

## Reconstruction of the calcaneal fractures (Kalkaneus kırıklarının rekonstrüksiyonu)

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*En önemli ayak yakınmalarından biri olan kalkaneus kırıkları arasında depresyon tipi ve dil tipi olanlar eklemi ilgilendirdiklerinden özellik gösterirler. Talusun kalkaneus üzerinde vertikal yüklenmesi sonucunda meydana gelirler. Depresyon tipi ile dil tipini ayıran en önemli özellik sekonder kırık hatlarının farklı olmasıdır. Cerrahi girişimin mümkün olan en erken zamanda yapılması gereklidir. Son çalışmalarda açık redüksiyon ve internal tespitin en iyi tedavi yöntemi olduğunu göstermektedir. Dil tipi kırıklar için L şeklinde, depresyon tipi kırıklar için sinus tarsi üzerinde lateral insizyonlar kullanılmaktadır. Deprese olmuş fragmanları eleve pozisyonunda tutmak için allogreft ve plak ile vidalar kullanılmalıdır. BU kırıklardan sonra gelişen kronik topuk ağrısı nedeni olan ve ihmal edilen plantar yağ yastığı hasarı göz ardı edilmemelidir.*

**Keyword:** Calcaneus fractures (kalkaneus kırıkları)

### Joint Depression & Tongue Types:

Probably the most notorious of all significant foot injuries-the fractures of the os calcis-is shrouded in a number of fallacies and medical "wives tales" (1). Recent advances in imaging with CT and our understanding of this injury now allows us the possibility of reconstruction of this severe injury, depending on type and severity (1, 2). Classifications are numerous, however number of major fragments and their orientations and displacements have generally become the industry standard for assessment and surgical considerations (2, 3). The classification of Essex-Lopresti remains the most commonly used classification (4). This discussion pertains only to the intra articular fractures of the "Joint Depression" type or "Tongue Type".

These fractures both involve a primary fracture line which fractures the os calcis into two major portions-the supero medial and body portion (5, 6). It is caused by shearing mechanics when the talus is loaded downward on the os calcis (7, 8). Because the talus has an eccentric position over the top of the os calcis, it causes the load to be "off center" and results in a shearing fractures with an oblique fracture line. On the lateral x-ray, this appears to be vertical starting at the sinus tarsi migrating downward to the plantar of the os calcis. On the axial x-ray, it shears the os calcis obliquely with a large medial over riding spike of bone that causes the shortening and lateral displacement of the main body of the os calcis after fracture. As the force continues, the talus is driven downward further into the calcaneus substance of the os calcis splitting the posterior facet and forcing the lateral wall of the bone outward, making a "lateral expansion deformity". The main difference between the "Joint Depression" type compared with the "Tongue Type" relates to where the secondary fracture lines occur (4). In joint depression type, the posterior facet is fractured posteriorly also and the anterior portion of the facet is driven downward (rotated downward) compressing the bone mass under the facet. The fa-

cet itself may be fractured into two or more pieces. The "Tongue Type" has a posterior secondary fracture line progressing toward the insertion of the heel cord and this large portion of bone is usually rotated up ward needs to be reduced at the time of surgery.

Any number of comminuted portions can result. In general, the more the comminution, the more difficult the fracture as far as surgical reduction is concerned and the less likely one is to obtain a good result post surgical due to massive disruption (2, 8). The less the comminution, especially along the medial wall, and the least considerations. Time of encounter is critical and generally, operation as soon as possible is the key. Encounter after about 8 hours usually means waiting severe pain and distention with neurological signs must be observed and monitored to determine if a compartment syndrome is developing. Open Reduction Internal fixation (ORIF) allows a spontaneous decompression to occur. If surgery as primary reduction is not being considered, then decompression by itself needs to be looked at as a method of treatment to prevent permanent damage to the foot. Medial arch splitting incisions or 3 linear longitudinals are both fine for the decompression.

ORIF is now best accomplished with screws and plate (1, 2, 3, 8). I perform the operation almost always entirely lateral through the lateral expansile "L" approach for Tongue type fractures and a low serpentine sinus tarsi approach for the Joint Depression type. Medial is dangerous and I believe offers little additional advantage since the visibility and access is so poor (2, 8). The key areas to cue in on are-the sub chondral bone under the posterior facet. This is the most dense bone and screws driven from lateral to medial into the sustentaculum offer good purchase. Plates can be self fashioned from 1/3 tubular or use of available H plates or calcaneal Fx plates are helpful. Occasionally, a self fashioned angled blade plate is made to reinforce the plantar "blowout". The critical aspect of the operation is restoration of the architecture of the os calcis including height and breadth, and



of course, articular restoration (2, 8). The posterior facet is often difficult to even locate since it is impacted and driven deeply into the substance of the os calcis and must be elevated with an instrument, supported with temporary k-wires, plated and bone graft support placed immediately underneath where a large defect is now noted. The calcaneal-cuboid joint needs careful evaluation to make certain that fissures have not extended into that region-commonly they do, even though x-rays in standard views may not show it (6). Specialized Brodens views are helpful in conjunction with CT scanning which is almost required for a proper surgical reconstruction of this injury.

The lateral wall "blow out" remains a problem even after joint restoration. The plate is necessary to re-establish the wall substance and act as a "washer" for some of the screws since they would otherwise have nothing against which to bite. The ORIF of the os calcis impaction fracture is a special skill and not intended for the novice fracture surgeon. It often requires bone grafting, perhaps allogeneic implant or autograft depending on the situation. We almost always use a freeze dried allogeneic femur head implant for the grafting material. The outcome must be a stable construct capable of active and passive ROM for rehab without fear of collapse or displacement. The soft tissue component to this injury is probably the most under-estimated aspect of calcaneal fracture. This includes fat pad disruption, which has been given lesser importance based on recent studies, but not eliminated as a source of chronic "heel pain" even after these injuries as an example, to provide some perspective as to the serious nature of these injuries. Permanent disability is a common sequelae from this injury, especially if it is a workers compensation claim (4, 9).

Rehabilitation of these injuries is often protracted and frustrating. Often, the x-ray result does not correlate with the clinical status of the patient. The largest current series of ORIF is from the Hanover, Germany clinical of Prof. Hans Zwipp and Sanders in Tampa, Florida. Their studies indicate value to ORIF which in the past has been seriously challenged. In any event, there is now a renewed interest in ORIF of this injury with the advent of newer technology for evaluation and osteosynthesis. Sub talar or triple arthrodesis remains the unchallenged salvage maneuver if all else fails "down the road". I prefer triple fusion rather than selective subtalar fusion.

## References

1. Paley, D. and Hall, H.: Calcaneal fractures controversies. Can we put Humpty Dumpty together again? Clin N Amer Vol 20, No 4: 665, 1989.
2. Sanders, R., Hansen, S. & McReynolds, I.S.: Trauma to the calcaneus and its tendon. Appears in Disorders of the Foot & Ankle, Ed. Jahss, 2nd Ed (Chapt 84) W.B. Saunders, 1991. Burdau, BD: Experimental os calcis fracture. Orthop. Transactions, Vol. 1, #1, May 1977.
3. Stephenson, J.R.: Treatment of displaced intra articular fractures of the os calcis using medial and lateral approaches, internal fixation and early motion. JBJS, 69A: 1 Jan. 1987.
4. Essex-Lopresti, P.: The mechanism, reduction technique and results in fractures of the os calcis. British J of Surg 39: 395-419, 1952.
5. Stephenson, J.R.: Displaced fractures of the os calcis involving the sub talar joint. The key role of the superomedial fragment. Foot & Ankle, 4: 91-101, 1983.
6. Carr, J., Hamilton, M.D. & Bear, L.S.: Experimental intra articular calcaneal fracture: anatomic basis for a new classification.
7. Palmer, I.: The mechanism and treatment of fractures of the calcaneus. Open reduction with the use of cancellous grafts. JBJS 30A:2, 1948.
8. Benirschke, S. and Sangeorzan, B.: Extensive intraarticular fractures of the foot. Clin Orthop Related Research 292: 128, 1993.
9. Thore, O.: Experimental os calcis fractures on autopsy specimens. Acta Orthop Scand (Suppl) 70, 1964.