

ROUNDUP³⁶⁰

Foot & Ankle

Optimal medial malleolar fractures X

■ The medial malleolar fracture is one of the most difficult fractures to fix around the foot and ankle, and offers the surgeon not only a deceptively difficult fixation, but unless care is taken with reduction and adequate compression achieved, late slippage or nonunion is not uncommon. The currently accepted standard fracture fixation method (including that taught by the AO) is the partially threaded medial malleolar screw. With a rising incidence of fragility fractures, achieving and maintaining fixation in any fracture is becoming increasingly important, particularly in difficult fixations such as the medial malleolus. Researchers in **London (UK)**, together with collaborators in **Regensburg (Germany)** and **Graz (Austria)**, conducted a cadaveric study to establish the best method of medial malleolar fixation. They hypothesised that suboptimal compression may be achieved as the result of using partially threaded screws that bypass the physal scar. The research team constructed an instrumented cadaveric study to assess the compression achieved in a standardised medial malleolar fracture using short (30 mm cancellous), long (45 mm cancellous) and fully threaded cortical (45 mm) screws. The instrumented cadaveric model revealed that median compression at the fracture site was highest with fully threaded and 35 mm partially threaded screws (1.0 kg/cm² and 0.95 kg/cm² respectively) and statis-

tically significantly higher than the 45 mm partially threaded screws.¹ This study only measures compression at the fracture site and does not establish failure in toggle, shear, torsion or pull out strength. Not quite a challenge to current AO philosophy, especially as screw length is not part of current AO philosophy. It's an interesting paper nonetheless.

Resurfacing in the talus?

■ Salvage of symptomatic large osteochondral defects can be tricky. Patients who have otherwise uninjured joints may complain of intransigent symptoms and difficulties with sports and other activities. Once the usual gamut of debridement, microfracture and a variety of biologic therapies have been exhausted, the surgeon is left with few options other than fusion of an otherwise healthy joint. Surgeons in **Amsterdam (the Netherlands)** have been investigating the potential value of metal resurfacing inlay implants. This is not a new technique and has been used both in the talus and the shoulder for many years. Surgeons have traditionally shied away from inlays for initial osteochondral fractures as results are somewhat limited and having excised a largeish portion of the talus, the surgery is somewhat final. However, this does potentially offer a very attractive salvage option for patients in whom other treatments have failed. Despite the relative rarity of these patients, the study team managed to identify 20 patients (average age 38 years) who were previously treated for

osteochondral defects and then underwent surgery with resurfacing inlay implants and entered them into this study. The investigators report a prospective outcome study with patients followed for a mean of three years. Outcomes were assessed with pain scores and the AOFAS score. At the final follow-up, patients demonstrated a significant reduction in pain scores (at rest, walking, running and stair climbing) and an improved AOFAS score from 62 to 87. Quality of life was also found to have significantly improved (as measured by the SF-36), but only in the physical component. Although patients' symptoms abated, the study team noted ongoing degenerative changes in 10% of patients.² These researchers have highlighted the potential use of infill resurfacing as a salvage option for patients with relatively poor function pre-operatively (this patient group had an AOFAS score of just 62 pre-operatively) and this certainly highlights the use of this option for difficult to treat patients.

Predicting outcome in Mobility ankles

■ Total ankle replacement is a bit of a 'Marmite' operation. Patients and surgeons either love it or hate it. The difficulty is often predicting which patients are going to have a good outcome pre-operatively. While the contra-indications and risk factors for early failure are well explored, there is surprisingly little research concerning which patients do best functionally following an ankle replacement. Researchers in **Tauranga (New**

Zealand) set about finding out. They performed a retrospective prognostic study using their own consecutive series of Mobility total ankle replacements. The study team included 129 patients within the study cohort with follow-up to four years. The study team included both radiological and clinical outcomes (Ankle Osteoarthritis Scale) and collated data on the potential pre-operative predictive factors for outcome. During the four years of the study, their cumulative failure rate was 5.6% and nearly 90% of patients reported improved outcomes at final follow-up with AOS pain scores of 17. The study team identified patients who had done 'poorly' based on their AOS score, with a score of greater than 30 designated a 'poor outcome'. Unsurprisingly, the study team were unable to identify any radiological parameters that predicted functional outcome, however, they did identify that patients receiving total ankle replacement for post-traumatic arthritis had a particularly poor outcome. Of those patients with persistent pain, the majority experienced medial-sided pain and the authors conclude 'there is a significant incidence of persistent pain, particularly on the medial side, for which we were unable to establish a cause'.³ Ankle replacement still has far to go in establishing reliable functional results, and particularly in the area of patient selection. We wonder if a similar study, this time concentrating on patient characteristics and expectations, might yield some more

positive results in terms of patient selection? In our experience here at 360 it is often the patient, not the surgeon who determines most about their outcome.

Can mal-aligned ankles be successfully replaced?

■ Following a theme, researchers in **Durham (USA)** have looked again at the importance of pre-operative tibio-talar alignment in total ankle replacement. The conventional wisdom is that excessive coronal tibiotalar mal-alignment is a contraindication to total ankle replacement. This research team, however, didn't take this at face value and set out to re-examine the effect of coronal alignment on outcomes in total ankle replacement. They set out to compare clinical outcomes and clinical performance scores between patients with different levels of coronal mal-alignment. This study cohort, similar in size to the previous one, contained 103 patients and was subdivided into groups according to pre-operative deformity. Excessive deformity (> 15°) in either plane was seen in 17, moderate valgus (5° to 15°) in 21, and moderate varus alignment (5° to 15°) in 27. The remaining 38 patients were neutrally aligned. Outcomes were assessed with clinical measures (American Orthopaedic Foot & Ankle Society (AOFAS) hindfoot score, the Foot and Ankle Disability Index (FADI)), quality of life assessment (SF-36), and clinical assessment (timed up and go test (TUG), the four square step test (4SST), and walking speed). All of these assessments were carried out prospectively pre- and post-operatively. The most marked finding was the improvement of coronal plane alignment, with 95% of patients achieving normal post-operative alignment. The surgical team used the now standard arthroplasty and balancing procedures with deltoid ligament release, lateral ligament reconstruction, and posterior soft-tissue release performed in addition to arthroplasty were necessary. As a whole there were significant

improvements in all measured scores including AOFAS (pain, function, alignment, and hindfoot scores) and the SF-36 (body pain, physical function), and there were marked and significant improvements in walking speed, TUG and 4SST scores. This is all in line with what other reports have shown. What differs here is that the authors had a large proportion of mal-aligned ankles. They demonstrated no differences between the subgroups in these outcome measures.⁴ This paper conclusively demonstrates that coronal plane mal-alignment is not necessarily a contraindication for total ankle replacement. The authors report an impressive correction of bony and soft-tissue deformity in their series with little residual post-operative deformity. It stands to reason that if the deformity can be corrected, then it should not compromise outcome.

Research: Cartilage colonisation in bipolar ankle grafts X

■ One of the more left-field options for ankle arthritis is the use of bulk bipolar allografts. Popular in some centres in the US and Europe for osteoarthritis, similar matched bulk allografts have found application in limb preserving tumour surgery, either where a prosthesis is contraindicated, or in some centres where these are used as first line treatments. However, opinion is divided on their use and likely long-term outcomes. There is plenty of data to support their short-term use, but the few long-term studies show increasing failure rates and relatively poor functional scores. One of the main objections that detractors have against allograft use is the perception that the graft remains inert and that very little biological activity occurs, leading to an inevitable failure of a large dead bone graft. One of the surgical teams

with much experience of this sort of grafting is from **Bologna (Italy)**, who have previously reported outcomes for bipolar grafting for both osteoarthritis and tumour applications. They set out to establish what actually happens at a biological level in patients treated with bulk bipolar ankle allograft for osteoarthritis. The research team studied a series of 17 patients who had undergone bulk allografting. They retrieved a DNA sample from 15 cases and compared it with donor and host DNA in order to establish the host or graft match, thus giving an indication of any new host biological activity. In addition, in a subgroup of six patients, gene expression was assessed using six allograft cartilage samples and a qt-PCR method. Further histology and immunohistochemistry (in-situ hybridisation) was used to confirm the PCR results and localise expression.

Not surprisingly, the researchers found a mixture of results. From a genotyping viewpoint, ten patients matched host DNA, three matched the graft DNA and two were a mixed picture. The local gene expression analysis (PCR) demonstrated that cartilage expression was occurring and that the graft was making new cartilage.⁵ This paper is extremely interesting and shows for the first time that migration of host cells from the subchondral bone can be expected in the majority of cases and that those cells can be expected, given time, to engage in cartilage manufacture. In other words this represents some (and by no means conclusive) evidence that, given time, bipolar ankle grafts can act like a scaffold and support the ingrowth of host-tissue-specific cells.

Research: CTs and proof of fusion X

■ The advent of 3D imaging has revolutionised visualisation in post-operative patients, and particularly in patients with fractures waiting to

heal or fuse. One of the difficulties with widespread adoption of a new technology is that sometimes the clinical relevance has yet to be assessed. Researchers in **Halifax (Canada)** have used the model of post-operative ankle fusion in an attempt to answer the question 'how fused is fused'. The research team assessed clinical outcomes using quality of life (SF-12) and clinical outcome scores (Foot Function Index (FFI), and American Orthopaedic Foot & Ankle Society (AOFAS) scores) administered at a 24-week review. At the same time a CT scan was arranged with the aim of determining the extent of osseous bridging callus. Impressively, the research team were able to assemble a cohort of 275 patients, all of whom had isolated joint fusion. They quantified the bridging callus into four broad categories; absent (0% to 24%), minimal (25% to 49%) moderate (50% to 74%), or complete (75% to 100%) and then investigated how dependent the outcome variables were on this volume of bridging callus. The authors were able to establish that the 'threshold' in their study was the minimal osseous bridging group. Patients with between 25% and 49% bony bridging were found to have a minimally clinically important change in all three outcome measures, while those in the absent callus group did not.⁶ This study is one of the first to quantify the relationship between bony bridging and clinical symptoms, one that is intuitively there, but has not been previously investigated. We were delighted to read such an innovative article here at 360 but then disappointed by the anything but innovative statistical methods. This paper suffers like many others from artificially transforming continuous data (bony bridging) into ordinal data. A more comprehensive statistical analysis would have enabled the relationship between bony bridging and symptoms to have been explored further.



Salvaging recalcitrant Achilles tendinopathy

■ The incidence of Achilles tendinopathy, like other degenerative inflammatory conditions, is continuing to rise, egged on by the army of weekend warriors and touchline dads. In recent years the treatment of Achilles tendinopathy (AT) has been revolutionised by the use of eccentric loading physiotherapy. The use of eccentric calf training in a carefully planned programme has been shown to be one of the most effective treatments of AT and is the standard of care in many institutions across the world. The difficulty lies in treating those patients with recalcitrant symptoms. Surgeons in **Guildford (UK)** have presented the outcomes of their strategy of a proximal medial release which is aimed at addressing residual gastrocnemius contracture. Their series consisted of 16 surgeries in 12 patients, all operated on over a two-year period. Follow-up data at two years was sadly only available in nine patients (ten cases). Patients were a typical cross-section for this condition with a mean age of 45 years and even gender distribution. The cases were a mix of insertional and non-insertional tendinopathy and all had failed eccentric loading prior to surgery. Outcomes were assessed using VAS scores, the AOFAS score and an Achilles tendon-specific outcome measure (Victorian Institute of Sport Assessment—Achilles). Despite the small numbers of patients assessed, the outcomes were promising with

two thirds of patients highly satisfied. Slightly better outcomes were seen with the non-insertional tendinopathy group than the insertional group, however, the numbers were so small (five in each group) that any statistical comparison is meaningless (although still presented in the paper).⁷ High satisfaction rates and low complication rates associated with the procedure make this a candidate operation for patients with really refractory tendinopathy where eccentric loading has failed. However, it is important not to over-interpret results from small studies such as this, and more research is definitely warranted in this case.

Recurrent fifth metatarsal stress fractures X

■ Recurrent metatarsal stress fractures can be extremely tricky to treat and are surprisingly common in some patients. The biology of healing and the 'Jones' fracture is well recognised, however, little is known about the risks for recurrent fracture. Researchers in **Seoul (South Korea)** set about investigating the scale of the problem and risk factors for subsequent re-fracture. Their paper is based on the analysis of the medical records of 168 consecutive fifth metatarsal stress fractures in 163 patients. Slightly unusually, all patients were treated by tension band wiring. Follow-up was to two years and in 49 cases (classified as Torg III) bone grafting was also undertaken primarily. All patients included in the study were active athletes and

there were 11 cases of nonunion, and 18 cases of subsequent re-fracture. The authors recorded potential covariates such as age, weight, fracture classification, time to union, and re-injury history. The biomechanics of the foot were also evaluated using radiological parameters designed to evaluate cavus deformity and fifth metatarsal head prominence. The authors identified a significant difference in weight between the uneventful union and re-injury groups. There were, however, no apparent differences in ages, fracture grade or rehabilitation strategy nor major biomechanics of the foot. There were some significant differences in protrusion of the fifth metatarsal head and 4/5 intermetatarsal angle. In all cases where a re-fracture occurred there was a traumatic history, and all fractures occurred within six months of starting rehabilitation.⁸ The authors have accurately and thoroughly evaluated the predictors of failure in their series of operatively treated base of fifth metatarsal fractures treated with a tension band wire. We would agree that patients with a high BMI and prominent head should not be treated with a tension band wire, but here at 360 we wonder if the authors should have gone further in their conclusions. An operative intervention with an 18% significant complication rate for an injury that could otherwise be treated conservatively perhaps should not be offered at all to patients at all.

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