

Evans Calcaneal Osteotomy And Cotton Osteotomy: Approach To The Pes Valgus Foot

Kieran T. Mahan, D.P.M.

INTRODUCTION

The Evans calcaneal osteotomy was first described by Dillwyn Evans as an approach for correction of the over-corrected clubfoot. The late Dr. Jim Ganley brought this procedure to the profession of podiatry through a surgical teaching film. Since that time, there have been many technical changes in the osteotomy. In addition, the indications for the procedure widened greatly, based upon its very successful use. Some of the technical changes in the Evans osteotomy have included a shift from autogenous to allogeneic bone, a shift from a linear incision to an oblique incision, and the increasing utilization of the procedure in other than transverse plane deformities.

With respect to the bone graft, freeze dried allogeneic bone has proven to be a very successful alternative to autogenous bone for this particular procedure. A variety of different types of allogeneic bone have been utilized, most commonly tri-cortical pieces of iliac crest. Although no one can dispute that autogenous bone has greater healing potential than allogeneic bone, use of the allogeneic bone reduces the morbidity caused by a second surgical site that is necessary to procure the autogenous bone. With respect to the skin incision, a linear incision provides excellent visualization of the lateral side of the calcaneus. The oblique incision however, follows the relaxed skin tension lines and results in a much finer scar. In addition, the osteotomy itself does not require a great deal of exposure and a linear incision is therefore unnecessary.

With respect to planal dominance, the Evans osteotomy was first used in the podiatric profession predominately for transverse plane flatfoot deformities. The concept of planal dominance involves a recognition that the axis of the subtalar joint is variable, and that any deforming force acting on that axis will produce different planes of compensation depending upon the predominant

axis of the subtalar joint. Therefore, a vertical axis of the subtalar joint will compensate with a transverse plane deformity and a transverse axis will compensate with a sagittal plane deformity. Because the Evans calcaneal osteotomy acts to create adduction of the foot, it has been most often thought of as a procedure primarily indicated for transverse plane deformities. With increasing utilization of the procedure came an expansion of the indications. This has led to experience which clearly shows that the osteotomy is successful in addressing other planes of compensation as well.

The Evans osteotomy is most commonly used in conjunction with other procedures. Mahan and McGlamry reported on a series of Evans calcaneal osteotomies done in conjunction with medial arch tendo-suspensions. This study documented the synergistic effect of the medial arch tendo suspension and the Evans calcaneal osteotomy. In particular, it was apparent that when the medial arch tendo suspension was combined with the Evans calcaneal osteotomy, there was a significant increase in the plantarflexion and stability of the first ray. This effect on the first ray most likely occurs secondary to stabilization of the lateral column, which allows the peroneus longus to more effectively pull down on the first ray. In addition, the tibialis anterior in effect is no longer inserting into the dorsal aspect of the first metatarsal. This allows the peroneus longus to function mostly unopposed. Medial arch tendo suspension is a powerful procedure, but it is time-consuming and technically difficult.

The Cotton osteotomy, in contrast, is a simple and quick procedure that also acts upon the medial column. The Cotton osteotomy is a plantarflexory osteotomy of the first cuneiform. The cuneiform is osteotomized leaving a plantar hinge intact, and a wedge-shaped bone graft is driven into the cuneiform, thereby plantarflexing the medial column. This procedure is much quicker to perform than the medial column tendo-suspension. The

purpose of this paper is to explore the effectiveness of this combination of procedures in dealing with the pes valgus foot.

TECHNIQUE

The Evans calcaneal osteotomy is approached through an oblique incision following relaxed skin tension lines. The incision is placed over the lateral side of the calcaneus, and centered about 2 cm proximal to the calcaneocuboid joint. The sural and the intermediate dorsal cutaneous nerves may run on the inferior and superior margins of the incision, respectively. Many times the intermediate dorsal cutaneous can be visualized preoperatively by plantarflexing and inverting the foot. When this is possible, the incision should be designed to avoid placement over the intermediate dorsal cutaneous nerve.

The incision is deepened through superficial fascia with ligation of 2-4 small venous structures. A moist saline sponge is then used to peel back the superficial fascia. This will facilitate later closure. An "L" shaped incision is then made through the deep fascia and extensor digitorum brevis. The bottom portion of this "L" is made along the peroneal tendons, just above the peroneal tendon sheath. Care is taken to insure that a portion of deep fascia is left attached to the tendon sheath to facilitate closure. A vertical portion of the "L" is made along the lateral side of the calcaneus. The extensor digitorum brevis is then peeled superiorly and distally. Great care is taken to insure that the dorsal calcaneocuboid ligaments are not disrupted. The peroneal tendons are then undermined and retracted inferiorly. At this point, the surgeon is ready to perform the osteotomy.

The calcaneocuboid joint is palpated and the peroneal tendons and sural nerve are retracted inferiorly. A sagittal saw is then used to make a through-and-through osteotomy in the calcaneus about 2 cm proximal to the calcaneocuboid joint. The osteotomy should be made with care to avoid going proximal into the middle facet of the subtalar joint. Once the saw cut is made through the dorsal, lateral, and plantar cortices, an osteotome can be used to complete the osteotomy and to check for any areas which may have not been completely cut. When the osteotomy is completed, a baby lamina spreader is then inserted on the dor-

sal side of the calcaneocuboid joint. This instrument can be modified by grinding down the teeth of the spreader in order to create less damage to the cancellous bone of the calcaneus. The osteotomy is then spread open and is ready to accept the bone graft. If possible, a second team of surgeons should have already prepared the bone graft. The usual bone graft is from 1.0 to 1.3 cm's in width. In order to allow for ease of insertion, the graft can be slightly tapered from lateral to medial.

The graft is then inserted into the osteotomy by hand, and driven medially with an impactor. It is important not to drive the graft past the lateral cortical surface of the calcaneus. If the graft rests against only cancellous bone, then compressive forces created by lengthening of the lateral column will result in a loss of correction as the bone graft sinks into the cancellous bone. The graft can also be modified by tapering its lateral side from wider superiorly to more narrow inferiorly. This accentuates the plantarflexion of the lateral column that also occurs with the Evans calcaneal osteotomy. In terms of the amount of correction, this is somewhat variable and requires a degree of subjective judgment to determine exactly how much graft to insert. Additional free portions of graft can be inserted adjacent to the tri-cortical iliac crest in order to fill space. The wound is flushed and inspected to insure that adequate correction has been achieved. Careful attention is paid to the effect of the osteotomy on plantarflexion of the lateral column, heel varus, and accentuation of any existing equinus deformity.

The osteotomy is then closed by suturing the deep fascia of the extensor digitorum brevis over the graft site. Closure of this layer is usually tenuous, as the lengthening effect of the interposed graft will create tension on the wound. The superficial fascia is closed with 3.0 or 4.0 absorbable suture, and the skin is closed with a 5.0 absorbable suture and reinforced with closure strips. Most commonly, the Evans osteotomy is done with the patient in a supine position with one or two sandbags placed under the hip to internally rotate the leg. Upon completion of the Evans osteotomy, the sand bags are removed and the leg is externally rotated.

Attention is then directed to the medial side of the foot where an incision is made on the dorsal medial side of the midfoot centered over the first cuneiform. The first metatarsocuneiform and the naviculocuneiform joints are identified, and an

additional 2-3 cms of incision length is added in each direction. Dissection is continued through the superficial fascia, and usually one or more perforators of the medial marginal vein are identified and ligated. The medial marginal vein can then be retracted superiorly. The tibialis anterior is identified and mobilized so that it can be retracted superiorly. An incision is then made through the deep fascia exposing the medial cuneiform. A sagittal saw is used to perform the osteotomy through the dorsal, medial, and lateral cortices of the cuneiform. It is important to insure that the medial and lateral sides are sufficiently cut so that when the osteotomy is wedged open, there will be a narrow plantar hinge left intact. If either of the medial or lateral sides is not completely cut, then the plantar fragment may fracture into the proximal or distal joints when the osteotomy is wedged open.

Once the osteotomy is complete, an osteotome is used to wedge-open the cuneiform. A wedged-shaped piece of corticocancellous graft is then driven into the osteotomy to achieve the appropriate amount of correction. It is important that the graft be placed from a dorsal direction. If the graft is placed medially, then it will primarily act to reduce the metatarsus primus varus and/or intermetatarsal angle. Indeed, one of the advantages of this procedure is that by splitting the difference between a dorsal or medial graft, some correction can be achieved in both planes. Deep fascial closure is performed with 3.0 absorbable suture, and superficial fascia is closed with 3.0 or 4.0 absorbable suture. The skin is closed with 5.0 absorbable suture and reinforced with closure strips. Internal fixation is usually not required for either the Cotton or Evans calcaneal osteotomies. The patient is placed in a below-knee cast for approximately 10-12 weeks, with a minimum of 8 weeks of non-weight bearing.

DISCUSSION

The Evans calcaneal osteotomy is clearly a very powerful surgical procedure. It is also clear that a medial column procedure is needed in many of these patients who have hypermobility or elevation of the medial column. The Evans/Cotton combination has been performed on a series of patients by the author, most commonly also utilizing a tendoachilles lengthening to address an ankle equinus deformity. The Cotton osteotomy has been performed as an adjunctive procedure in combination with the medial arch tendosuspension. In those patients for whom the medial column deformity is primarily structural, the Cotton osteotomy appears to be effective in providing plantarflexory correction. Given the fact that it involves much less dissection, less tourniquet time, and less operating time, it would seem to have a clear advantage over the medial arch tendo-suspension in these patients.

However, a significant proportion of these patients with pes valgus also have hypermobility of the first ray as a component of their deformity. In these patients, the Cotton osteotomy alone does not produce adequate medial column stability. The medial arch tendosuspension provides much more dynamic stability of the medial column by creating a new plantar ligament between the first ray and the navicular. In addition, the medial arch tendosuspension eliminates the tibialis anterior as a dorsiflexor of the first ray while allowing for tightening of the spring ligament and tibialis posterior tendon.

The Cotton osteotomy can be effectively used as a supplement to the medial arch tendo suspension in some patients and can be used in place of the suspension for those patients, who have a more structural sagittal plane deformity of the medial column. However, the Cotton osteotomy is not a universal replacement for the medial arch tendosuspension in all patients with pes valgus deformity.