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Mid-term follow-up of talar dome resurfacing surgery using the HemiCAP device for osteochondral lesions: Review of 3 cases

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Background: *Surgical management of talar osteochondral defects is a rapidly advancing area of foot and ankle surgery. The HemiCAP resurfacing is a new surgical technique in foot and ankle orthopaedics. This device provides a Cobalt-Chromium articular prosthetic component that allows partial resurfacing for localized talar dome defects. The effectiveness, safety and follow-up have yet to be established for this surgical method.*

Methods: *A prospective case series review of three cases using the HemiCAP articular resurfacing component for osteochondral defects of the talar dome. The patient mean age was 55 years (range 46-65). All patients were male. Each case had a large medial talar dome defect measuring between 10-20mm on pre-operative MRI or CT. Each patient underwent scoring using the visual analogue scale (VAS), AOFAS Ankle-Hindfoot scale and Kaikkonen scale pre-operatively, at 1 year and 3 years. Routine post-operative clinical follow-up took place at 2, 6, 12 weeks, 12, 24, 36 months for all cases and they were assessed clinically for pain, range of motion (ROM) and wound problems. Serial radiographic assessment was performed to observe any signs of metal work loosening and osteolysis of the tibio-talar joint.*

Results: *Full ROM of tibio-talar joint was achieved in all cases 4 months post-operatively under physiotherapy guidance. Mean follow-up period was 38 months (range 36 to 41 months). Improved patient scoring after surgical implantation of a HemiCAP talar dome resurfacing device was noted in all cases. Kaikkonen score noted an improvement by 25-35 points and this was maintained at the 3 year review. An AOFAS scoring improvement of 39-44 points was also observed and maintained at the 3 year follow-up. A 3 point reduction in VAS pain scoring was also demonstrated after surgery. All patients returned to routine daily activities and work by 5 months post-operatively.*

Discussion: *We have demonstrated the use of HemiCAP articular resurfacing component in maintaining a good improvement for patients at mid-term follow-up for joint-preserving surgical management of symptomatic large talar dome defects, however, larger studies with long-term follow-up are required.*

Key words: Osteochondral talar dome defects, HemiCAP talar resurfacing.

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Surgical management of talar osteochondral defects (OCDs) is a rapidly advancing area of foot and ankle surgery.

Seven to forty-one percent of patients with lateral ligament rupture also sustain a talar OCD [1, 2]. Raiken, et al. [3] found that two-thirds of talar OCD are located on the medial talar dome.

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Figure 1A and 1B Left ankle at presentation including AP (A) and Lateral (B) radiograph in case #1.

Currently, the mainstay of primary treatment of talar OCDs is arthroscopic debridement and microfracturing with a successful outcome found in 85% of cases [4,5]. There are a variety of reconstructive treatment options for the surgical management of large or failed primary surgery on talar OCDs, these include cancellous bone grafting, osteochondral autograft transfer and autologous chondrocyte implantation [5]. These procedures are not without their drawbacks including donor site morbidity, limited availability and two-stage surgery [6,7].

When osteochondral defects are associated with the presence of subchondral cysts, the management of such lesions becomes very difficult. These cases are a real challenge as there is limited literature available for surgical management and options such as drilling alone are not sufficient to restore the anatomy in cases of large sized talar dome defects.

We used the Hemi CAP (Contoured Articular Prosthetic) device in the management of our three cases. These cases were performed on two patients (one patient with both ankles affected) with large sized talar defects in order to restore the anatomy and gain the best functional outcome for them from this injury.

The HemiCAP resurfacing device is a novel surgical technique developed in 2007 for management of large talar defects.

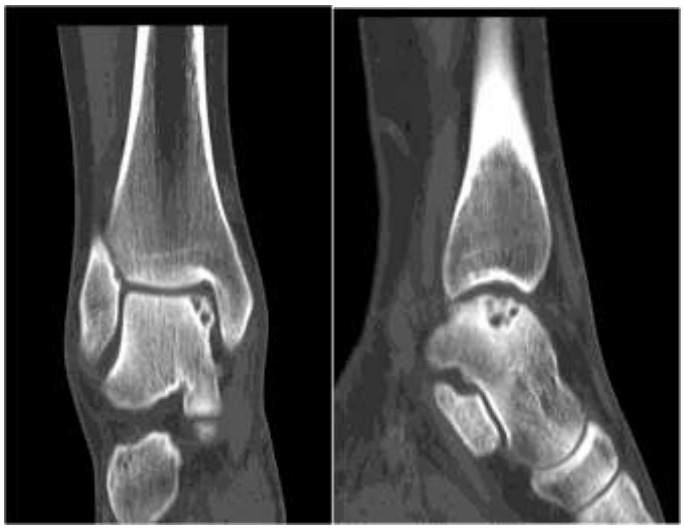

Figure 2A and 2B Anterior posterior (A) and Lateral (B) Computerized Tomography (CT) of the right ankle post arthroscopic debridement in case #1.

This device has a cancellous taper post component that joins together with a taper interlock, providing a Cobalt-Chromium-Molybdenum alloy articular prosthetic component that allows partial resurfacing for localized medial talar dome defects. It allows stress bearing contact at the bone/prosthetic interface.

Manufacturers suggest its use for treatment of patients with localized post-traumatic degenerative disease, necrosis associated with large unstable osteochondral fractures or osteochondritis dessicans. Tibio-talar joint stability is key in achieving long-term success of this implant which therefore requires intact soft tissue or reconstructable at time of implantation of HemiCAP. This device is proposed as part of an interim clinical strategy for patients who have failed previous treatments including injections, debridement and drilling of lesions. These patients are likely to receive a tibio-talar joint replacement or fusion in the future and the HemiCAP is recommended as a single use device. The effectiveness, safety and follow-up have yet to be established for this surgical method.

We present our follow-up case series of this novel technique in the management of large talar dome defects where the patients underwent talar dome HemiCAP resurfacing surgery for osteochondral lesions.

Figure 3A and 3B Anterior posterior (A) and Lateral (B) radiograph of right ankle at 3 year follow-up in Case #1.

The surgical technique is described and surgical outcomes are reported at a medium-term follow up (average of 3 years).

Case Reports

Case # 1

A 43 year old signal engineer presented with a three year history of severe deep seated bilateral ankle pain. Previously, 20 years ago he had suffered a right ankle fracture which was managed conservatively. Since this injury he had been experiencing pain in his right ankle, which was managed with analgesia, without impairment to his mobility. No previous injury was noted in his left ankle. In the last three years, however, his right ankle pain had gradually worsened and on presentation he was experiencing symptomatic pain while exercising and during night-time.

During this three year period his left ankle had also become symptomatic and he was suffering with exercise and night-time pain similar to his right ankle.

Examination: He had normal hind-foot alignment and was capable of single and dual heel raise stance. He had difficulty getting into the squatting position due to pain anterior in both his ankle joints. He was tender bilaterally on the medial side of the ankle joint. There was no subtalar joint tenderness. The forefoot and mid-foot examination were normal.

Investigation: Plain weightbearing radiographs revealed osteochondral defects on both tibio-talar joints over the medial side of the talus. (Figs. 1A and 1B)

Right Ankle magnetic resonance imaging (MRI) scan revealed: an area of osteochondral damage on the medial corner of the talar dome measures approximately 1.5cm in surface area, involving the superior and medial surfaces. Two small (5mm) subchondral cysts were present, but no loose osteochondral fragment was seen.

Left Ankle MRI scan revealed a similar lesion to his right talus with an area of osteochondral damage to the medial corner of the talar dome measuring approximately 1.5cm in surface area.

Right ankle surgical management

His right ankle was most symptomatic at presentation and he underwent right ankle arthroscopy and debridement nine months after initial presentation. Post operatively he still continued to suffer with pain within his right ankle. A computed tomography (CT) scan three months following surgery showed zones of established osteochondral damage in the medial aspect of the talar dome and sizeable subchondral cysts were seen. (Figs. 2A and 2B)

He underwent further right ankle arthroscopy and debridement eleven months following previous surgery due to continued pain. Following revision arthroscopic debridement he continued to complain of severe pain in the right ankle.

Figure 4A and 4B Anterior posterior (A) and Lateral (B) of left ankle radiograph at 3 year follow-up in Case #1.

Following the unsuccessful relief of his symptoms after 2 attempts of arthroscopic debridement and drilling, a HemiCAP prosthesis (Arthrosurface Inc) was fitted for his symptomatic right talar defect 30 months following initial review. (Figs. 3A and 3B)

Left ankle surgical management

He underwent ankle arthroscopy and debridement of his talar dome defect 13 months after initial presentation (4 months following his right ankle arthroscopy). He had continued pain in this ankle at 11 months follow-up from his arthroscopy. His right ankle pain still being more symptomatic than the left and the decision was made to proceed with talar dome resurfacing with the HemiCAP prosthesis on the right prior to contemplating a similar procedure on the left. 6 months following a successful insertion of the HemiCAP prosthesis on the right and 36 months following initial presentation he underwent insertion of the HemiCAP prosthesis on the left talar dome defect. (Figs. 4A and 4B)

Case # 2

A 55 year-old man with a four-year history of increasing pain in the anterior aspect of his left ankle. He was previously treated with an ankle arthrotomy and debridement of his ankle joint six years prior to presentation for a similar pain.

Figure 5A and 5B Anterior posterior (A) and lateral (B) radiograph of Left ankle at 3 year follow-up in Case #2.

Examination: He was able to single stance heel raise on his left side, his ankle movements were unrestricted and pain free, but he was tender over the antero-medial joint line.

Investigation: His plain radiographs showed an osteochondral lesion over the medial aspect of the talar dome. A CT scan confirmed an osteochondral lesion visible on the talar dome approx 10mm by 12mm in the coronal plane, and a kissing lesion visible in the subchondral bone of the tibial plafond measuring about 8 mm in diameter. The articular cartilage was intact and there was no joint effusion.

He underwent an ankle arthroscopy and debridement of adhesions and anterior synovitis four months after his initial presentation. Post operatively he continued to experience pain within his left ankle and began to receive steroid injections (Depo-Medrone and Marcaine) to the joint at his three monthly review visits. Although he had some initial relief with the injections, his pain persisted and gradually his mobility worsened. A HemiCAP prosthesis (Arthrosurface Inc) was fitted to his left talar defect 16 months following his initial presentation. (Figs. 5A and 5B)

Operative technique

Both patients underwent general anaesthetic with the use of intravenous antibiotics prior to inflation of limb tourniquet. The patients were positioned supine. HemiCAP prosthesis was inserted in these cases by first performing a medial malleolus osteotomy. A curved skin incision was performed over the medial malleolus which was pre-drilled to allow two lag screws prior to creating the osteotomy. The medial malleolus osteotomy was performed at an angle of 30 degrees relative to the long axis of the tibia to expose the talar dome defect.

The defect was debrided using a drill guide and the guide pin was advanced into the center of the defect. A cannulated drill and then screw (taper post) was placed into the defect. A trial cap was then placed on top of the taper post to confirm that it was inserted to correct depth to allow the cap to lie flush or slightly below the existing articular cartilage.

A centering shaft was then placed over the taper post and then a contact probe placed over the centering shaft to allow the probe to obtain offsets at the 4 indexing points. This allows the correct articular component according to the sizing card to be selected.

Once the centering shaft was removed and replaced with the guide pin, the circle cutter was advanced onto the articular surface. According to the measured offsets the appropriate surface reamer is selected. The surface reamer is then driven over the guide pin until it contacts the top of the taper post.

A sizing trial was then used to confirm the correct selection of HEMICAP articular component. The articular component held in the implant holder by suction is then inserted onto the taper post and impacted to engage the taper interlock. The osteotomy was then fixed with two 3.5 mm lag screws and wound closed with sub-cuticular suture.

All patients were mobilized non-weight bearing in a plaster cast for a period of 6 weeks and then protected weight bearing until 3 months post-operatively in a walker boot. At 6 weeks post-operatively, radiographs were performed to confirm consolidation of the medial malleolus osteotomy. All three cases were performed by the senior author AB.

Outcomes

All cases had routine post-operative clinical follow-up at 2, 6, 12 weeks, 12, 24, 36 months and were assessed clinically for the pain, ROM and wound problems.

All wounds healed without complication. One case had delayed union of his medial malleolus osteotomy which achieved bony union at 5 months post-operatively. He was mobilized protected weight bearing for 4 months in a walker boot. No other complications were observed or reported at 3 year follow-up for all cases.

Serial radiographic assessment was performed to observe any signs of metal work loosening and osteolysis of the tibio-talar joint.

Full ROM of tibio-talar joint was achieved in all cases 4 months post-operatively under physiotherapy guidance. Mean follow-up period was 38 months (range 36 to 41 months).

Results

Improved patient scoring after surgical implantation of a HemiCAP talar dome resurfacing device was noted in all cases. Kaikkonen score noted an improvement by 25-35 points and this was maintained at the 3 year review. An AOFAS scoring improvement of 39-44 points was also observed and maintained at the 3 year follow-up. A 3 point reduction in VAS pain scoring was also demonstrated after surgery. (see Table 1). All patients returned to routine daily activities and work by 5 months post-operatively.

	VAS (0-10) 10 = worst			AOFAS (Max 100)			Kaikkonen (Max 100)		
	Pre-op	1 year	3 year	Pre-op	1 year	3 year	Pre-op	1 year	3 year
Case 1	9	5	6	43	84	77	30	55	55
Case 2	8	5	5	41	85	85	30	65	65
Case 3	8	5	5	47	86	85	30	65	65

Table 1 Patient VAS, AOFAS and Kaikkonen scores for 3 year follow-up.

Discussion

Talar dome injuries have been known by different names – osteochondritis dissecans (OCD), osteochondral fractures, transchondral fractures, flake fracture, chip fracture, and osteochondral lesions of the talus(OLT) [8,9,10,11]. Many believe the disagreement over the etiology of the lesion is responsible for the different terms of description for the same lesion [8]. The anterolateral and posterior medial aspects of the talar dome are the most frequently affected areas in males especially in the second to fifth decades of life [10,12].

The etiology in most cases is now believed to be trauma [8], however ischemia, embolic, endocrine, accessory centers of ossification and genetic/hereditary factors have been proposed [8,9,10,11,12,13,14]. Trauma is considered by most investigators as the commonest cause of lateral talar dome injuries [8, 13, 14]. The trauma could be direct or repetitive (micro-trauma). Conversely about 80% of medial injuries are not accompanied by a clear history of trauma [12,13]. Of the three cases in our series, one had an initial history of an ankle fracture and the others had no clear history of trauma to the affected ankle joint.

The clinical presentation varies from asymptomatic to pain with activity, stiffness, swelling, restricted range of motion, locking, crepitus, weakness, instability and occasionally a palpable loose body [8, 13].
Plain radiographs, CT scan and MRI are important image modalities for the diagnosis and staging of talar dome injuries, another key element being a high index of clinical suspicion [8,15].

Current literature suggests arthroscopic debridement and bone marrow stimulation (i.e. drilling and micro fracture) as the first step in the surgical treatment of symptomatic lesions smaller than 15mm [16,17].

Verhagen, et al. conducted a systematic review of 39 studies describing their results of treatment strategies for OCD of the talus [18]. Their review found no randomized clinical trials (RCT), fourteen studies described the results of non-operative treatment (NT), four reporting results of excision alone, ten studies showing results of excision and curettage (EC), twenty one illustrating results of excision, curettage, and drilling (ECD), two reporting on results of cancellous bone grafting after EC, one commenting on results of osteochondral transplantation, three studies reviewing the results of fixation and one study on the results of retrograde drilling. The average success rate of NT was 45%. Comparison of different surgical procedures showed that the highest average success rate was reached by excision, curettage, and drilling (ECD; 86%), followed by excision and curettage (EC; 78%) and excision alone (38%). On the basis of this systematic review, they concluded that NT and excision alone were not to be recommended in treating talar OCD, both EC and ECD were shown to achieve good/excellent results at this time [18].

The more recent evidence, however, shows that EC and ECD are very beneficial for a lesion less than 15mm and ineffective in bigger lesions [18]. While the modern standard treatment of arthroscopic debridement combined with drilling or micro-fracture can be effective in smaller lesions, many surgeons have begun to seek alternatives for larger and more problematic lesions[18]. Osteochondral lesions of the talus that remain symptomatic following arthroscopic debridement pose a particular challenge.

In a randomized controlled trial by Gobbi, et al.,[19] comparing the outcome in various surgical treatments of osteochondritis of the talus (chondroplasty versus microfracture versus osteochondral autologous transfer (OATS)); of the 33 ankles in 32 patients reported, 11 had chondroplasty, 10 ankles(9 patients) had microfracture and 12 ankles had OATS, treatment group outcomes were measured using the American Orthopaedic Foot and Ankle Society (AOFAS) Ankle-Hindfoot Scale (AHS), the Subjective Assessment Numeric Evaluation (SANE) rating, Numeric Pain Intensity (NPI) and magnetic resonance imaging (MRI). Golbi [19] found that at 24 hours post operatively patients in the OATS group had a higher numeric pain intensity score (NPI) with a mean score of 5.25, compared to chondroplasty and microfracture with means of 3.3 and 3.4 respectively. At the mean follow up time of 53 months there was no difference between the AOFAS AHS and the SANE rating for all of them and no significant difference in complication rates, with the most common complication being persistent pain across all groups.

Pearson's correlation analysis demonstrated an inverse relation between microfracture and OAT groups in that better outcome was associated with smaller lesions, compared with the chondroplasty group, which revealed mixed results with no particular trend [19]. These findings correlate well with the findings in the two patients in our report. On the AOFAS AHS, they both scored very highly, 86 and 84 respectively with one being pain free and the other having a 70% reduction in pain.

In their letter to the editor, Von Bergen, et al. upheld the notion that OATS is regarded as an effective salvage procedure, therefore an alternative for patients with failed previous procedures [16].

Chang and Lenczner reported on a case of osteochondritis dissecans treated with an osteochondral autograft and concluded that despite a successful clinical outcome in the patient, radiologically there was still a notable defect and this incongruity of the talar dome was attributed to settling of the graft [13].

Whether the persistence of the defect in time will affect the functional outcome and thus the effectiveness of the autograft technique in surgical treatment of the talar dome lesions is difficult to tell as this has not been reported or studied.

Conclusions

The search continues for better surgical technique and effective management of larger talar dome lesions. We present the first prospective case series for talar dome OCD resurfacing with the use of the HemiCAP device with medium term follow-up. One published case report of this device with 2 year follow-up has been published with similar results [20]. Our study highlights this technique as offering good clinical outcomes for surgical management of large talar dome lesions at medium term follow-up.

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