CURRENT TREATMENT OPTIONS

Fix single column or both: Always fix both. A study by Svend-Hansen corroborated the poor results associated with isolated medial malleolar fixation in bimalleolar ankle fractures. 46% Poor results.

A landmark study by Pettrone [J Bone Joint Surg Am 1983;65A:667-677] established radiographic criteria for evaluating the adequacy of lateral malleolar reduction and syndesmotic disruption and then used these criteria to assess ankle fractures treated by medial malleolar fixation versus bimalleolar fixation. They concluded that the relative orders of importance for structures that require restoration are the lateral malleolus, medial malleolus, deltoid ligament, and finally the syndesmosis. Their conclusions were that anatomic reduction of bimalleolar fractures correlated with superior outcome and that the prognosis worsened as the number of deranged structures increased following treatment.

Phillips [J Bone Joint Surg Am 1985;67A:67-78] reported a prospective study of displaced ankle fractures with an acceptable closed reduction who were randomized to operative treatment or continuation of nonoperative treatment. Their conclusions stated that bimalleolar ORIF provided far superior results than closed treatment of ankle fractures.

In a loaded cadaver ankle model testing tibiotalar stability in bimalleolar ankle fractures, 6-mm lateral displacement of the lateral malleolus, there was no significant change on the contact area of the ankle as long as it was axially loaded. However, once the deltoid ligament was sectioned, all ankles showed a significant decrease in tibiotalar contact area. This result was consistent with the observation that the pattern of instability was not a straight lateral translation but rather anterolateral rotation underneath the tibial plafond..

Stable ankle fractures are therefore treated for 6 weeks in a supportive brace with weight bearing allowed as tolerated. [Weber's A and Some Weber's B]

Once an unstable ankle fracture is identified, a closed reduction is indicated as the first line of treatment. Once a satisfactory closed reduction is achieved, held in slab and X rayed. Timing of the surgery depends on the soft tissue status.

Close reduction: "Quigley's maneuver.": the lower extremity, at rest, with the body supine, lies in external rotation. Suspended by the great toe, then the ankle and foot being of much less weight and mass of the leg and thigh, fall into adduction, internal rotation and supination."

Timing. The major consideration with regard to surgical timing of ankle surgery is related to the status of the soft tissues.

A prompt closed reduction of a subluxed or dislocated ankle is imperative to stabilize the soft tissues. Clinical experience has shown that a reduced mortise will decrease articular damage as well as facilitate decreased swelling of the ankle.

The presence of blisters has also been taken into the consideration of timing. Fracture blisters occur because of strain at the dermal-epidermal junction secondary to fracture displacement at the time of injury. A complete separation of the dermal-epidermal junction (full thickness) presents as blood-filled blisters, whereas partial separation (partial thickness) presents as serous-filled blisters. The presence of blisters directly over the area of planed incisions has historically been a cause of surgical delay. A standardized protocol of blister unroofing and application of Silvadene cream has been shown to decrease soft tissue complications and promote re-epithelialization allowing surgery to proceed after a delay of approximately 1 week.

Breederveld evaluated the effect of surgical delay and found no difference in outcome, although a prolonged length of stay for the delayed group was cited.

Locked plating has been found to be advantageous in ankle fractures, providing increased fixation in the distal fracture fragment over conventional plating in osteoporotic bone.

Placing the fibular plate in the posterolateral antiglide position can be advantageous in osteoporotic patients.

In diabetic ankle fractures and noted a significantly high complication rate in insulin-dependent. The presence of vascular disease, neuropathy, and Charcot neuropathy, however, has been widely accepted as the most important predictors of complications in this patient population.

Results

The prognosis for most rotational **ankle fractures** appropriately treated is generally good.

Depends on:

1. Adequacy of reduction
2. The patient factors most predictive of functional recovery were found to be patient age, gender (males with better outcomes)
3. The presence of diabetes mellitus, and the ASA classification.

Lateral Malleolus Fixation

1. Commonest: lateral fibular plating or posterior plating of the fibula.
   1/3 plate; locking plate
2. Intramedullary fixation as well as isolated lag screw fixation.
3. Tension band fixation

The patient is most commonly positioned supine with a sand bag under the ipsilateral hip to ease access to the fibula. If a bimalleolar fracture is present, the bump should not be so large as to limit access to the medial aspect of the ankle. In circumstances where difficulty is encountered approaching the medial malleolus after fibular fracture fixation has been accomplished, the bump can be removed, which will allow external rotation of the limb and improved access.

The approach to the fibular shaft should be undertaken with caution as the peroneal muscle bellies as well as the peroneal nerve become more prominent and require extensive mobilization and soft tissue disruption. Periosteum is elevated approximately 1 to 2 mm from the fracture ends. Hematoma is removed from the fracture site by light curettage and gentle irrigation.

Pointed reduction clamp can then be used to gently restore both the length and rotation of the fracture and obtain compression at the fracture site. An assistant should facilitate the manual reduction via providing an indirect reduction force by pulling traction and providing rotation at the foot.

A lag screw perpendicular to the fracture line, obtaining primary compression at the fracture site. The rotational forces around the fracture line are then neutralized by placement of a one-third tubular plate. When the plate is applied laterally, the distal most screws must be kept unicortical to avoid penetration into the lateral gutter of the ankle joint. These distal screws may be cancellous screws.

In certain situations, the plate can be placed posteriorly. The advantages of the posterior plate are its antiglide function and the ability to achieve bicortical screw purchase distally without violating the ankle joint.
In fractures that are not comminuted, the antiglide position of the plate may allow for sufficient stabilization and the omission of distal screw fixation in addition to the lag screw. The main disadvantage of this approach is mobilization of the peroneal tendons and potential irritation of the tendons.
Long oblique and noncomminuted fracture patterns have also been successfully fixed with lag screws alone.
Intramedullary fixation of the fibula has also been described in the past with the main indications being noncomminuted fractures. Ideal fracture configurations are transverse.

Posterior Malleolus Fixation

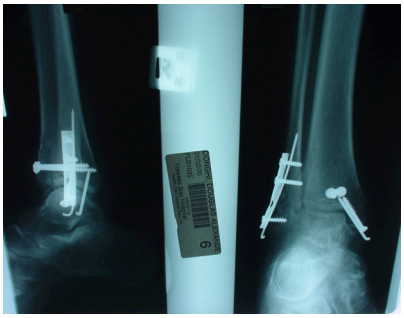
The posterior malleolus should be undertaken when 25% to 30% of the joint is involved.
Although the posterior malleolus fracture may occur as part of any rotational mechanism.
The posterior malleolus is important in stabilizing against posterior subluxation of the ankle.

length. The posterior malleolus has also been recently shown to contribute to the stability of the syndesmosis.

Outcome data on posterior malleolar fractures are sparse but it is worse than bimalleolar fractures. Even small posterior malleolar fragments may increase the risk of arthrosis.

Two techniques exist for posterior malleolus fixation. In one technique, the fracture line is directly visualized [Posterior approach] and instrumented, while in the other, an indirect reduction [anterior approach] is performed. The joint line is not directly visualized.

To obtain an adequate reduction via this method, the fibula must first be fixed and brought out to length, as this will also provisionally align the posterior malleolus. Once the posterior malleolus has been brought down by the fibula, it is compressed from anterior to posterior with a clamp. Lag screws can then be placed through small stab incisions from anterior to posterior to compress the posterior malleolus into position.



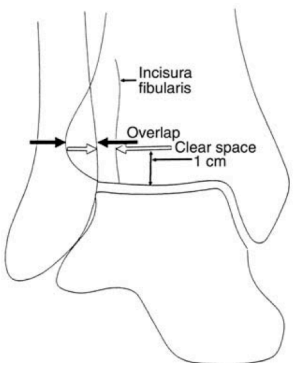
Indirect: Anterior to Posterior

Direct fixation of posterior mallelus

Syndesmosis [J Am Acad Orthop Surg 2007;15:330-339]

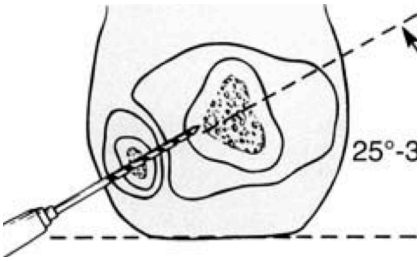
A rupture of the syndesmosis complex and instability at that articulation is a well-known feature of rotational ankle fractures. It is known that a syndesmosis injury can in fact occur in the absence of a fibula fracture or in the presence of a fibula fracture at the level of the joint. The ability to predict that a syndesmosis disruption is present based on current classification schemes is poor, and the surgeon must carefully scrutinize the injury to ascertain a syndesmotic disruption.

1. A manual stress test or a “cotton test”



Solari [J Orthop Trauma 1991;5:190-195.] shown that in a Weber C fracture model with syndesmotic disruption, fixation of the lateral and medial malleoli restored 73% of **ankle** stability. The addition of syndesmotic fixation increased stability to 100%.

Reduction of the syndesmosis



1. Fibula must be brought back out to length
2. Its rotation must be corrected to normal.
3. It is desirable to avoid over compression of the syndesmosis

[the talus is narrower posteriorly than anteriorly, and the plantarflexed posture allows for increased compression across the syndesmosis. This has been thought to cause overtightening of the mortise and loss of motion at the joint.

The concomitant presence of deltoid injury is an important factor leading to instability of the ankle joint.

Unfortunately, our ability to judge an accurate syndesmotic reduction intraoperatively is not as reliable as we once thought with a large proportion of syndesmotic reductions shown to be inaccurate.

The syndesmosis can be fixed using one or two screws; the screws can be placed either tricortically or tetracortically. The screws used can be either 3.5- or 4.5-mm screws. Most surgeons use 3.5-mm cortical screws; however, 4.5-mm screws are also used and are easier to localize and remove under local anesthesia in the outpatient setting. The larger screw also is less likely to break once the patient begins weight bearing on the leg. Tetracortical fixation is stiffer and more secure, and therefore those screws are more likely to break than to loosen compared with the 3.5-mm screws.

MEDIAL MALLEOLUS FRACTURES

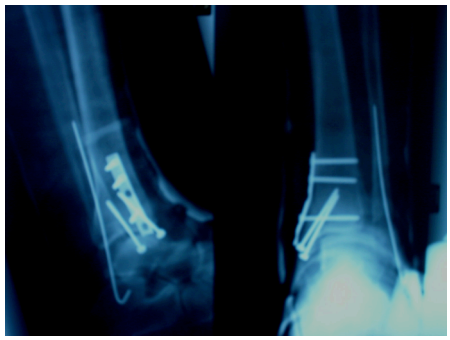
Fixation of the medial malleolus is critical for ankle stability in the setting of a bimalleolar ankle fracture and especially when associated with a syndesmotic injury.

1. When anteromedial articular surface communition is suspected use anterolateral approach.
2. Remove interposed periosteal which usually interposed in the fracture
3. Wash out of the joint: to remove any loose fragments.
4. With pointed reduction clamp reduce anatomically and fixed with K wires
5. Fix with 2 parallel 4.0 mm cancellous screw

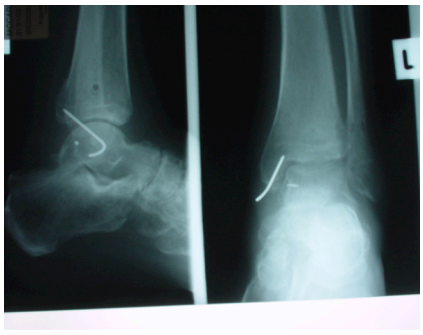
Shear-type fractures of the medial malleolus that are associated with SA fracture patterns may benefit from an antiglide type of construct along with intrafragmentary screws. Because of the direction of the fracture line, placement of screws from the tip of the medial malleolus proximally would cause displacement at the fracture site. In addition to an antiglide plate, screws oriented horizontally along the joint line can provide adequate compression at the fracture site at a line perpendicular to the fracture.

The radiographic position of implants within the medial malleolus must be examined closely to avoid intra-articular penetration. The mortise view that is often taken to assess implant position within the medial malleolus gives an inaccurate assessment of intra-articular penetration. The reason for this is the lack of parallelism between the medial and lateral talomalleolar spaces caused by the asymmetric shape of the talar dome (wider anteriorly than posteriorly).

Screw fix



Antiglide construct



Repair of Deltoid lig and K wire fix