CHAPTER **35**

MOSIACPLASTY OF THE TALUS

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Osteochondral lesions of the talus have been referred to as osteochondritis dessicans, transchondral fractures, osteochondral defects, talar dome fractures, or flake fractures. This entity combines a cartilaginous segment along with an osseous fragment or underlying subchondral deformation or cystic formation. They may be caused by traumatic or nontraumatic etiologies.[1]

Berndt and Harty published their classic manuscript on transchondral fractures in 1959.[2] They reported on the mechanism of injury, staging of the fractures, morphological presentation, the frequency, and treatment recommendations. They described two classic locations, one on the medial and the other on the lateral talar dome. The medial talar dome lesion occurred in 56.3% of cases while the lateral talar dome lesion occurred in 43.7%. The mechanism of injury for the lateral talar dome osteochondral fracture is a forced inversion of the foot while it is dorsiflexed in the ankle joint. This results in a lateral ligamentous disruption allowing the superolateral aspect of the talus to strike the lateral malleolus resulting in an avulsion fracture. This produces a shallow, wafer-shaped fracture of the lateral superior surface of the talus that is located on the anterior 1/4 to 1/3 of the talar dome. The medial talar dome osteochondral fracture is created by a forced inversion of a plantarflexed foot combined with external rotation of the tibia. The resulting impaction of the posterior 1/3 of the medial talar dome produces a deeper, cup-shaped lesion. A lateral ligamentous disruption is not normally observed. The lateral talar dome fracture is usually associated with a traumatic event while the medial talar dome lesion can have a traumatic or nontraumtic mechanism.

Berndt and Harty[2] described four stages of osteochondral fracture. Stage I is an impaction of the subchondral bone and is usually not visable radiographically. However, the cartilaginous impaction can be recognized during arthrotomy or arthroscopy. Stage II is an incomplete fracture. Stage III is a complete fracture that is nondisplaced. Stage IV is a complete fracture that is displaced. It may be displaced with elevation in its crater or be completely displaced out of its crater and free within the joint. They recommended conservative management of lateral osteochondral lesions stages I and II along with medial lesions stages I, II, and III. Surgical management was recommended for lateral lesions stages III, IV, and medial lesions stage IV. While their staging for acute osteochondral fractures is accurate, it does not completely explain some chronic or nontraumatic lesions. Some chronic defects present with cystic lesions below the articular cartilage. With the advent of MRI and arthroscopy, an attempt has been made to further classify these lesions. Taranow et al[3] reported on the University of Pittsburgh MRI grading. Stage I is subchondral compression or bone bruising on T2 weighted images. Stage II is manifested by a subchondral cyst and is a chronic situation. Stage III demonstrates a partially or fully detached fracture that is nondisplaced. Stage IV involves a displaced fracture.

The conservative management of acute osteochondral fractures has been cast immobilization with non-weightbearing for 6-8 weeks. Chronic lesions have also been treated with cast immobilization as well as bracing, physical therapy, nonsteroidal anti-inflammatories, and activity modification.

The surgical management of an acute osteochondral fracture is normally excision of the fragment or microfracture of the defect. This results in a defect that will hopefully be repaired by a fibrocartilaginous resurfacing phenomen. On occasion, the osteochondral fracture can be reduced and internally fixated with a mini-fragment screw to restore a congruous articular surface.

The surgical management of a chronic osteochondral fracture can be excision of the fragment either in an open procedure or arthroscopically followed by drilling, abrasion, or microfracture of the defect, antegrade or retrograde drilling with bone graft, and mosiacplasty.[1-5]

The big question is under what circumstances does one employ the various techniques to repair a chronic osteochondral defect. Cartilaginous and osteochondral lesions that are of a small size can

respond well to excision of the cartilaginous or osteochondral fragment followed by microfracture of the defect. If the osteochondral defect has a viable cartilaginous flap tear with a cystic defect, then the articular flap can be elevated with the lesion being debrided from an antegrade direction, bone grafted, and the flap of cartilage stabilized with an absorbable pin. If the cartilage is viable over a cystic lesion, then retrograde drilling and bone grafting is a good choice. Mosiacplasty should be reserved for those cases that have both a large cartilaginous and osseous defect or to cases of failed fragment excision and drilling or microfracture of the defect.

As reported by Hangody et al[3,4] the mosiacplasty technique resects the degenerated cartilaginous/osseous defect and replaces it with a composite graft of new cartilage and bone. The graft can be autogenous or allogenic. Mosiacplastic technique is performed with specific instrumentation. The osteochondral defect is visualized, either through arthrotomy or malleolar osteotomy, and the size of the lesion is measured. If a malleolar osteotomy is required, it must be oblique (superiorly oriented) in configuration to allow for proper orientation of the mosiacplasty instrumentation. Sometimes, a malleolar osteotomy can be avoided by notching the tibia or in cases of a more posteriorly located lateral lesion, by deattaching the fibular collateral ligaments. A decision needs to be made if the defect will be reconstructed with a single graft plug or multiple plugs. The osteochondral defect is now excised in a cylindrical fashion with the appropriate harvester going to a depth below the lesion usually to about 10-15 mm. The talus can be quite dense and require significant force with the mallet to reach the correct depth. It is crucial to penetrate sclerotic, avascular bone to allow for vascular ingrowth and consolidation of the graft. At this point, quickly rotate and gently toggle the harvester to separate the degenerated osteochondral plug and remove. The resulting hole is made uniform with a sound and the depth measured (the sound is marked in millimeters).

The next step is to harvest the donor graft with the appropriate harvester to the same depth as the defect created in the talar dome. This can be an autogenous graft taken traditionally from the ipsilateral knee or talus. It can also be taken from a cadaveric talus. The harvested graft is one millimeter greater in diameter than the defect plug that was excised. The donor graft is then gently impacted into the defect in the talar dome. Because the donor graft is one millimeter thicker that the defect, it is secured by a press fit and requires no fixation. Be sure to place the graft at the appropriate angle. If multiple grafts are required then repeat the process until the lesion is reconstructed. One problem that can arise with this sequence is that the donor plug, if it breaks prematurely will be too short. This situation can be rectified by harvesting some cancellous bone locally from the tibia and packing it into the recipient hole to make it the proper depth. For this reason, the other option is to take the donor graft first and then create the recipient defect in the talar dome to the depth of the donor graft.

There are numerous unanswered questions regarding the mosiacplasty technique.

1. Is it better to use one large graft or multiple smaller ones? For defects one centimeter or smaller one plug can be used. For larger lesions, multiple plugs must be used.
2. What should be the source of the donor graft? Traditionally it has been taken from the patient's ipsilateral knee either with an arthrotomy or arthroscopically. It is taken from along the superolateral femoral condyle or the intercondylar notch. One or multiple grafts up to one centimeter can be taken from these locations. The potential problem is that a normal knee may now become symptomatic. There are several locations on the talus that a smaller graft can be taken. These areas include the articular surfaces on the medial, superior, and lateral aspects of the talus anteriorly. This has the advantage of taking the graft from the symptomatic ankle. The disadvantage is that only smaller grafts can be taken. The donor graft may be taken from a cadaver talus. This can be a cryopreserved talus or a fresh specimen. The advantage is that the talus is size matched so the graft can be taken from the same location as the defect. This aids in the alignment of the graft with the surrounding cartilage. Multiple grafts can be taken. No additional joint is traumatized. The disadvantages include the viability of the articular cartilage and the incorporation of the graft. Another disadvantage is the cost of the allogenic talus.
3. Do you leave the donor grafts proud or flush with the surrounding cartilage? The cartilage from the knee can be 1-3 mm thicker than the

cartilage on the talus. It is also more compressible. Therefore, knee grafts need to be left elevated slightly. Grafts taken from the talus that match the thickness of the remaining articular cartilage and should be seated flush.

4. How congruous can you actually make the reconstructed articular surface and how congruous does it have to be? The talus is convex from anterior to posterior and concave from medial to lateral. Also the shoulders of the talus are convex in both directions. Is it easier to restore the complex geometry of the talar dome with one graft or multiple grafts? There are questions how to best reconstruct the shoulder of the talus. Should one just reconstruct the superior surface and leave the side walls or should the grafts be angled? Should the shoulder be reconstructed with an enblock resection and replaced with a similarly shaped allogenic graft?
5. What is the best postoperative course? How long should the patient be immobilized and when should range of motion exercises be initiated? How long should the patient be non-weightbearing?

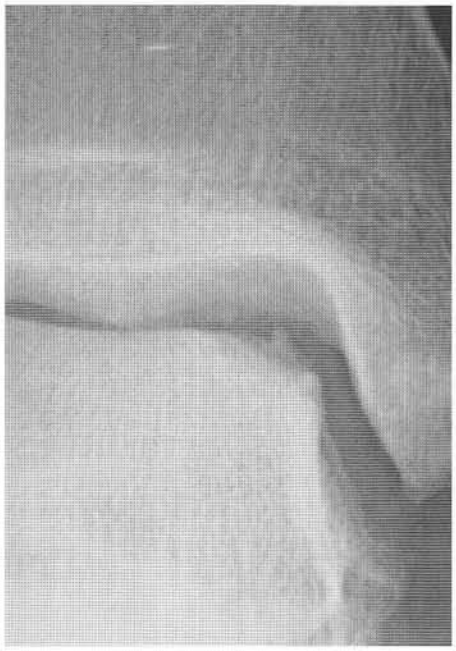

Figure 1. AP view of chronic medial talar dome osteochondral lesion.

Figure 2. Computed tomography scan demonstrating the lesion.

Figure 3. Repair of medial talar dome lesion with mosaicplasty technique utilizing two autogenous osteochondral grafts taken from the ipsilateral knee and approached through a medial malleolar osteotomy.

Figure 4. AP postoperative view of mosiacplasty and internal fixation of the medial malleolar osteotomy.

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