

# ROLE OF THE FLEXOR DIGITORUM LONGUS IN PERPETUATION OF TRANSVERSE PLANE DEFORMITY OF THE LESSER METATARSOPHALANGEAL JOINTS

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Complete restoration of sagittal and transverse plane deviations in patients with an overlapping second toe often proves to be one of the more challenging conditions for foot and ankle surgeons. It appears that most patients seem to undergo satisfactory reduction of the sagittal plane deformity with digital arthrodesis and release of the contracture at the metatarsophalangeal joint. However, achieving transverse plane correction is generally more difficult. Over time, as the transverse plane deformity persists, a secondary instability in the sagittal plane may develop. It has been the experience of this author that many patients still retain some degree of medial deviation of the second toe if a more limited approach is employed in patients with more advanced deformities. Furthermore, each surgeon has also encountered patients with purely transverse plane deformity whereby one or several of the lesser toes is deviated medially, yet with no significant hammertoe contracture. This has also been a difficult problem to correct, despite the number of techniques, both osseous and soft tissue, that have been described to correct this condition.

Different procedures have been performed in combination with digital fusion to augment the repair of the overlapping second toe, including flexor tendon transfer, resection of the base of the proximal phalanx, partial second metatarsal had resection, or Weil or other forms of decompression osteotomy. However, in each circumstance, the procedure fails to address potential medial displacement of the long flexor tendon. It is the opinion of this author that once the second toe demonstrates significant medial displacement that the flexor digitorum longus tendon deviates from its central location beneath the metatarsophalangeal joint, and perpetuates deformity. Therefore, for the past several years this surgeon has attempted to evaluate patients for potential flexor tendon displacement intraoperatively, and address this as part of the surgical approach. Doing so has provided for improved surgical outcomes.

The key question is at what point does the flexor digitorum longus tendon become a problem relative to lesser metatarsophalangeal deviation. Patients who have mild medial deviation of the second toe are likely to have intrinsic

muscle imbalance without involvement of the long flexor. In most of these circumstances the flexor tendon still resides in a fairly central location relative to the longitudinal axis of the toe and metatarsal. It has been the experience of the surgeon that arthrodesis of the second toe combined with lateral plication of the metatarsophalangeal capsule, as described by Ruch, seems to provide a good overall result in patients with this level of deformity. Both the dorsal and medial capsule are incised, but the lateral capsule is left undisturbed. Typically, a 2-0 non-absorbable suture is used to reinforce the lateral capsule. The key to this maneuver is to place the suture plantar to the midpoint of the metatarsophalangeal joint. This has proven to provide powerful correction in many patients.

The author will also employ a Weil osteotomy in those patients who are exhibiting chronic symptoms associated with pre-dislocation syndrome, or chronic inflammation involving the metatarsophalangeal joint and/or flexor plate. The same type of capsular repair can be employed in combination with the osteotomy, and the two procedures in combination appear to provide greater potential for transverse plane deviation than either performed alone.

However, many patients present with more significant deformity that cannot be adequately controlled with this repair technique alone. Those patients who have significant overlap of the second toe will require a more aggressive approach to their care. In older patients one may even appreciate some contracture of the skin at the dorsomedial aspect of the joint when attempting to reduce the toe into a corrected position.

Initially, in older patients, the author employed a technique whereby the base of the proximal phalanx was removed from the second toe, and the second and third toes were syndactylized. While one would anticipate that this would provide adequate relaxation of the flexor tendon and joint structures to alleviate medial contracture, this was not the case in a number of patients. In fact, one could many times visualize the long flexor tendon within the first interspace following removal of the base of the proximal phalanx. Therefore, for a period of time the author actually transected the long flexor tendon as a component of this repair process. This provided

significant alleviation of medial deviation and maintenance of correction. The loss of flexor function was not a problem given the fact that the second toe was stabilized by the adjacent third toe.

As mentioned, this approach was employed primarily in older patients where the use of syndactyly was more readily accepted. In younger patients, transfer of the flexor tendon into the base of the proximal phalanx was employed for a brief interval, but was not considered an optimal approach in the hands of this surgeon. The digits appeared to plantarflex excessively at the metatarsophalangeal joint, with restricted dorsiflexion of the toe. In addition, the digits simply did not appear to have a physiologic appearance. As such, this approach was abandoned.

Over time, the author has started to employ partial metatarsal head resection of the second metatarsal in order to address this condition in patients with greater levels of deformity. It was felt that this would provide greater stability than resection of the base of the proximal phalanx, avoiding the need for syndactyly. The clinical results so far have confirmed this supposition. A Kirschner wire is used across the joint for six weeks in order to encourage organized fibrosis and stability. In some instances there is some limitation of dorsiflexion at the joint level postoperatively, but overall this has not impaired function. It has provided excellent correction in most patients, and has been successful in alleviating pre-dislocation or joint related symptoms as well. Nonetheless, there were still patients where some degree of medial deviation of the digit was encountered. Therefore, an alternative measure was felt to be necessary to address this problem.



Figure 1A. Symptomatic overlapping second toe with medial displacement of the long flexor tendon.

The greater issue was how could one neutralize the effects of the displaced long flexor tendon without completely sacrificing this structure. Would it be possible to transfer the tendon into a more favorable position, yet not sustain the adverse effects of the more traditional flexor transfer? Toward that end, the author began to employ a different technique. This consists of an adjunctive procedure whereby the flexor digitorum longus is identified within the first interspace. The medial aspect of the tendon sheath is then incised as far proximal and distal as possible. The tendon is then tagged with a 2-0 nonabsorbable suture, and this suture tag is passed beneath the metatarsophalangeal capsule to the lateral aspect of the joint. This suture was then anchored in to the plantar lateral aspect of the capsule at the base of the proximal phalanx.

This approach has proven to be very effective in neutralizing the medial displacement force of the flexor tendon, and has made the difference between a toe that demonstrates an improved alignment versus a more complete correction (Figure 1). The author has also used this technique to augment the realignment of the lesser metatarsophalangeal joints when there is a pure transverse plane deviation, yet without performing metatarsophalangeal joint arthroplasty or osteotomy (Figure 2).

In conclusion, it is the opinion of the author that the failure to achieve correction of more advanced transverse lesser metatarsophalangeal joint deformities is related to displacement of the flexor digitorum longus tendon. Measures to recentralize or neutralize the effects of this deforming force should result in enhanced surgical outcomes.



Figure 1B. Preoperative radiographic appearance.



Figure 1C. Seven months postoperative following partial second metatarsal head resection, arthrodesis of the second toe, and lateral transfer of the long flexor tendon.



Figure 2A. This patient has previously undergone repair of hammertoe deformities via arthrodesis, but has significant medial deviation of the lesser metatarsophalangeal joints with interdigital irritation and pain.



Figure 2B. Over 3 years postoperatively following dorsal and medial capsulotomy of the second, third, and fourth metatarsophalangeal joints, lateral retention sutures, and transfer of the FDL tendon of the second toe to the lateral capsule at the base of the digit.