsophalangeal joint replacement - an improvement on previous designs?**

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**Background:** The painful 1<sup>st</sup> metatarso-phalangeal joint (MTPJ) is a common presentation in outpatient clinics. Options for treatment include arthroplasty and arthrodesis. Previous MTPJ replacement implant designs have had poor mid-term success. The Moje prosthesis was designed to overcome some of the problems with earlier implants, and employs ceramic bearing surfaces and a press-fit tapered stem design. Previous studies have reported good early results in small numbers of patients.

**Methods:** Between February 2002 and December 2006 the senior author implanted 55 components in 48 patients. AOFAS hallux scores and satisfaction scores (0 to 10) were recorded at follow-up. Radiographs were analysed for component alignment, implant bone coverage and subsidence. The mean age of patients at implantation was 56 years (34-77). Average follow-up was 42 months (15 to 74).

**Results:** There were no patients lost to follow-up. Average AOFAS score was 72 (25 to 100) and satisfaction score was 8.2 (range 1 to 10). 82% stated they would have the same procedure again and 82% reported minimal or no pain. There were no deep infections but 35% of patients reported altered sensation. Four implants have been removed (8%) because of worsening pain and implant loosening. 50% of metatarsal implants and 80% of phalangeal implants were implanted within 5 degrees of the long bony axis. Average bony coverage was 80%, resulting in subsidence of 90% of metatarsal and 70% of phalangeal implants at follow-up.

**Discussion:** Despite the poor radiographic appearance in the majority of cases, this procedure has good clinical outcome at the mid-term stage with 92% implant survival. The long-term clinical significance of the radiographic appearances is currently unknown. Improved surgical technique, including better bony coverage, may reduce the risk of implant subsidence.

### **Three to Five year outcomes of MOJE arthroplasty for Hallux Rigidus**

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**Aim:** To assess medium term results of MOJE arthroplasty for degenerative Hallux Rigidus.

**Materials and Methods:** Patients over 18 years of age with symptomatic degenerative hallux rigidus, with at least three years follow up were included in the study. Patients who had previous surgery for hallux rigidus were excluded. A press fit Moje ceramic on ceramic prosthesis was implanted using the standard technique. Patients were non-weight bearing for the initial two weeks followed by physiotherapy according to the Moje protocol. All patients were assessed radiologically and clinically using the AOFAS (American Orthopaedic Foot and Ankle Society) and Foot Function Index (FFI – R, short form) as the primary outcome measure and a Visual Analogue Pain score (VAS) as the secondary outcome measure. Radiological assessment was carried out independently by two authors. Prosthesis loosening was defined as more than 5mm subsidence (sum of proximal and distal components), implant tilting and presence of osteolytic lesions. Revision of arthroplasty was taken as an end point to define failure.

**Results:** 27 Moje replacements of the first metatarsophalangeal joint in 25 patients operated by one surgeon were included in the study. There were 22 female and 3 male patients with a mean age of 61 (range: 48-83). Mean preoperative range of movement (sum of dorsi and plantar flexion) was 31<sup>0</sup> (range: 10-65). Mean preoperative FFI – R score was 100 (range: 53-183); mean preoperative AOFAS score was 45 (range: 28-64); mean preoperative VAS was 8 (range: 3 -10). The average follow up was 49 months (range: 36-60). There were no wound complications. Postoperatively, 5 joints (19%) required closed manipulation and 3 joints (11%) required open arthrolysis to improve the range of movement. Three joints (11%) drifted into valgus, two of them requiring a corrective Akin osteotomy of the proximal phalanx. One patient (4%) required open reduction for dislocation and one patient required excision of the medial sesamoid for persistent pain. In all, 12 replacements (44%) were symptomatic enough to require a further procedure. None of the joints required revision. The mean postoperative range of movement was 35<sup>0</sup> (range: 15-60, p=0.85, Relative Risk=1.069, 95% Confidence Interval: 0.72-1.59). There was improvement in postoperative FFI–R score (mean:41, Range:27-66, p=0.007, RR=0.53, 95% CI:0.34-0.83), AOFAS score (mean:83, range:68-100, p=0.07, RR:1.5, 95% CI:0.98-2.38) and VAS (mean:1, range:0-5, p=0.04, RR:0.80 ,95% CI:0.0.66-0.97). Radiologically, there were signs of loosening of prosthesis in 4 joints (15%) without an adverse outcome in pain and functional scores.

**Discussion:** There is a high incidence of stiffness requiring further surgical procedure to improve the range of movement following this replacement. Although pain and function scores improve with Moje arthroplasty, patients should be counselled that their range of movement may not improve and annual long-term clinical and radiological surveillance would be necessary to assess the integrity of this prosthesis. Further studies including larger number of patients with longer follow up are required to assess the long-term results of this procedure.