

# REVERDIN HALLUX VALGUS CORRECTION

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The Reverdin Osteotomy is a medially based incomplete wedge osteotomy of the first metatarsal head. The wedge is resected on the frontal plane approximately 1/8 inch proximal to the articular cartilage. The procedure was originally described by Reverdin in 1881.<sup>1</sup> The osteotomy is typically combined with other procedures designed to correct hallux valgus. Most often it is used in conjunction with a modified McBride procedure, but is also combined with the Keller procedure when a hemi-implant is to be employed.

The principle value of the Reverdin osteotomy is to correct a deviated proximal articular set angle. By creating a neutral or a slightly negative proximal articular set angle, the retrograde forces from the toe can assist in closing the intermetatarsal angle and maintaining correction of metatarsus primus adductus through a process referred to as reverse buckling.<sup>2</sup> The procedure cannot be expected to close a high intermetatarsal angle in the presence of a rigidly plantarflexed first metatarsal.

## **SURGICAL CONSIDERATIONS**

General considerations should include an evaluation of the bone stock in which the osteotomy is to be performed. There should be an absence of significant cystic degeneration or osteoporosis of the metatarsal head. The presence of such findings could signal a delay in healing.

A deviated proximal articular set angle is a major indication for use of the Reverdin osteotomy. The larger the deviation the larger will be the wedge resection.

Reverse buckling is achieved by a shift in the balance of power from the lateral side of the deformed joint to the medial side in the corrected joint. In order for reverse buckling to be effective not only must a neutral or negative proximal articular set angle be created, but in addition, muscle-tendon-capsule balancing must be achieved. Good attention to anatomic dissection will facilitate soft tissue balancing and contribute to the success of the Reverdin osteotomy.

There is no real limit to the metatarsus primus adductus that may be corrected by reverse buckling. There are, however, two cautions that should be made. First, the first ray must have flexibility in order to undergo reverse buckling. An appropriate test is executed by holding the foot at the lesser tarsal area with one hand and attempting to dorsiflex and plantarflex the first ray with the other hand. If there is good flexibility in the sagittal plane then reverse buckling is possible. Flexibility in the sagittal plane normally signals flexibility in the transverse plane.

In achieving reverse buckling we are seeking to accomplish a physiologic hallux adductus. This represents a 0 to minus 5 degree proximal articular set angle. This is a safe amount of overcorrection, provided the fibular sesamoid has not been removed or the lateral head of the short flexor severed. In the latter situation no amount of overcorrection is safe since it may result in a pathologic hallux adductus or hallux varus.<sup>2</sup>

A second consideration is the degree of soft tissue contractures that are present. In a severely deformed hallux valgus with a very high intermetatarsal angle which has been present for many years one must consider the amount of soft

tissue tension that will be created by performing a Reverdin osteotomy in conjunction with a modified McBride procedure. Such may result in enough soft tissue tension to produce severe jamming of the joint. On the other hand, the Reverdin osteotomy can be combined with the Keller-Hemi implant procedure in such patients by simply resecting sufficient bone from the proximal phalanx to relieve all soft tissue tension. Often a principle reason for choosing the Keller-Implant procedure is to permit release of severe soft tissue tension.

### **SURGICAL TECHNIQUE REVERDIN-MCBRIDE PROCEDURE**

A longitudinal skin incision extends from mid-metatarsal to mid-proximal phalanx. The incision is about midway between the tendon dorsally and the dorsomedial margin of the joint.

The superficial fascia is divided in line with the skin incision. Veins that are encountered are ligated or coagulated. The nerve is not normally encountered in this approach, but if it is seen it is carefully retracted. Dissection is carried down to the deep fascia which at this level is constituted by the extensor hood apparatus. Medial dissection is carried down to a point beneath the first metatarsophalangeal joint. Dissection then follows the deep fascia laterally to the floor of the interspace where the intermetatarsal ligament is encountered.

A spreader is placed in the first interspace and placed under moderate tension. A Metzenbaum scissor is placed beneath the intermetatarsal ligament and opened to identify the extent of the structure. The scissor is then used to sever the ligament near the lateral capsule of the first metatarsophalangeal joint. This exposes the adductor hallucis tendon very clearly. A small puncture is made deep to the adductor tendon just proximal to the base of the proximal phalanx. A hemostat grasps the tendon and it is freed from its insertion and dissected free back to its muscle. The tendon is tagged with a large gauge suture for later use.

A freer elevator is forced deep to the fibular sesamoidal ligament and the ligament is suspended while it is severed. The sesamoid is then pressed plantarly with the elevator while the incision is extended proximally and distally parallel

to the fibular head of the short flexor tendon. This provides the mobility for replacement of the flexor apparatus beneath the metatarsal head.

Attention is then redirected to the medial side of the joint. An "L" shaped incision is made in the capsule, dorsomedially to the joint line then vertically at the joint line. The capsule is undermined and freed from the metatarsal head medially. The dorsal capsule is undermined and sharply freed from the metatarsal head and retracted.

A baby Hohman retractor is introduced dorsally and a Seeburger retractor is placed beneath the metatarsal head completely delivering it from adjacent tissues. Osteotomes are used to remove redundant medial and dorsal lipping from the metatarsal head. No more bone is removed than the amount necessary to bring the head flush with the plane of the metatarsal neck. The remaining bone is carefully smoothed with a Joseph rasp.

An oscillating saw or an oscillating sagittal saw is used to make the Reverdin wedge cuts. The first cut is distal and is made parallel to the remaining effective articular cartilage of the metatarsal head and about 1/8 inch proximal to the margin of the cartilage. The second cut is perpendicular to the long axis of the bone and is placed so that it will connect with the first cut just medial to the lateral cortex of the bone. The wedge is removed and the osteotomy closed by digital pressure. Often there is a poor fit of the osteotomy surfaces and refinement is needed.

Refinement of the osteotomy fit is accomplished by a process called reciprocal planing. Holding the osteotomy closed, the oscillating saw blade is passed in and out along the line of the osteotomy. The blade's teeth thus file the high spots and quickly results in an osteotomy that fits perfectly.

The osteotomy is closed and the head examined medially and plantarly for any prominent step defect. The rasp is used to smooth any step defect that may be noted. An osteotomy so planed will result in a 0 to minus 5 degrees proximal articular set angle by the time it is compressed at closure.

Capsular closure is initiated by a single suture at the apex of the flap formed by the dorsal and vertical incisions. With the apex thus tagged a #15 scalpel blade is used to make a

puncture in the capsule laterally over the neck of the metatarsal. The scalpel is passed next to bone across the neck with the tendon and capsule held suspended. The lateral puncture in the capsule provides passage for the adductor tendon. The adductor tendon is pulled through the puncture via its suture tag. The tendon is stretched medially and grasped with a curved Crile hemostat and anchored to the thicker part of the medial capsule with a 2-0 pulley suture. Once the adductor tendon has been transferred, the horizontal capsular incision is closed first followed by closure of the vertical capsular incision. Superficial fascia and skin are closed in layers.

### POSTOPERATIVE CARE

Following closure, the hallux is bandaged straight with a kling bandage over a well-padded compression dressing. Assuming no complications present, the foot is redressed at three days following surgery. A somewhat lighter weight dressing is then applied but with supportive bandaging to maintain alignment of the toe. Subsequently the foot is redressed at one to two week intervals. Sterile bandaging is usually discontinued by the end of the third week. A wedge of urethane or foam rubber can be used between the hallux and second toe for a retainer during daytime hours. An elastic bandage or tubular elastic may assist in control of edema for an additional two or three weeks.

Passive range of motion exercises are begun by the third postoperative day. The patient is encouraged to dorsiflex and plantarflex the metatarsophalangeal joint passively for a few repetitions at least thirty or forty times per day. This can be most helpful in maintaining a full range of motion after healing.

Weightbearing following surgery is usually possible the day following surgery, but as a practical matter we usually wait until the second and sometimes the third postoperative day in bilateral cases. The amount of walking or dependency is restricted during the first two to three weeks to assist in control of edema. By three weeks the amount of walking can be increased daily until six to eight weeks at which time no restriction is usually necessary.

The Darby surgical shoe is normally used during the first three to four weeks. By that time

a flexible lace oxford such as a jogging shoe can be most helpful. The urethane wedge is continued between the hallux and second toe as a retainer (provided the second toe has not undergone surgery in which case the wedge would be contraindicated).

Night splinting with a hallux valgus night splint is helpful in maintaining the correction while the capsular incision matures. This can be utilized from three or four weeks until several months after surgery. A loose sock worn over the splinted foot can prevent it from being a nuisance by getting caught in bed covers.

Poly-urethane molds with a dorsal and planar flap can be helpful in dissipating edema in those instances where swelling persists. The mold also provides a removable retainer that permits easy bathing and simple replacement to hold the established alignment.

### COMPLICATIONS

Stiffness of the joint may occur following such extensive degloving of the metatarsal head unless one insists on early passive range of motion. With good compliance in the exercise routine compromised range of motion should be an extremely rare occurrence.

Hallux varus may occur if an excessive wedge of bone is removed. Adequate planning of the wedge osteotomy by making the distal cut parallel to the effective residual cartilage and the proximal cut perpendicular to the long axis of the metatarsal should assist in preventing excessive bone resection. Caution must be exercised in the event that the fibular sesamoid is removed. In the latter situation one must not overcorrect the proximal articular set angle or a pathologic hallux varus or hallux adductus may occur.

Aseptic necrosis is a frequently mentioned potential complication of distal metatarsal osteotomies. The authors have seen only one such occurrence in over three thousand Reverdin-McBride hallux valgus corrections and have seen none with the Reverdin-Keller procedure. The one case that was seen had surgery performed elsewhere. Review of the patient's preoperative x-rays showed extensive osteoporosis and cystic degeneration of the metatarsal head, a poor candidate for such a procedure.

Displacement of the capital fragment has been seen in two instances. In both instances the osteotomy had fractured through laterally. In addition they were fixed with Kirschner wires running from distal dorsal to plantar proximal, exactly opposite from that which is recommended. A dorsal-distal to proximal pinning will facilitate unseating of the cap as the toe bends dorsally. With good preservation of the hinge, pinning should be unnecessary. Appropriate preservation of the lateral hinge can prevent instability, and with closure of the capsule the osteotomy is secure and requires no pinning since the osteotomy is distal to the point of metatarsal weight-bearing.

### DISCUSSION AND RESULTS

One of the major advances made in the Reverdin Osteotomy is the technique for precise fitting of the osteotomy every time. After the wedge is removed, the osteotomy is held gently closed while the oscillating saw with a very thin blade is run in and out along the osteotomy line. This maneuver, known as reciprocal planing is repeated as many times as necessary until a precise fit is obtained. Using the oscillating saw in this way employs the saw teeth as a file to reduce the high spots (contact points) of the osteotomy until all points contact equally.

We have seen excellent results compromised in many patients who subsequently returned to normal foot gear only to see some recurring hallux abductus. The use of a daytime hallux wedge between the hallux and second toe and the use of a night splint until the ligaments heal can go a long way to prevent early drift of the toe.

The Reverdin osteotomy is an excellent addition to hallux valgus correction provided it is combined with good soft tissue correction and return of the flexor apparatus appropriately beneath the metatarsal head. With this approach we have been able to correct very high intermetatarsal angles in those patients where flexibility of the first ray is still present. We do not recommend the procedure to close down the intermetatarsal angle if associated with a rigid plantarflexed first ray.

The Reverdin osteotomy may be more appropriately combined with a Keller-hemi implant arthroplasty in those older patients in whom extremely high intermetatarsal angles are combined with extensive soft tissue contractures. In such cases resection of bone from the proximal phalanx allows relaxation of the soft tissue and facilitates realignment of the joint without the jamming which can be mitigated by tight soft tissue structures.

### REFERENCES

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