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ORIGINAL STUDY

Tendon balancing in hallux valgus surgery

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Recurrent valgus of the hallux after hallux valgus surgery is an unpleasant complication. A possible cause is the imbalance and maltracking of particularly the extensor hallucis longus (EHL) and less frequently the flexor hallucis longus (FHL) or extensor hallucis brevis (EHB) tendon of the hallux. In patients with a tight achilles tendon, the EHL tendon can be recruited to aid dorsiflexion of the foot, creating imbalance. The literature on this subject is very scarce.

In 10 patients with severe hallux valgus, a perioperative evaluation after performing the osteotomies and capsular closure showed tight extensor or flexor tendons of the hallux with residual valgus maltracking. A balancing of the tendons was performed with a realignment -lengthening procedure.

A good clinical result was obtained in all patients. No adverse effects were seen after tendon balancing. Strength in all tendons was at least 3+, except in one patient with multiple sclerosis. No weaknesses or difficulties during walking were reported.

Tendon balancing could play a role in prevention of hallux valgus recurrences and can be performed without loss of strength or compromising of walking ability.

Keywords : hallux valgus ; recurrence ; tendon balancing.

INTRODUCTION

The surgical correction of hallux valgus deformities is one of the most frequently performed foot and ankle procedures. As with any surgery, complications can occur. One of the most apparent is recurrence of the hallux valgus pathology. Recurrence rates up to 16% have been reported in the literature. Multiple potential causes have been described and they include both patient-related factors and surgical factors (*11*).

On several occasions, the senior author encountered a rapid recurrent hallux valgus due to an overactive and maltracking extensor hallucis longus tendon, which could be corrected with a lengthening and realignment of the tendon.

This leads to believe that during hallux valgus surgery attention should be paid to the tension and tracking of the extensor hallucis longus (EHL) and to the flexor hallucis longus (FHL) maltracking of these tendons can lead to recurrent hallux valgus. The extensor hallucis brevis tendon (EHB) also has a valgus inducing effect on the hallux due to the lateral muscle origin.

Our hypothesis is that balancing of the extensor and flexor tendons after bony corrections for hallux valgus gives more reliable, sustainable corrections

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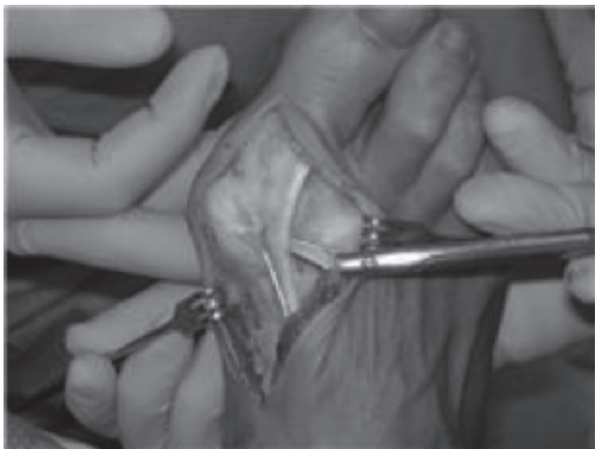

Fig. 1. — Peroperative evaluation of a tight EHL which obviously pulls the hallux into abduction.

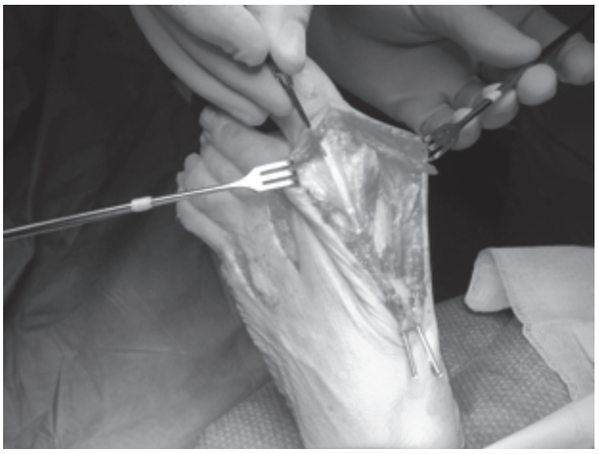

Fig. 2. — Peroperative evaluation of a tight EHL after performing a proxmal chevron osteotomy and 2 Weil osteotomies.

without adverse effects on strength and walking ability. To our knowledge, there is no literature on this subject.

MATERIAL AND METHODS

Between January 2009 and May 2010, 208 patients underwent a realignment procedure for a hallux valgus deformity in the regional hospital Heilig Hart in Lier, Belgium. In 23 patients with minor deformity, a distal chevron osteotomy with capsulorrhaphy was used, 134 patients underwent a scarf - akin osteotomy with lateral release and capsulorrhaphy and in 51 patients with severe deformity a proximal chevron-akin osteotomy with lateral release and capsulorrhaphy was performed. Perioperatively, after completing the procedure, the tension in the extensor and flexor tendons of the hallux was evaluated by holding the foot 90° with reference to the axis of the tibia with a flat surface under the foot to mimic a weight-bearing position. When excessive tension was noted, often with tendency to residual valgus deformity of the hallux, a balancing procedure of the hallux tendons was performed (Fig. 1-4).

After reviewing our database, additional tendon balancing was performed in only 14 (15 feet) of the 208 patients. 2 Patients had a scarf – akin osteomy and 12 patients (13 feet) had a proximal chevron – akin osteotomy (Fig. 5).

In 11 feet an isolated Z-lengthening of the EHL with reefing of the medial extensorhood was performed. In one foot a tenotomy of the EHB was added to the lengthening of the EHL. In two other feet a tenotomy of the FHL at the level of the interphalangeal joint, was added to the lengthening of the EHL. In a last patient both lengthening of the EHL and tenotomy of the EHB and FHL was necessary for balancing the hallux.

Fig. 3. — Z-lengthening of the EHL

All patients were invited to the hospital for a clinical evaluation. Nine patients (ten feet) responded and were included. Active and passive motion of the hallux was measured as flexion and extension strength of the hallux. The AOFAS score was evaluated. Radiologically the hallux valgus angle was measured on pre-and postoperative weight bearing films.

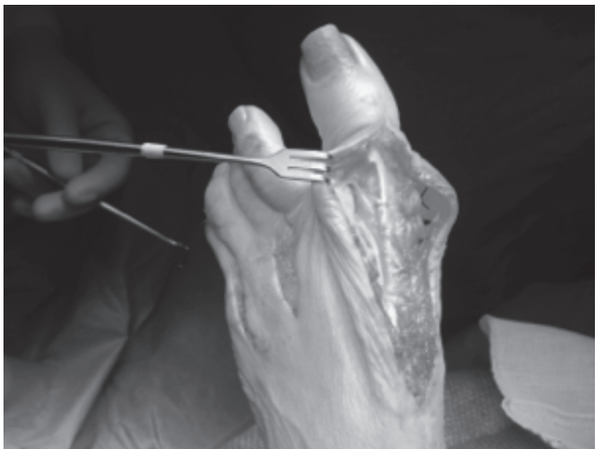

Fig. 4. — Status after lenghtening of the EHL with a balanced tendon forefoot.

RESULTS

Nine patients (10 feet) were included in the evaluation (Table I). The mean time of follow-up was 8.3 (range 2-18) months after surgery.

In eight feet active extension and flexion of the hallux was at least grade 4, according to the MRC scale (*5*). One patient was only able to resist gravity, but could not perform flexion and extension against resistance. The last patient suffers from multiple sclerosis. She was satisfied with the result but was not able to move the toes voluntarily because of her neurological deterioration.

There were no cases of overlengthening of the EHL tendon or extensor lag of the hallux. No patient experiences weakness during walking (Table I).

One patient had a bilateral tenotomy of the FHL tendon at the level of the interphalangeal joint. She has a good alignment of the halluces and is happy with the result. Clinically she cannot actively flex the interphalangeal joint of the hallux but has a satisfactory active flexion in the MTP1 joint (intrinsic muscles) with a good overall control of hallux position during stance and walking. Passive motion was near normal in all patients.

Radiographic measurement of the hallux valgus angle showed a normal value (15° or less) in 9 of ten feet. One patient had a mild recurrence with a hallux valgus angle of 15.5°. No hallux varus alignment was noted.

The mean AOFAS score is 88.3 points. All patients, except one, had excellent results and would redo the operation.

DISCUSSION

In treatment of hallux valgus deformity, different techniques are available.

For mild to moderate hallux valgus a distal chevron osteotomy can be used (*14*). With a scarf osteotomy larger corrections in moderate hallux valgus can be obtained (*1*). More severe deformity can be treated with a proximal osteotomy like a crescent or proximal chevron osteotomy (*8*).

If the hallux is passively not correctable particular attention should be paid to perform a release of the lateral sesamoid bone to allow a perfect reduction of the sesamoid bones under the first metatarsal

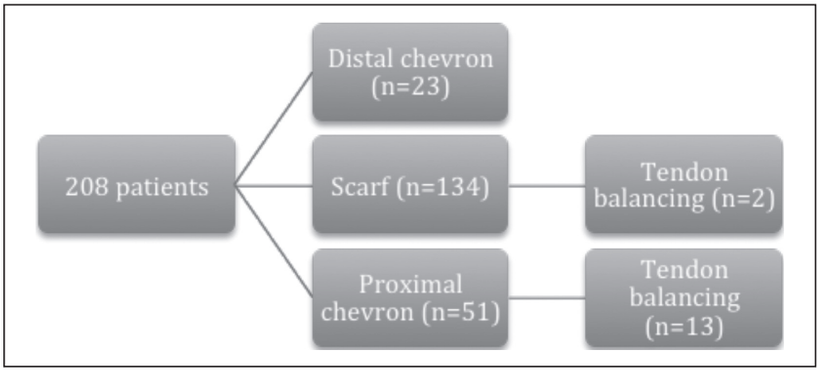

Fig. 5

Table I. — Postoperative outcomes after bony osteotomy and tendon balancing

	Side	Power in flexion	Power in extension	Hallux valgus angle postoperative	Aofas
1	L	4	4+	15	100
2	L	5	4+	15,5	93
3	L	4+	5	1,3	95
	R	4	4+	6,7	85
4	R	4	4	5	65
5	R	4	4	8,4	90
6	L	5	5	6,6	87
7	R	5	5	12,1	93
8	L	3+	3+	15	90
9	R	0	0	12,6	85

head. If not, this could be a cause of recurrence of hallux valgus (*9*).

Another important adjunctive procedure is the closing wedge osteotomy of the proximal phalanx (Akin osteotomy). In the series of Malvija, Barouk and Weil (*2,6,15*), an Akin osteotomy was performed in respectively 25%, 66.7% and 80% of patients after a scarf osteotomy. Park reported 81% needed an Akin osteotomy after a proximal chevron osteotomy (*10*). An Akin osteotomy can effectively realign the extensor and flexor tendons if some malalignment still exists after the metatarsal osteotomy and medial reefing of the MTP 1 capsule. It cannot correct excessive tension of these tendons.

Recurrences occur after each type of hallux valgus osteotomy. Coetzee (*3*), for example, describes early recurrence in as much as 25% of his patients after scarf osteotomy. In the series of Adam *et al* however, recurrence occurred in only 2 of 34 feet after scarf osteotomy (*1*). Mann *et al* presented a study with 92 primary hallux valgus corrections with a proximal osteotomy. They describe recurrences in only 4 of 92 patients (*7*).

A lot of possible causes for recurrence are described in literature. Inadequate technique or incorrect procedure, insufficient correction, lack of reduction of the sesamoids, patient related factors (*11,14*), and others are described as possible causative factors.

Little to no attention however is given so far to the role of unbalanced and maltracking flexor and extensor hallucis longus and brevis tendons in recurrence of deformity. Especially in patients with major deformity, shortened and maltracking flexor and extensor tendons of the hallux can be observed after performing osteotomies for a hallux valgus deformity. In our clinical experience a number of patients who had a rapid recurrence of hallux valgus were seen without an obvious cause of recurrence except for tendon imbalance. They often had a very tight extensor hallucis longus tendon in combination with a short Achilles tendon. It seemed that the extensor hallucis tendon was recruited to aid in dorsiflexion of the foot. As the medial part of the extensorhood is streched out in patients with hallux valgus, the tight extensor will pull the hallux back in valgus. Isolated lengthening of the EHL, reefing of the medial extensorhood and stretching of the Achilles tendon could resolve the problem.

Few articles are published on this subject. Sanders *et al* published a biomechanical study about the role of the flexors of the hallux. Contraction of these tendons caused an increase of the hallux valgus angle and an increase in the varus deviation of the first metatarsal (*13*).

Sometimes a tenotomy of the FHL is necessary for good tendon balancing. This procedure can be done with minimal patient morbidity despite significant weakness in flexion strength of the interphalangeal joint. These results have also been described after FHL tendon transfer for augmentation of the Achilles tendon (*4-12*).

We evaluated all patients during surgery after performing lateral release, osteotomies and capsulorraphy. We noted that sometimes in severe cases the extensor tendons are too tight and lateral to the midline of the MTP1 joint, this can also occur with tightness of the flexor tendons.

We think that balancing and realigning these tendons during surgery can lessen the risk of recurrence without compromising functional outcome. Our results show that this procedure doesn't seem to have adverse effects on active and passive motion of the hallux and the walking ability is not compromised.

We do understand the limitations of this study. First of all , it is a retrospective study. But we think that the awareness of an existing tendon imbalance after a hallux valgus correction can help us to achieve better results in our practice.

Secondly this is only a small patient cohort. Therefore, it is not possible to draw definite conclusions from this study.

Further prospective randomized control trials will be necessary to prove the importance of the flexor and extensor tendons in recurrences.

CONCLUSIONS

A tightness and imbalance of extensor and flexor tendons of the hallux can be a cause of progressive hallux valgus recurrence after otherwise adequately performed surgery.

Especially in severe hallux valgus surgery there should be an awareness of this problem and the tendons should be checked and balanced during surgery after performing the lateral release, medial reefing and osteotomies. Most often a Z-lengthening of the extensor hallucis longus and reefing of the medial extensorhood will be needed. Tenotomy of the extensor hallucis brevis and flexor hallucis longus tendon may be needed as well. This study shows that balancing of the flexor and extensor tendons, has good results, without significant loss of strength and without compromising the walking ability.

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