

## Interference screw fixation versus Pulvertaft weave for tibialis posterior transfer

■ The tibialis posterior (TP) transfer is a common treatment for foot drop. By transferring the tendon, the surgeon addresses the foot drop in a dynamic way. There is little in the way of surgical options that fare better or are more widely respected. This study group from **London (UK)** noted, however, that the standard practice is currently immobilization of the ankle in a non-weight-bearing cast for six weeks.<sup>6</sup> A potentially better regime would be early active dorsiflexion with protected weight-bearing. This would offer the potential to reduce stiffness and medical complications

associated with lower-limb immobilization. The authors of this study set up a cadaveric model to establish if tendon displacement under cyclic loading differed with the Pulvertaft weave (PW) and interference screw fixation (ISF) in a cadaveric foot model. In one of the more extensive cadaveric studies we have seen here at 360, the authors undertook 24 TP tendon transfers in cadaveric feet, half with each technique (PW vs ISF into the cuboid). The cadaveric feet were then cycled 1000 times with a load range of 50 N to 150 N and then loaded to failure. Outcomes assessed were strain to failure and tendon displacements. Tendon displacement was similar in both groups; however,

one specimen in the ISF group suffered early screw failure. For tendon transfer, ISF and PW techniques were comparable, with no differences in tendon displacement after cyclical loading or load to failure. However, the authors reported that there was greater variability observed in the PW group, which suggests it may be a less reliable technique.

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## Wrist & Hand

**X-ref** For other Roundups in this issue that cross-reference with *Wrist & Hand* see: *Research Roundup 7*.

### How should we treat scapholunate ligament ruptures?

■ The scapholunate interosseous ligament is somewhat of an enigma. After an injury when someone falls heavily on the outstretched hand, a mild 'sprain' may settle but a significant rupture can cause disabling loss of function and altered carpal mechanics, and may ultimately lead to osteoarthritis. During our orthopaedic training, the risk of the latter is drilled into us and the necessity to repair or reconstruct seems obvious. As is often the case, however, the evidence is less convincing than the dogma and we were delighted to come across this systematic review from **Salford (UK)**, which addresses the topic in detail.<sup>1</sup> As the review team points out, there is no really high-quality evidence of the natural history of the condition; the authors were able to identify only a single

satisfactory long-term study and even this paper only reported on the outcomes of lower-grade injuries. This gap in the literature is likely due to the rather obvious observation that higher-grade injuries will usually be operated due to the concern of future degenerative change. Accepting that, based on the limited evidence and expert opinion, surgery may be in the patient's best interests, have we really any idea which technique is best to use? We were rather concerned to read the work of this group, which confirmed that the literature is replete with suggestions from authors who promote their individual hunch as to how to treat the ruptured ligament, typically with the publication of a small series with short-term follow-up, inadequate outcomes, and no control. There is no shortage of papers on the topic; however, of 1191 papers that the authors identified on the topic, only 17 had adequate information suitable for inclusion in this review. Even then, there was no consensus except that surgery generally provides modest pain relief

but long-term stiffness and weakness abound. Across these series, the reported complication rates are high (20%) and there appears to be little correlation between radiological and clinical outcome. In addition to all of this, the evidence would also suggest that patients suffer the risk of a complex regional pain syndrome (CRPS) rate at around 4%. There is some evidence presented that perhaps capsulodesis gives slightly better grip and movement than tenodesis, even though it seems less capable of reducing the scapholunate gap. It is clear that any procedure performed for a scapholunate injury is at best speculative and not entirely satisfactory; the patient should be consented accordingly. In order that we make progress in our understanding in this area, the authors helpfully suggest a minimum data set to allow some form of comparison between future studies due to the heterogenous collection that has occurred thus far. Longer-term follow-up of cohorts is desperately needed to shine a light on this area.

### How do we best treat partial tendon lacerations?

■ Flexor tendon lacerations require considerable skill from both the surgeon and the therapist, as well as a motivated and compliant patient, if a good result is to be achieved. Whilst the management of complete flexor tendon injuries is relatively well understood, a particular dilemma for a surgeon is the management of a partial flexor tendon injury, especially when suffered in zone II. Surgical repair inevitably risks stiffness, due to scarring from the manipulation of the tendon and the added bulk of the repair running through the pulleys. There is thus a reasonable argument that the outcome may be better following conservative treatment. However, many surgeons are reluctant to manage these injuries conservatively due to the reported risks of late rupture, as well as triggering and entrapment from scar tissue and lacerated tendon. The current consensus of expert opinion seems to suggest that most surgeons would repair an injury involving over 50%



of the cross-sectional area. Exactly how much tendon can actually be damaged before a repair is necessary, with the concomitant risk of making the patient worse, is far from clear. Researchers from **Cleveland, Ohio (USA)** reviewed all the relevant clinical and biomechanical literature and reached some interesting conclusions.<sup>2</sup> Whilst the authors were quick to acknowledge that the level of evidence of clinical data on the topic is low, and that some of their conclusions come from animal and cadaveric data, there is still a lot that can be taken from this sensible review. The group recommends surgical exploration of suspected partial flexor tendon lacerations, with those lacerations involving 90% of cross sectional area having enough integrity for immediate active protected motion. For injuries more than 90% or more than 75% with triggering, they recommend repair with non-circumferential simple epitendinous sutures. Where triggering occurs in injuries less than 75%, bevelling of the tendon edges or partial release of A2 or A4 pullies is advocated. We at 360 are surprised by these numbers, which are higher thresholds for operative intervention than conventional wisdom would suggest; however, intuition may very well be leading to over-intervention.

### Electronic cigarettes and the effect on hand micro-circulation

■ We are sure that our readership, in common with the 360 team, have

been faced more than once with the patient who proudly declares that they have quit smoking, only to concede that they use e-cigarettes. While the orthopaedic fraternity in general understand the harm caused by traditional cigarettes, we are often less versed in the risks of this newcomer to the scene. This thoroughly enjoyable and educational article from a team based in **London (UK)** examines the effect of smoking e-cigarettes on the microcirculation of the hand.<sup>3</sup> The non-dominant hands of 15 healthy volunteers (eight smokers, seven non-smokers) were attached to a non-invasive O<sub>2</sub>C Doppler probe, which measured tissue perfusion at baseline control reading of deep (7 mm) and superficial (3 mm) levels from the skin. Participants commenced a five-minute smoking protocol of non-nicotine (0 mg) e-cigarettes with continuous microcirculation measurements during smoking and for 20 minutes afterward. This was then repeated with a nicotine (24 mg) e-cigarette. Smokers had a statistically significant reduction in hand microcirculation during and up to 20 minutes after smoking a 24 mg eCigarette. There was a maximum reduction of 77% in superficial flow and 29% in deep flow. After smoking a 0 mg eCigarette, smokers demonstrated an increase in superficial flow of up to 70% with no change in deep flow. From the basic science perspective, it is well understood that nicotine increases circulating catecholamines, which then impair circulation to microvascular beds, including those of the hand, and that tobacco smoking additionally leads to elevated carbon monoxide and a hypercoagulable state. For the increase in microvascular flow in the smokers, the authors point to the other ingredients, which they believe may cause vasodilation. With respect to the failure to vasoconstrict in non-smokers, this may be poor smoking technique leading to low chemical delivery, or a less sensitive response to nicotine with lack of

prior exposure. Regardless, this study confirms nicotine replacement is potentially just as bad independent of the delivery vehicle, and suggests that those more addicted to the mechanical part of the habit would be better served by changing to the zero-nicotine form.

### Universal 2 total wrist arthroplasty: high satisfaction but high complication rates

■ Patients with severe destructive disease of the wrist requiring intervention essentially face a choice between opting for the usually reliable wrist fusion surgery or seeking the increased range of motion offered by a prosthetic arthroplasty. Although wrist arthroplasty has been available for a number of years, it is still far from a mature technology, and as newer designs become available it is always useful to have lengthy follow-up studies. We therefore welcome this study from **Glasgow (UK)** examining the outcomes of the Universal 2 total wrist arthroplasty.<sup>4</sup> This design evolution changed the shape of the carpal component from toroidal to ellipsoid with the aim of increased stability and reduced polyethylene wear, as well as optimizing the volar tilt of the radial component from 20° to 14°, also for stability purposes. The study reports the outcomes of 48 wrist arthroplasties undertaken in 46 patients treated over an eight-year period. Impressively, the authors were able to report a seven-year mean follow-up period. Over this time, the Disabilities of the Arm, Shoulder and Hand (DASH) scores improved from a mean of 58 to 25, and the patients achieved a mean flexion of 33° and extension of 24°. Of 45 patients, 39 said they would have the procedure again. Despite these high satisfaction rates, a significant proportion of patients experienced complications and radiographic loosening. Median nerve neuropathy was common, at 8.3%, with 4.2% of patients requiring carpal tunnel release rate within 12

months. Half the patients displayed some evidence to suggest radiographic loosening. The authors state that this was of variable significance, with six undergoing revision for this reason; there was only one other revision that was for pain. The previous universal wrist arthroplasty suffered a dislocation rate of up to 16% but there were no reported dislocations in this series, which would suggest that this issue has been appropriately addressed. The overall complication rate, which also included a periprosthetic infection, a wound infection, and two tendon ruptures, was quite high. However, the majority of the patients had an initial underlying diagnosis of rheumatoid arthritis, which needs to be considered when taking these results in context. Six patients died during the follow-up period, giving an associated mortality of 13% at a mean of 5.2 years postoperatively. The mortality seen here was from unrelated causes and serves to underline the frailty of this population, but the overall complication rate is not inconsiderable and is obviously a trade-off that should be discussed with patients from the outset.

### Dorsal wrist plication for midcarpal instability

■ Midcarpal instability (MCI) presenting with a clunking wrist on ulna deviation, the 'catch-up clunk', represents a massive challenge to the hand surgeon. Carpal instability is very difficult to diagnose accurately, no effective therapy regime exists, and surgical treatments such as soft-tissue reconstructions and partial wrist fusions have been published as small, usually personal series. In most of these series, the results can be described as mediocre at best. It is therefore safe to say that positive results for treatment options are welcome in this area, and an author from **Toronto (Canada)** has written up another personal technique.<sup>5</sup> A total of 23 patients with 27 symptomatic wrists were studied; a further two patients were lost to follow-up.

Midcarpal instability was diagnosed on physical examination, in which subluxation and the Lichtman catch-up clunk reproduced patients' pain symptoms. Average patient age was 27 years and median symptom duration was 12.8 months. Based on the Lichtman classification, two wrists were grade V and the remainder were grade IV. All underwent or had previously undergone a minimum period of immobilization of at least six weeks followed by hand therapy instruction. All patients underwent surgical plication of the dorsum of the wrist using the technique described, which had previously been tested on cadavers. At a mean follow-up of 35 months, all patients had improved pain and there were statistically significant improvements in grip strength and Patient-Rated Wrist Evaluation scores. The procedure proved most beneficial to female patients aged under 25 years with hypermobility and without major traumatic or work-related injuries. In contrast, relatively poorer results were achieved in men aged over 25 years who had moderate or severe trauma that was mostly work-related. Instability recurred in two patients who then went on to undergo a four-corner arthrodesis. A total of 20 patients were satisfied with the procedure, which seems commendable. As always with new techniques, we await results from groups unassociated with the originating surgeon. However, the initial results in this relatively large series seem good, especially in this cohort of patients who can be very tricky to treat.

### **Late displacement of the distal radius fracture: does it affect function?**

■ Our knowledge regarding the management of the humble distal radius fracture is steadily advancing but some controversies do and will inevitably remain. Recently for UK surgeons, the evidence and these controversies have been consolidated in the British Society for Surgery of the Hand (BSSH) /

British Orthopaedic Association (BOA) guideline on 'Best practice for management of Distal Radial Fractures', which affirms the view that comminuted fractures in older patients are more likely to undergo late displacement. The guidance uncontroversially recommends a repeat radiograph following injury at one to two weeks. However, there was no available quality evidence supporting a need for imaging subsequently and so this is not advocated. This is in contrast to the American AAOS guideline, which is a level 5 consensus recommending three weeks of radiographic surveillance in patients undergoing nonoperative management. Given these are two fairly major clinical guidelines offering contrasting advice, we were interested to read this multicentre study from a group based in **Sundsvall (Sweden)**.<sup>6</sup> The authors set out to prospectively examine the outcome of conservatively treated fractures, which were seen to be minimally displaced at between 10 and 14 days post-injury. The final decision on treatment path was made at this stage based on defined radiological parameters, and this conveniently minimizes the risk of selection bias. The authors report the outcomes of 209 fractures that were initially included in the study and were able to report outcomes from 175 who were successfully followed up. Outcomes were reported clinically and radiologically at three months and one year to assess function, grip strength, range of motion, and quality of life. Late displacement was seen to occur in 28% of the cases reported in this study and was associated with loss of grip strength and range of motion. However, no significant differences were seen in the Quick Disabilities of the Arm, Shoulder and Hand score (QuickDASH), EuroQoL 5D (EQ-5D), and visual analogue scale for pain (VAS). Furthermore, if the fracture was initially displaced, the authors report that the risk of late displacement increased to 52%. As the

authors point out, the findings could be perceived to support either the American Academy of Orthopaedic Surgeons (AAOS) or BSSH recommendations depending on your point of view. The lack of any appreciable difference in patients' function or quality-of-life measures supports a follow-up of between one and two weeks, accepting possible late displacement. However, if minimizing displacement is paramount, maybe in younger and higher demand patients, then the follow-up should be longer than this, especially where there is initial displacement.

### **Variables affecting outcome of carpal tunnel release surgery**

■ Successful outcomes of carpal tunnel release surgery are potentially affected by a number of factors, and the literature is at best inconsistent in deciding which are important factors and to what extent. Many previous studies have been small, retrospective, and with relatively high loss to follow-up, so this sizeable prospective study from a team in **Glendale, Wisconsin (USA)** is a welcome addition to the existing literature.<sup>7</sup> The study team enrolled over 1000 consecutive patients into their study and recorded the preoperative symptoms in terms of frequency of daytime numbness, night-time awakening, and duration of symptoms. In addition to this, the authors included physical examination findings, height, weight, gender, diabetes, thyroid disease, and severity of electrodiagnostic studies as part of their cohort study. The actual release surgery was performed by a single surgeon using a standard open technique and patients were followed up at one week, six weeks, and six months post-surgery, with numbness resolution at six months as the primary endpoint from a reporting perspective. Instead of formal outcome scoring, patients were asked what percentage resolution they felt the operation provided them with when compared with their preoperative symptoms, as well as direct

questions about nocturnal awakening symptoms. Interestingly, a number of preoperative factors including diabetes, nocturnal awakening, and abductor pollicis brevis fibrillations on nerve conduction studies were found to be predictive of poor outcome on simple univariate analysis. However, when multivariate analysis was performed, only age and gender were independently predictive of reported percentage resolution of daytime numbness symptoms six months post-surgery. Below the age of 50 years, the mean reported resolution of daytime numbness by six months is 97.3% (men 91.8% and women 99.4%). After the age of 50 years, there was a linear 0.77% decline in average resolution of daytime numbness per year. Other findings reported included a complete resolution of symptoms in 71% of patients under 40 years, but in those over 80 years old, this was only 43%. In this latter group, there was a 14% chance of no improvement at all. Nocturnal awakening was reported by 89% of patients preoperatively and usually resolved in all age groups with just 8% of patients under 40 years old, 10% between 40 and 80 years old, and 15% over 80 years old reporting persistence of this symptom. While the outcome measures in this study are limited in scope, they are pragmatic, and useful information can be gleaned for counselling and informed consent in this large series of patients.

### **Low-intensity pulsed ultrasound (LIPUS) for scaphoid nonunion**

■ Scaphoid fractures have a not insignificant nonunion rate, even when undisplaced, with rates as high as 15% reported. Treatment is somewhat of a mixed bag, with units varying their practice from operative intervention in the majority of cases – arguing the return to work earlier, as well as reduction of pain and nonunion rate – to those conservative units where only significant displacement is considered an indication for surgery. Furthermore, not all patients are good

candidates for surgery, which is the standard treatment for nonunion, complicating the picture somewhat. In those patients unsuitable for, or wishing to avoid surgery, a variety of techniques have been employed, with mixed success, including extracorporeal shock wave therapy, pulsed electromagnetic wave therapy, and low-intensity pulsed ultrasound (LIPUS) stimulation. These have been postulated as a means of enhancing enchondral ossification at the fracture site and there are studies concerning use in small and long bones. The argument is that these interventions will promote union without the need for surgery; however, they can be inconvenient and costly. This group from **Baltimore, Maryland (USA)** has performed a systematic review and

meta-analysis to study the use and efficacy of low intensity pulsed ultrasound stimulation.<sup>8</sup> Five studies were included and, in total, these reported just 166 cases, with an average patient age of 31 years and fracture age of 20 months. Across these studies, a mean healing rate of 78.6% was seen and an average time to union of 4.2 months was reported; however, an exclusion included cases of avascular necrosis. As the authors note, there are a lack of prospective studies in this area and so the evidence base remains relatively weak, especially as the evidence here was mostly level III, with only a single level II paper reported in the literature. Nonetheless, there are few options other than surgery for this group of patients, so, in specific circumstances where funding permits and patients

can bear the long lag time, LIPUS may be worth trying. Without doubt, however, better-designed and better-conducted studies are required here to make anything but the weakest of recommendations.

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## Shoulder & Elbow

**X-ref** For other Roundups in this issue that cross-reference with *Shoulder & Elbow* see: *Research Roundups* 5 & 7.

### Scapular fractures: is surgery beneficial in the mid to long-term? X-ref

■ The scapular fracture has been gaining more interest of late, with recent symposia at the Orthopaedic Trauma Association (OTA) and a broadening interest in the orthopaedic shoulder and trauma communities. We were delighted, here at 360, to see a relatively large series examining the long-term benefits or otherwise of intervening in the scapula fracture. In this retrospective study from **St. Paul, Minnesota (USA)**, 66 (67%) of 98 eligible patients with an acute operatively managed intra- (n=29) or extra-articular (n=37) scapular fracture were followed up for a mean of seven years (4.7 to 10.3) post-surgery.<sup>1</sup> The operative indications are well documented in the paper, are based on the existing literature, and are consistent with

previous studies from this group. The authors report in their series a 100% union rate, no infections, and Disabilities of the Arm, Hand and Shoulder (DASH) scores approaching normative values for the population studied, which steadily improve over time. An excellent range of motion and strength was achieved compared with the patient's contralateral arm, but with a reduced range of external rotation. The secondary surgery rate in the extra-articular group was 26% (n=8); this was for elective metalwork removal (n=5) or manipulation under anaesthesia (MUA) for stiffness (n=3). In comparison, the secondary procedure rate in the intra-articular group was 31% (n=9) and was for elective metalwork removal (n=3), MUA for stiffness (n=4), or shoulder arthroplasty (n=2). The authors concluded that operatively managed intra- and extra-articular scapular fractures report excellent functional outcomes at between five and ten years after open reduction and internal fixation (ORIF), but no difference was identified between those

groups. As the authors acknowledge in their paper, there are limitations to this very large series of patients. First, the retrospective nature leads to problems with loss to follow-up and a heterogeneous group of patients included in the report. There is no nonoperative control group within in the study, and as such there is no evidence presented here to suggest that surgery provides a superior outcome for these injuries in the longer term. Finally, but importantly, only six patients in this series sustained low-energy trauma, which is not consistent with the current data, which would suggest an increasing incidence of low-energy scapular fractures in women, where non-operative treatment is possibly more appropriate.

### Proximal humerus fractures: still no evidence surgery provides benefit X-ref

■ The role of surgery for fractures of proximal humerus continues to be debated, and a recent large study documented an almost three-fold

increase in the use of primary reverse shoulder arthroplasty for fractures of the proximal humerus. Given the recent results of the Proximal Fracture of the Humerus Evaluation by Randomization (PROFHER) study, which demonstrated no benefit of open reduction and internal fixation (ORIF) over nonoperative management in certain patients, some have suggested that reverse shoulder arthroplasty should be the next comparator to nonoperative treatment for these complex fractures. However, to date we are aware of no study that has definitively proven the superiority of surgery, with a recent study we discussed here at 360 demonstrating no difference in any patient-reported outcome or range of movement between nonoperative management and reverse shoulder arthroplasty. In this new large systematic review with meta-analysis from **Utrecht (The Netherlands)**, the authors attempt to establish what the evidence is from the literature to support or otherwise operative management of proximal