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Mitchell Bunionectomy

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The Mitchell operation for hallux valgus was first described in the literature in 1945 by Hawkins and associates.¹ Mygind, in 1952, described a similar procedure.² C. Leslie Mitchell subsequently published an article in 1958 describing this procedure, and from this point on it became known as the Mitchell bunionectomy. Mitchell's original description of this procedure included an osteotomy of the distal portion of the first metatarsal, lateral displacement and angulation of the head of the metatarsal, and exostectomy and capsulorrhaphy.³

The following is a description of the operative technique as it appeared in 1958. A dorsal medial incision is made on the foot, curving above the bursa and callus. A Y-shaped incision is made through the medial capsule and periosteum of the first metatarsal. The arms of the Y should meet 1/4 in. proximal to the metatarsophalangeal joint. If the arms of the Y extend too far proximally, insufficient tissue is left to obtain secure medial capsulorrhaphy.

The neck and shaft of the metatarsal are then stripped subperiosteally. The lateral capsular attachments are not disturbed, because these structures are the only remaining source of blood supply to the metatarsal head. The exostosis is removed flush with the shaft of the metatarsal.

Two holes are drilled, one being 1/2 in. and the other 1 in. from the articular surface. The distal drill hole is slightly medial so the holes will be in line when the lateral shift of the head is accomplished. Care is taken to place these holes perpendicular to the metatarsal shaft. A #1 chromic catgut suture is placed through the holes by means of a ligature carrier or straight needle.

A double incomplete osteotomy is then done 3/4 in. from the articular surface between the drill holes and perpendicular to the shaft. The thickness of the bone between the two cuts is dependent on the amount of shortening of the metatarsal that will be necessary to relax the contracted lateral structures. About 2-3 mm. (1/8 in.) of bone is usually removed. The size of the lateral spur depends on the amount of metatarsus primus varus to be neutralized by the lateral shift of the metatarsal head. In a moderate deformity, one-sixth of the width of the shaft is left to form the lateral spur, while in severe deformity one-third of the shaft remains. The osteotomy is completed proximally with a thin sawblade (Fig. 14-1).

The metatarsal head is shifted laterally until the lateral spur locks over the proximal shaft. Lateral angulation of the head is slight so the articular surface parallels the axis of the second metatarsal. Slight plantar displacement or angulation is desirable. At this stage, the suture is tied, giving surprising stability to the osteotomy site. Medial capsulorrhaphy is carried out with the hallux held in slight overcorrection. Chromic 00 is commonly used for capsular repair.

Splints made of padded tongue depressors are applied with the toe in slight overcorrection and with 5° of plantar flexion, to avoid displacement or angulation at the osteotomy site. Splints are worn for 10 days, and after suture removal a short walking cast is applied to the leg, encompassing the great toe.³

With the exception of a few changes in the execution of the Mitchell, the procedure has not changed over the years from the technique just described. In many of the studies performed since 1958, the operation was performed exactly as described by Mitchell.^{4,5}

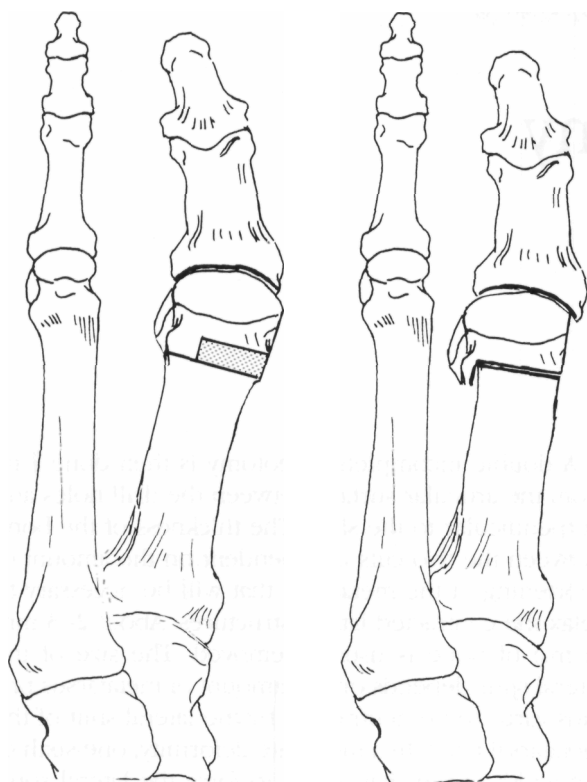


Fig. 14-1. Diagrammatic representation of Mitchell osteotomy.

As late as 1987, suture material was still being used for fixation as it is today.⁶

The Mitchell osteotomy has proven itself as originally described; advancement in surgical techniques and fixation methods have given it a stable place in a surgeon's armamentarium for the correction of hallux valgus deformity.

SURGICAL TECHNIQUE

The dissection of the first metatarsophalangeal joint in light of anatomic dissection for hallux abducto valgus deformity is basically the same for most procedures performed. We recommend a lateral release to mobilize the sesamoid apparatus before the lateral shift of the capital fragment. We have not found avascular necrosis, a complication that was alluded to by Mitchell and Meier. As a matter of fact, avascular necrosis is a rare event with the Mitchell procedure.⁴⁻⁸ Correction

via medial capsulorrhaphy may be achieved by the surgeon's preferred capsulorrhaphy technique.

Depending on the amount of shortening of the first metatarsal desired by the surgeon, fail-safe holes can be drilled using 2-mm., 3-mm., or 4-mm. burrs. This eliminates the guesswork about how much shortening will result (Fig. 14-2).

Fixation with Chromic 00, which was described by Mitchell and others, should be replaced with more rigid forms of internal fixation. Reports in the literature and our experience is that better results are achieved with rigid fixation.^{9,10}

The medial eminence, which is usually resected before lateral displacement in most osteotomies on the first metatarsal, should be minimal to nonexistent with this procedure. This will ensure that there is adequate bone-to-bone surface contact to provide enough reduction of the deformity.

Because of the rigidity acquired with internal fixation coupled with accurate capsulorrhaphy, the splint described by Mitchell can be substituted. Ideally, non-weight-bearing is the best suggested method for bone healing. We find that a modification of a surgical shoe to decrease weight-bearing of the first metatarsophalangeal joint complex is adequate for good healing and sagittal plane stability of the osteotomy.

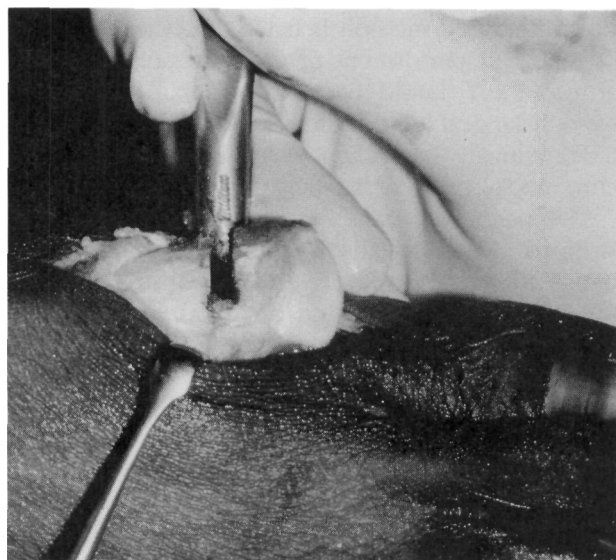


Fig. 14-2. Intraoperative view of the osteotomy before completion of the proximal cut. The fail-safe hole is apparent.

FIXATION

The method of fixation, as described by Mitchell and others utilizing suture material, although reported to have adequate results seems to lend itself to potential complications. The most serious complication is dorsal displacement of the capital fragment after fixation is in place. This may lead to lesser metatarsalgia, lesser metatarsal lesions, and hallux limitus or rigidus.

With the advances in fixation devices available to the surgeon over the years since the Mitchell procedure was first described, better and more sound fixation principles are available that will yield better results. The cross-Kirshner wire (K-wire) technique is one of the more frequently used fixation methods. By having two references of fixation, the likelihood of dorsal displacement of capital fragment is greatly decreased.

For the surgeon with more expertise, the Herbert bone screw provides an excellent type of fixation that ensures stability. This is currently the method of fixation being used by the authors, along with the crossed K-wire technique. Both of these provide rigid internal stability, decreasing the chance of movement of the metatarsal head postoperatively while at the same time allowing early joint range of motion to prevent joint stiffness. Another alternative is insertion of a screw using the A-O guidelines. It is the recommendation of this author and others that all osteotomies be secured with some form of internal fixation because of the instability of the Mitchell procedure when relying on the lateral spicule, soft tissue, and splinting techniques to maintain correction.⁹

INDICATIONS

The indications for the use of the Mitchell rather than another type of osteotomy or procedure are based mostly on specific radiographic criteria. As is the case for most bunion procedures, pain, aesthetic dissatisfaction, and difficulty in fitting proper shoes are the most probable causes bringing the patient to the foot surgeon. Pain has been indicated as the most dominant presenting factor in which a Mitchell osteotomy was performed.^{3,8,11-13}

Radiographically, the selection of the Mitchell procedure has specific guidelines that must be met for a successful outcome. Five basic features must be addressed when considering this procedure: hallux ab-

ductus angle, proximal articular set angle (PASA), intermetatarsal angle (IMA) between the first and second metatarsals, the relative length of the first metatarsal, and the amount of metatarsus primus elevatus. Other factors such as quantity of bone stock, osteoarthritis, width of the metatarsal head, tibial sesamoid position, and metatarsus adductus must also be considered, although the previously mentioned factors will eventually allow one to select or rule out the use of the Mitchell osteotomy.

Hallux Abductus Angle

The upper limits of the hallux abductus angle (HAA) in which a good result can be obtained have been consistent, being somewhere in the $30^\circ \pm 5^\circ$ range.^{6,14} Similarly, angles greater than 40° have been reported to be associated with poor results.^{14,15} The average amount of correction of hallux abductus with the Mitchell osteotomy is dependent on the surgeon performing the operation. Averages of correction have been stated in the literature, but they have appeared very sporadically.^{5,6,11-13} The most likely cause of failure of success in reduction of the HAA is the inadequate amount of soft tissue rebalancing performed around the first metatarsophalangeal joint. From our experience, all hallux abductus deformities can be brought into the normal range of 10° - 15° when the Mitchell is utilized with soft tissue correction techniques such as a modified McBride procedure, provided the intermetatarsal angle (IMA) is not excessive.

Proximal Articular Set Angle

When performing the Mitchell procedure as described in his original article, it is important that the PASA be within normal range. This matter will be discussed further in the modifications section.

Intermetatarsal Angle Between the First and Second Metatarsal

Unlike the HAA, there is some controversy as to how high an IMA can be to provide a good result with the Mitchell. It is suggested that the maximum angular relationship be 15° .^{5,12,15} Some authors advocate the use of the Mitchell in IMA as high as 20° , but in our experience this is too great an angle to provide enough lateral displacement of the capital fragment to

reduce the IMA to within normal range. The width of the metatarsal head is directly proportional to the amount of correction that can be achieved, so it is feasible that some IMAs greater than 15° can be corrected with this procedure. We find a basal osteotomy to be more appropriate with these greater IMAs.

Length of the First Metatarsal

The length of the first metatarsal is a very important criterion that must be evaluated carefully. It is obvious that the Mitchell bunionectomy is a shortening osteotomy, providing on the average approximately 4.9 mm. of shortening.⁶ Although Mitchell found no correlation between the amount of shortening and second metatarsalgia, since his report other authors have noted this as being a problem¹⁶; more than 7 mm. of shortening appears to yield poor results.^{3,4} Mitchell and associates were reassured by the Harris and Beath¹⁷ study, which concluded that a "short first metatarsal seldom, if ever, is the cause of foot disability." A closer reading of their data, however, shows that only 4 percent had a first metatarsal that was 5 mm. or more shorter than the second. It is logical then to conclude that if a first metatarsal is short preoperatively, the amount of shortening acquired postoperatively will result in a difference between the two metatarsals that can be several millimeters beyond the normal range. This in turn correlates with the poor results reported in the literature.^{3,4}

Metatarsus Primus Elevatus

When metatarsus primus elevatus is present, the first metatarsal is not bearing the weight it should during the propulsive phase of gait. This results in a dumping effect onto the second metatarsal. Assessing this is important so that when the lateral displacement is performed, some plantar displacement can be incorporated to allow the first metatarsal to bear weight. Also, to compensate for the inherent shortening of the osteotomy, plantar displacement is required to prevent an iatrogenic metatarsus primus elevatus, which could cause metatarsalgia of the lesser metatarsals.

CONTRAINDICATIONS

Most contraindications for the Mitchell osteotomy fall into the same category as do contradictions for other joint preservation procedures: degenerative joint disease, inadequate bone stock, and any other general contraindications to surgery must be elevated.

Specific to the Mitchell bunionectomy, these contraindications are mostly radiographic entities. HAAs greater than 40° are considered to produce a poor result, as was mentioned. A PASA greater than the normal limits combined with a Mitchell osteotomy will produce a joint that is not likely to have a normal range of motion or an incongruous joint that can result in degenerative joint or recurrence of the hallux valgus deformity. The IMA between the first and second metatarsal should be 15° or less. The most important contraindication is a short first metatarsal, that is, one that is more than 5 mm. shorter than the second metatarsal.^{6,17} We prefer that the final outcome be such that the length of the first metatarsal is between that of the second and third metatarsal.

Another contraindication mentioned in the literature is that of age. Some authors recommend not performing the Mitchell procedure after a certain age.^{9,15} They mention problems in healing as a complication. Perhaps what should be considered, however, is the physiologic versus the chronologic age of each patient.

MODIFICATION

When considering a modification of the Mitchell osteotomy, the eponym Roux osteotomy is often mentioned as this modification. This modification takes into account the PASA or deviation of the effective articular cartilage in relationship to the long axis of the first metatarsal. The standard Mitchell osteotomy does not address this problem.

The difference between the two osteotomies is the manner in which the first or distal cut is performed. The Mitchell cut is performed perpendicular to the shaft of the metatarsal, which would make it parallel with the articular cartilage assuming the PASA is within normal limits. With the Roux, this bone cut is not perpendicular to the shaft of the metatarsal but remains parallel to the articular surface. When the remaining



Fig. 14-3. Mitchell bunionectomy. (A) Preoperative; (B) postoperative.

cuts are performed and the wedge of bone is removed, the increased PASA will return to normal range because of the inherent design of the cuts. The remaining stages of the operation are unchanged from the Mitchell: dissection, fixation, and closure.

The indications for the Roux are the same as for the Mitchell except for the additional criterion of a PASA greater than 10° . The contraindications are also the same with the exception of having a normal PASA.

The osteotomy was originally proposed by Roux¹⁸ in 1920 in his original article. According to research, the Roux osteotomy appears to be a modification of Reverdin's original operation rather than a modification of the Mitchell osteotomy.^{1,19} Mitchell's original

article was published some 25 years after Roux's publication.

SUMMARY AND CONCLUSIONS

The Mitchell bunionectomy is one of many distal metaphyseal osteotomies for the correction of the moderate hallux valgus deformity with or without mild hallux limitus. The procedure has proven successful in individuals in whom a long first metatarsal bone is confirmed radiographically. The procedure has clear advantages over the Austin type of osteotomy in situations in which shortening of the first metatarsal is

clearly desired. When it is performed properly, a favorable outcome can be expected with minimal complications. Accurate surgical technique with appropriate fixation is most important to ensure a successful outcome. It is our opinion that this procedure, although not commonly indicated, has a place in the armamentarium of foot surgeons (Fig. 14-3).

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