CHAPTER **38**

TRANSCHONDRAL FRACTURES OF THE TALUS

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Transchondral fractures of the talus are becoming more easily recognized by foot and ankle specialists, due to their increased awareness. Unfortunately most patients with traumatic ankle injuries are initially treated by emergency room or internal medicine physicians which often results in a delay in diagnosis. When these injuries are not initially recognized and treated, they often progressively deteriorate. This delay may result in prolonged disability, compensatory injuries, and may necessitate an ankle arthrodesis in the future.

The etiology is usually traumatic, and is particularly common after inversion ankle sprains. Most reports have demonstrated that conservative management is successful in less than 20% of the cases,[1-6] although there are some reports which demonstrate good results.[7-9] There has never been a controlled long-term study on conservative management of these injuries. Good results seem to depend on the size and depth of the lesion, the condition of the cartilage, and the presence of associated problems such as synovitis, soft tissue masses, or tibial plafond lesions. This paper will include an update on current concepts and techniques in the surgical management of transchondral fractures of the talus.

SURGICAL MANAGEMENT

Surgical management is indicated when large transchondral defects or loose bodies are present. Patients who have not responded to conservative management may also be appropriate candidates. Most transchondral fractures can be treated arthroscopically with or without an ankle joint distractor, depending upon the location of the lesion. An ankle arthrotomy is often performed in patients with tibial plafond lesions which may necessitate bone grafting; situations where open reduction internal fixation of the fracture fragment is being considered, and also in some posterior lesions.

With chronic talar dome injuries, there is often associated pathology such as ankle joint synovitis or adhesive capsulitis. An arthrotomy is often ineffective in managing these secondary deformities. One may consider performing an ankle arthroscopy prior to an arthrotomy in an effort to more effectively eliminate the associated soft tissue pathology.

For lesions of the central to posterior medial talar dome, the authors prefer performing a medial malleolar osteotomy for direct visualization. An inverted chevron-type osteotomy (apex proximal) provides a more inherently-stable configuration than the transverse osteotomies. The incisional approach is placed centrally on the malleolus, bisecting the anterior and posterior colliculi. An axis guide is still helpful, directed from superior-medial to inferior-lateral, entering the ankle joint just above the medial bend of the tibia. Care must be taken to protect the posterior tibial tendon and neurovascular bundles both anteriorly and posteriorly to the malleolus. Fixation of the malleolus is achieved with either metallic or absorbable screw fixation (Figs. 1-6).

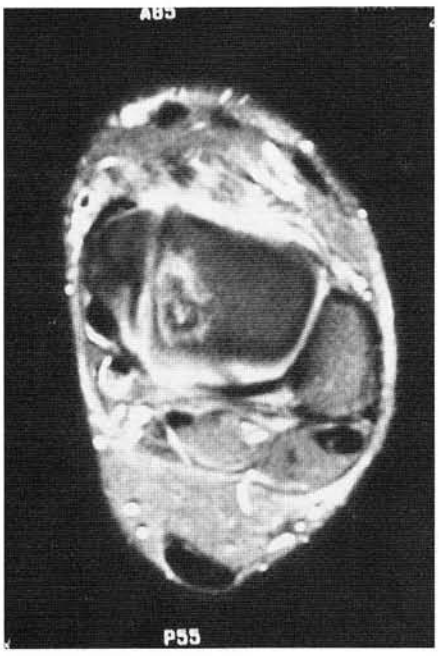

Figure 1A. MRI study of axial view showing a Stage II/III posterior medial lesion.

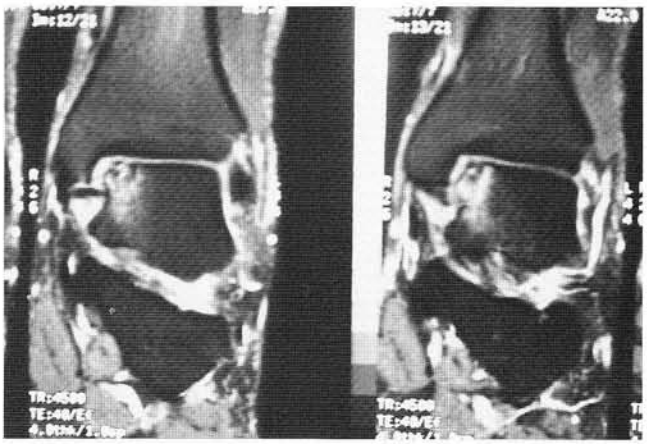

Figure 1B. Coronal view showing a Stage II/III posterior-medial lesion.

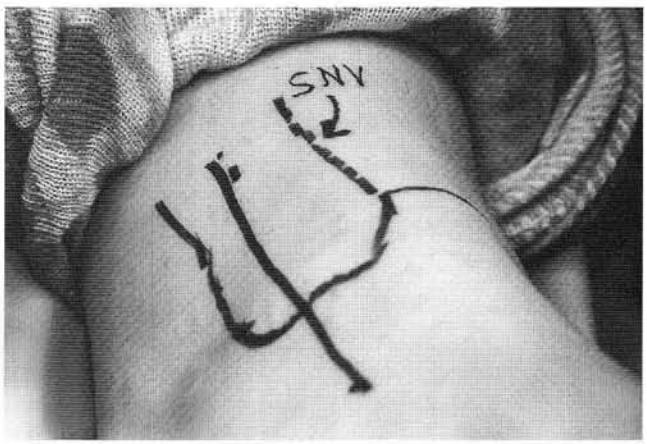

Figure 2. A central incisional approach on the medial malleolus is used. The saphenous neurovascular bundle is located anterior, and the flexor tendons posterior.

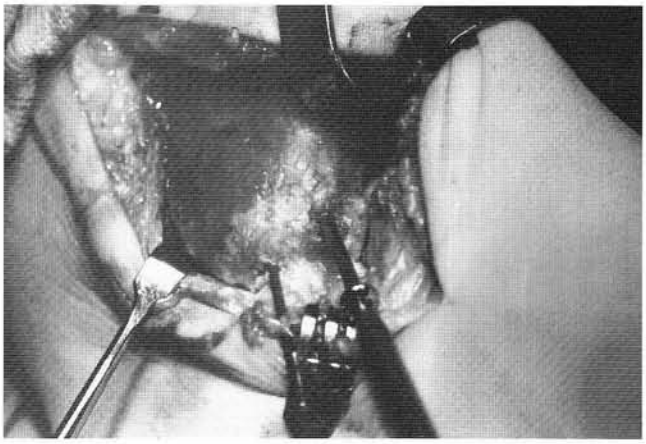

Figure 3. Two 4.0 mm partially-threaded cancellous screws are introduced prior to the malleolar osteotomy. This will guarantee perfect re-alignment of the malleolus and facilitate the fixation sequence at closure.

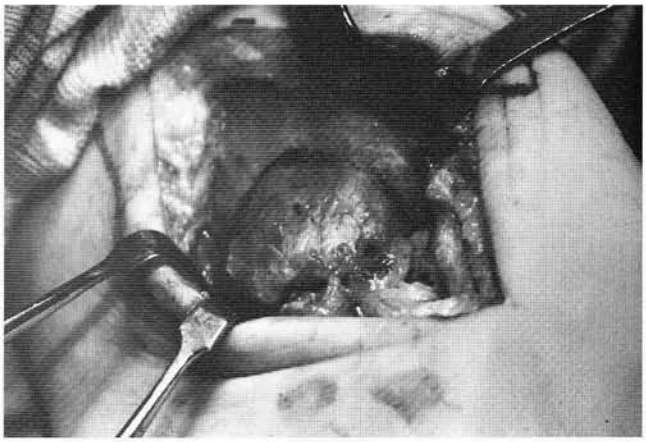

Figure 4. The Chevron osteotomy is used to give exposure to the posterior-medial talar dome. Note the Senn retractors are used to carefully retract the posterior tibial tendon.

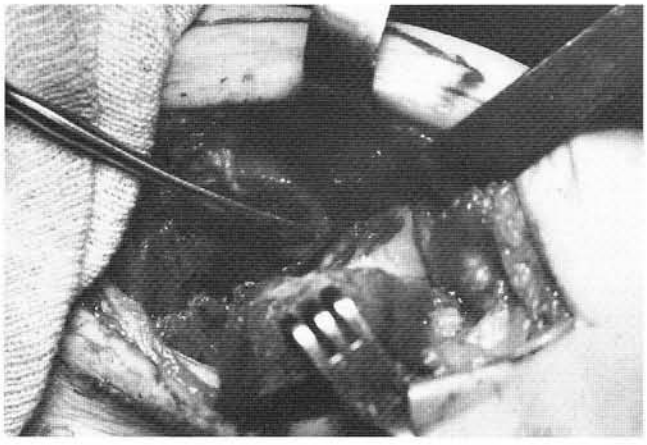

Figure 5. Direct visualization of the dome lesion is obtained, facilitating subchondral drilling or abrasion arthroplasty techniques.

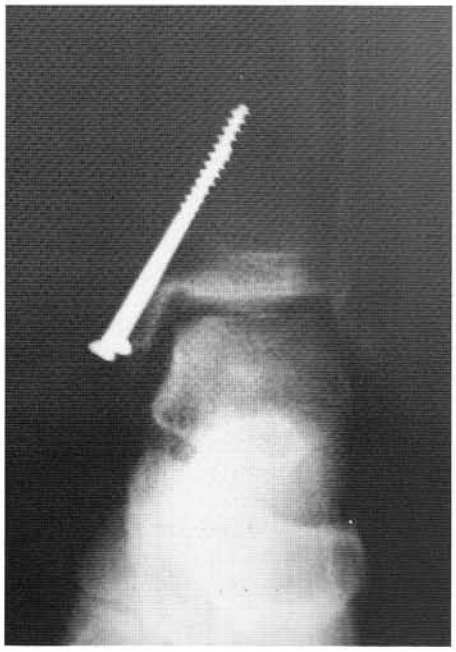

Figure 6A. Immediate postoperative AP radiograph. Note the alignment of the subchondral bone of the ankle as well as minimal visibility of the malleolar osteotomy.

Figure 6B. Immediate postoperative lateral radiograph.

Although Berndt and Harty described lesions in the anterior-lateral and posterior-medial aspects of the talar dome, the authors have also observed lesions located posterior-lateral and anterior-medial. Anterior-medial lesions can be approached fairly directly with either arthroscopic or open techniques. The posterior-lateral lesion deserves discussion. If the surgeon is comfortable with the arthroscope, then a posterior portal would facilitate direct visualization and treatment of this area. An ankle distractor may also assist with the approach.

In open situations, it is not advisable to perform a lateral malleolar osteotomy to expose this lesion. The lateral collateral ligaments do not allow the fibula to mobilize as easily as the medial malleolus does with the deltoid ligament. Transection of the lateral ligaments would require more immobilization in the postoperative period. A posterior-lateral arthrotomy provides direct visualization to this area. It is recommended that the surgeon stay just posterior to the peroneal tendons and retract them anteriorly, as the ankle joint is approached. The sural nerve is usually located posterior to the incision. Ankle dorsiflexion will provide full visualization to the central and posterior lateral dome for treatment (Figs. 7-12).

SURGICAL RESULTS

Most physicians will agree that a technically well-performed arthrotomy is preferred to a poorly-performed arthroscopy. Surgical results are difficult to interpret, due to the short follow-up period of most studies. Although the transchondral lesion may be repaired postoperatively, it is the quality of the new cartilage and the ability to maintain the cartilage in the future that determines the success of the procedure. If one considers a good result as being the ability to walk unlimited distances, experiencing mild pain with running or jogging, and not needing pain medication, the literature demonstrates similar results for both arthroscopic[10-14] and arthrotomy[5,9,15-17] procedures (Tables 1, 2).

CONTINUOUS PASSIVE MOTION (CPM)

Passive range of motion exercises are often recommended after abrasion arthroplasty or subchondral drilling techniques in the repair of a transchondral defect. Continuous passive range of motion (CPM) exercises by a physical therapist play a vital role in the postoperative plan.

Figure 7A. Preoperative lateral radiograph depicting a State II posterior-lateral lesion.

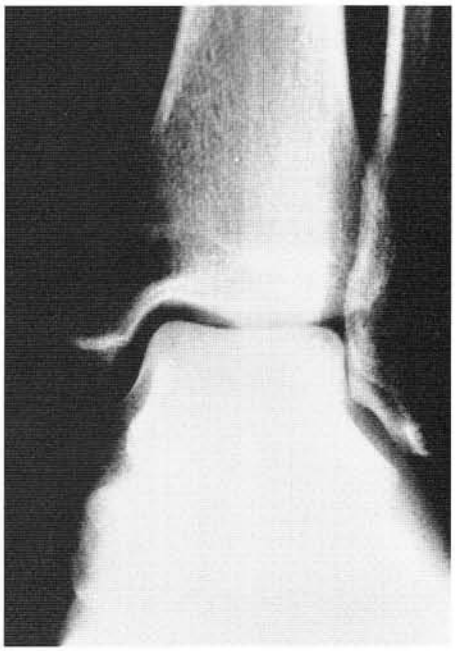

Figure 7B. Preoperative AP radiograph.

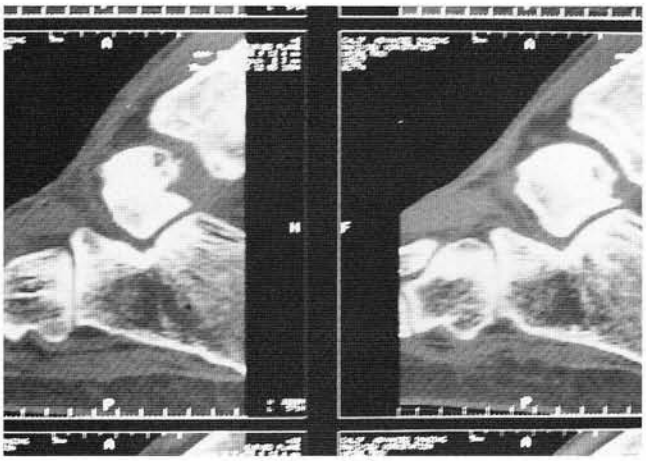

Figure 7C. CT scans confirm this unique posterior-lateral position.

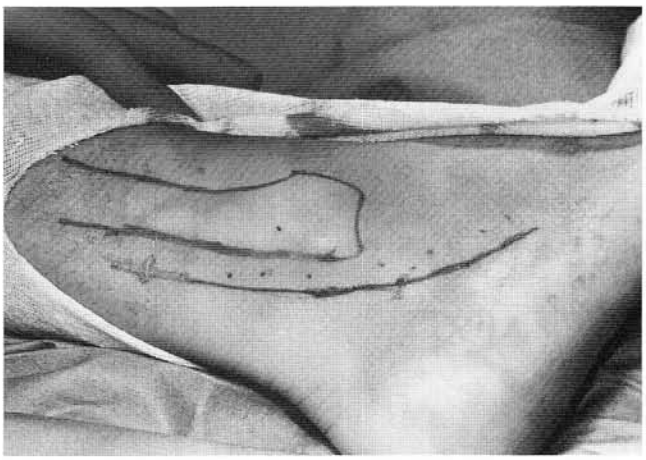

Figure 8. Hockey stick incisional approach between the peroneal tendons and the sural nerve.

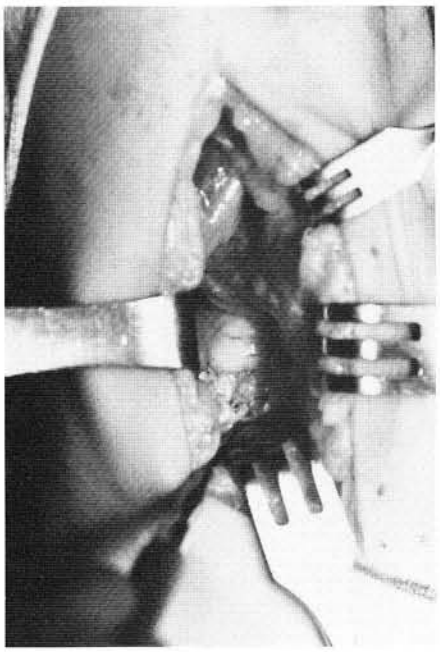

Figure 9. Exposure of the posterior lateral ankle after dissection through the capsule. Note direct visualization of dome lesion.

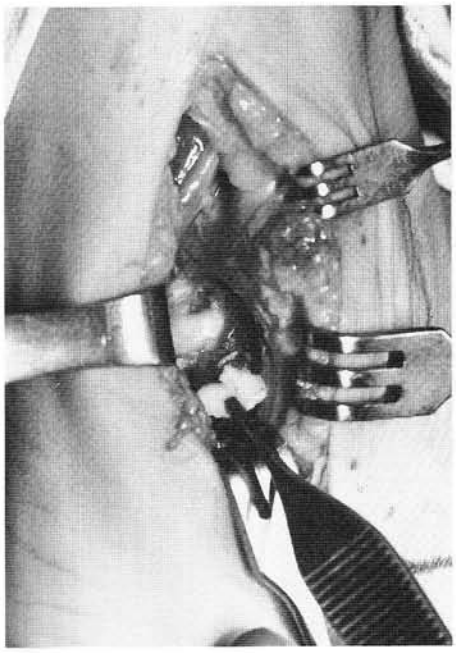

Figure 10. The damaged cartilage is removed to reveal a 1 cm lesion. The borders of the lesions are now resected sharply to healthy cartilage.

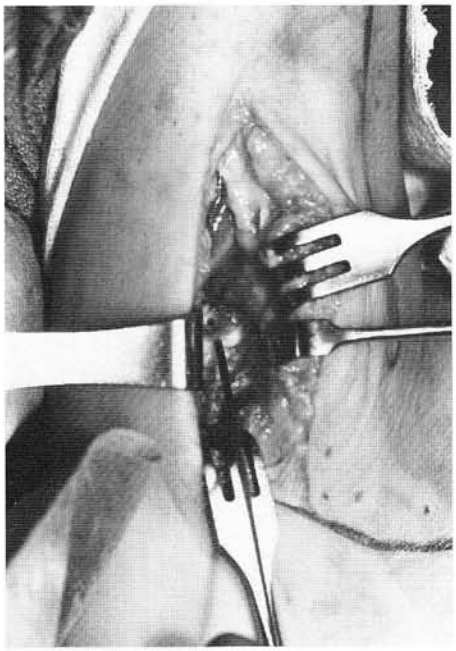

Figure 11. Example of subchondral drilling utilizing a K-wire.

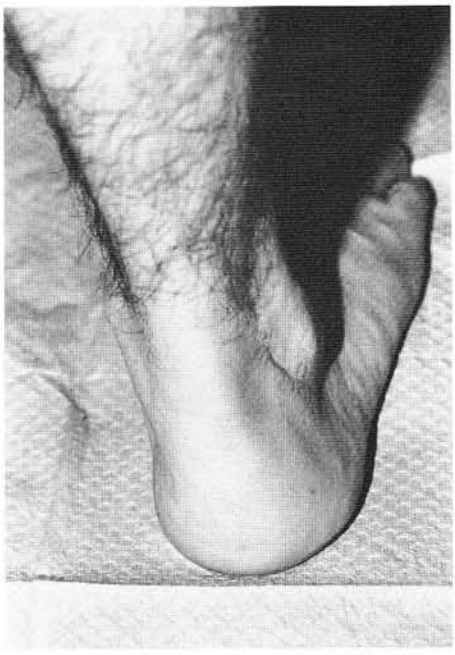

Figure 12. One year postoperative follow up. The patient relates a complete return to prior activities with 90-95% relief.

Table 1

ANKLE ARTHROTOMY RESULTS

STUDY	GOOD RESULTS*
Huylebroek (9)	12/16
Pettine (5)	16/28
Alexander (15)	22/25
O'Farrell (16)	15/24
Angerman (17)	17/20
Total	**82/113 (73%)**

*With a greater than four-year follow-up

Table 2

ANKLE ARTHROSCOPY RESULTS

STUDY	GOOD RESULTS*
Van Bueken (13)	13/15
Loomer (14)	25/38
Baker (11)	10/10
Pritsch (10)	18/24
Parisien (12)	17/18
Total	**83/105 (79%)**

*With a greater than four-year follow-up

In 1980, Salter[18] published his study on the effects of CPM, immobilization, and normal cage activity following transchondral defects in rabbit knees. There were 40 rabbits in each group and 10 rabbit knees were evaluated from each group at 1, 2, 3, and 4 weeks. The results demonstrated that 18% of the immobilized group had healed lesions consisting mostly of fibrous cartilage, while 15% of the rabbits who performed normal cage activities had healed lesions with mostly fibrous cartilage. Interestingly, 55% of the group who used CPM 24 hours-per-day had healed defects which consisted mostly of hyaline cartilage.

In 1982, Salter[19] published a one-year follow-up study which demonstrated a maintenance of hyaline cartilage at the transchondral defect site. In addition to an increase in hyaline cartilage formation, CPM often helps decrease postoperative edema, and enhances an earlier return to activities. This most likely occurs as a result of an increase in proteoglycan synthesis because passive motion seems to enhance an increase in hydrostatic pressure, ph, 02 tension, calcium concentration, growth hormone, cortisol, vitamin E, and ascorbate.[20]

When using postoperative CPM in patients without an osteotomy, the authors recommend beginning with 5 degrees of plantarflexion and 0 to 5 degrees of dorsiflexion. The range of motion is then increased during the second and third weeks. When using CPM with a malleolar osteotomy, the authors recommend beginning with 5 degrees of plantarflexion and 0 degrees of dorsiflexion. One would then increase the plantarflexion only in the second and third weeks. According to Salter[18] there are no appreciable changes in the formation of hyaline cartilage or the repair of defects with the use of CPM greater than a three-week period.

POSTOPERATIVE MANAGEMENT

An ankle arthrotomy for posteromedial defects often necessitates a medial malleolar osteotomy, unless performing a tibial plafond groove.[3] Fibular osteotomies are typically unnecessary for posterolateral lesions which can be treated with an anterior arthrotomy alone. When treating these lesions of the talus without an osteotomy, many physicians advocate immediate weight bearing, but it is the authors' preference to manage these patients in a Jones compressive dressing for 2 to 3 days, and then switch to a non-weight-bearing posterior splint for 3 weeks with crutches. During this three-week period it is critical to perform daily passive range of motion exercises with a physical therapist or with a CPM device. Patients then begin ambulating in a CAM walker for three additional weeks before returning to their regular shoes and daily activities.

In patients who require a malleolar osteotomy, the authors prefer to manage these patients in a non-weight-bearing posterior splint for six weeks, and then change to a weight-bearing CAM walker for an additional 3 to 6 weeks. Passive range of motion is typically started within the first week. Most patients are able to return to their daily activities in 3 to 4 months.

When performing these procedures arthroscopically most surgeons recommend immediate weight bearing.[10-14] The authors prefer to encourage the patients to begin partial weight bearing within the first week, and ambulate in a CAM walker for 3 to 4 weeks before returning to regular shoes. Passive range of motion exercises are begun immediately postoperatively. Most patients are typically unable to return to their daily activities for 6 to 8 weeks.

LATERAL ANKLE LIGAMENT INJURIES

It is common that patients with persistent ankle joint pain after an inversion ankle sprain often have a transchondral fracture of the talus. Hutchinson[21] reported that 31% of 112 chronically-symptomatic ankles had a transchondral fracture, and that 27 out of 35 had a talar tilt of 18 degrees or greater. Taga[22] reported that 29 out of 31 persistently-painful ankles demonstrated a transchondral fracture with arthroscopy prior to ankle stabilization.

Management of the patient after surgical repair of the lateral ankle ligaments usually follows a non-weight bearing immobilization regimen for the first three weeks. It is important to minimize early motion and allow the formation of scar tissue of adequate strength as the repair heals.

Subsequently, the patient is allowed minimal motion in the sagittal plane with protected weight-bearing from 4 to 6 weeks. In conjunction with talar dome repair, this poses an unique management dilemma. Ideally, the authors would prefer to achieve immediate range of motion following repair of transchondral injuries. Therefore, their current regimen consists of non-weight bearing for 4 to 6 weeks with CPM only in the sagittal plane. The authors emphasize only sagittal plane motion of 5-10 degrees for the first several weeks and only in the plantarflexory direction if an osteotomy is performed. The patient is then graduated to protective weight-bearing in a CAM walker for an additional three weeks.

CONCLUSION

Transchondral fractures can become a persistently painful-injury which may increase in size, and ultimately require an ankle arthrodesis due to the development of degenerative joint disease. Successful long-term results appear to be dependent on the size of the lesion and the time period after injury before diagnosis and treatment. Smaller lesions appear to heal more completely and remain asymptomatic. With earlier recognition and treatment by a foot and ankle specialist, one can strive for minimizing progressive deterioration by promoting hyaline cartilage formation. At this time the authors are uncertain as to the long-term maintenance of this cartilage. In a recent experimental study on rabbits, Takahashi[23] reported excellent results using cartilagenous-osseous grafts for the repair of transchondral defects. This may play a role in the future treatment of these injuries.

REFERENCES

1. Berndt AL, Harty M: Transchondral fractures (osteochondritis dissecans) of the talus. *J Bone Joint Surg* 41A:988-1020, 1959.
2. Davidson AM, Steele HD, Mackenzie DA, Penny J: A review of twenty-one cases of transchondral fracture. *J Trauma* 7:378-414, 1967.
3. Flick AB, Gould N: Osteochondritis dissecans of the talus (transchondral fractures of the talus): Review of the literature and new surgical approach for medial dome lesions. *Foot Ankle* 5:165-185, 1985.
4. Naumetz VA, Schweigel JF: Osteocartilaginous lesions of the talar dome. *J Trauma* 20:924-927, 1980.
5. Pettine KA, Morrey BF: Osteochondral fractures of the talus. *J Bone Joint Surg* 69B: 89-92,1987.
6. Cox HA, Kuwada GT: Transchondral fractures of the talar dome. *Clin Pod Med Surg* 12:667-687, 1995.
7. Canale ST, Belding RH: Osteochondral lesions of the talus. *J Bone Joint Surg* 62A:97-102, 1980.
8. Bauer M, Jonsson K, Linden B: Osteochondritis dissecans of the ankle. *J Bone Joint Surg* 69B:93-96, 1987.
9. Huylebroeck JF, Martens M, Simon JP: Transchondral talar dome fracture. *Arch Orthop Trauma Surg* 104:238-241, 1985.
10. Pritsch M, Horoshovski H, Farine I: Arthroscopic treatment of osteochondral lesions of the talus. *J Bone Joint Surg* 68A:862-864, 1986.
11. Baker CL, Andrews JR, Ryan JB: Arthroscopic treatment of transchondral talar dome fractures. *Arthroscopy* 2:82-87, 1986.
12. Parisien JS: Arthroscopic treatment of osteochondral lesions of the talus. *Am J Sports Med* 14:211-217, 1986.
13. Van Bueken K, Barrack RL, Alexander AH, Ertl JP: Arthroscopic treatment of transchondral talar dome fractures. *Am J Sports Med* 17:350-356, 1989.
14. Loomer R, Fisher C, Lloyd-Smith R, Sisler J, Cooney T: Osteochondral lesions of the talus. *Am J Sports Med* 21:13-19, 1993.
15. Alexander AH: Surgical treatment of transchondral talar-dome fractures (osteochondritis dissecans): Long-term follow-up. *J Bone Joint Surg* 62A:646-652, 1980.
16. O'Farrell TA, Costello BG: Osteochondritis dissecans of the talus: The late results of surgical treatment. *J Bone Joint Surg* 64B:494-497, 1982.
17. Angermann P, Jensen P: Osteochondritis dissecans of the talus: Long-term results of surgical treatment. *Foot Ankle* 10:161-163, 1989.
18. Salter RB, Simmonds, DF, Malcolm BW, Rumble EJ, Macmichael D, Clements N: The biological effect of continuous passive motion on the healing of full-thickness defects in articular cartilage. *J Bone Joint Surg* 62A:1232-1251, 1980.
19. Salter RB, Minster RR, Clements N, Bogoch E, Bell RS: Continuous passive motion and the repair of full-thickness articular cartilage defects-A one-year follow-up. *Orthop Trans* 6:266-267, 1982.
20. Mankin HJ: The response of articular cartilage to mechanical injury. *J Bone Joint Surg* 64A:460-466, 1982.
21. Hutchinson BL, Wardle DJ: Diagnosis and treatment of talar tilt and its relationship to the occurrence of transchondral fractures: A retrospective study. *J Foot Surg* 30:151-155, 1991.
22. Taga I, Shino K, Inque M, Nakata K, Maeda A: Articular cartilage lesions in ankles with lateral ligament injury. *Am J Sports Med* 21:120-127, 1993.
23. Takahashi S, Oka M, Kotoura Y, Yamamuro T: Autogenous callo-osseous grafts for the repair of osteochondral defects. *J Bone Joint Surg* 77B:194-204,1995.