



Flexor tendon lengthening for hammer toes and curly toes in paediatric patients

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The purpose of this retrospective study was to evaluate the outcome of flexor tendon lengthening performed for hammer toes or curly toes in children, after a mean follow up of 31 months. Specific attention was given to postoperative active flexion of the toe.

The deformity improved in all patients, but less in the fourth and fifth toe. Active flexion returned and strength was recovered in all patients.

We think that open flexor tendon lengthening for hammer and curly toes is a safe and reliable procedure. We recommend a transverse skin incision, Z-lengthening of the flexor digitorum longus in hammer toes and an associated tenotomy of the flexor digitorum brevis in curly toes.

Keywords : hammer toes ; curly toes ; children ; flexor tendon lengthening.

INTRODUCTION

Hammer toes and curly toes in children are not rare, but the literature on surgical correction is very scarce. The most recent publication dates back to 1995 (3). The toe deformities are usually supple and correct when the toe flexor tendons are relaxed (with passive plantar flexion of ankle and metatarsophalangeal joint). When indeed shortness of the toe flexors is responsible for the deformity, lengthening of the flexor digitorum longus and/or brevis tendon can be considered. Thus, osseous correction and pinning of the toes, possible damage to the growth plates of the phalanges and permanent shortening of the toe are avoided (2, 5, 7).

Curly toe is characterised by flexion, external rotation and varus deformity of the interphalangeal joints. Hammer toe is characterised by flexion of the interphalangeal joint, without rotational or varus deformity. The deformity may cause nail deformities, callosity, pain or cosmetic problems. Frequently both sides are affected at one or more toes. The prevalence of congenital curly toe in neonates is 32.6 per 1000. The deformity can sometimes be seen on a prenatal ultrasound (4).

Treatment options vary from careful neglect to strapping and surgical treatment (1, 2, 5, 7).

This paper reports our results with open flexor tendon lengthening for symptomatic hammer toe and curly toe in children. Specific attention was given to assess the postoperative flexion function of the toe.

MATERIALS AND METHODS

We operated on 11 children for a symptomatic, supple hammer or curly toe. No patient had any gross neuromuscular pathology. All patients had a supple deformity

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that was correctable when the ankle joint and metatarsophalangeal joint were flexed (which relaxed the flexor tendons). There were no bony deformities on preoperative radiographs. A history and family history were recorded. The degree of deformity was graded according to Hamer *et al* (5): grade 0: no deformity; grade 1: mild deformity with or without adduction and with or without rotation; grade 2: as grade 1 but with some overriding of the adjacent toe; and grade 3: as grade 2 but with increased fixed flexion so that the toe nail was not visible from the dorsum of the foot (table II).

The operation was performed under general anaesthesia and in a bloodless field. A transverse plantar incision was made at the distal interphalangeal joint (DIP) if only lengthening of the flexor digitorum longus tendon was intended. If the intention was to lengthen both flexor tendons, then the incision was made transversely at the base of the toe. The flexor sheath was incised longitudinally. We performed only a Z-lengthening of the flexor digitorum longus (FDL) for the hammer toes. In curly toes, Z-lengthening of the FDL and tenotomy or lengthening of the flexor digitorum brevis (FDB) was performed. The wound was closed with an absorbable skin suture. The corrected toe was strapped in extension for 3 weeks.

Clinical photographs of the feet were taken standing and without weight bearing preoperatively in 3 patients and postoperatively in 5 patients.

At follow-up, the satisfaction of the patients and the parents was recorded. The outcome was assessed using the AOFAS-score (6) and a scoring system as used by Biyani *et al* (2) (table I). We also assessed tiptoeing and flexion grip strength of the operated toe.

The relation between outcome (Biyani score) and continuous variables was assessed with the Kruskal-Wallis test. Comparing the outcome (Biyani score) and toe location was done by X^2 tests (table III). $P < 0.05$ was taken as the threshold for statistical significance.

RESULTS

Between January 2002 and August 2005, we operated on 11 children for an open flexor tendon lengthening. Two patients were lost to follow-up. The remaining 9 patients were available for this study. The mean follow-up period was 31 months (range: 9 to 47). In 1 curly toe (the fifth toe), we performed excision of the second phalanx, one year after flexor tenotomy, because of recurrence of the deformity. After this procedure the patient had a

Table I. — Outcome assessment criteria and scoring system as described by Biyani *et al* (2)

	score
<i>Pain</i>	
no pain	5
occasional discomfort on prolonged walking or running	3
usually painful, requiring shoe alteration	0
<i>Deformity</i>	
none	10
mild on weight bearing	6
mild even in the resting foot, which accentuates on weight bearing	3
gross even in the resting foot	0
<i>Stiffness</i>	
none	5
mild	3
moderate or severe	0
<i>patient/parent satisfaction</i>	
pleased	5
satisfied, but could have been better	3
dissatisfied	0
<i>Results</i>	
excellent	22-25
good	18-21
fair	14-17
poor	< 14

good alignment and she was satisfied. Because we have no AOFAS-score after the flexor tenotomy, this toe was excluded.

A total of 15 lesser toes were operated on at an average age of 7 years (range: 1 to 14). There were 5 second, 3 third, 6 fourth and 1 fifth toes (table II).

In 4 patients the deformity was bilateral, affecting the same toes. Four children (5 toes) had a hammer toe deformity and 5 children (10 toes) presented with curly toes. All patients had a moderate to severe deformity; none had any stiffness of the affected toes. Half of the patients with hammer or curly toes experienced preoperative moderate pain; this was not related to the severity of the deformity.

None of the patients had postoperative wound problems. There was no scar tethering.

In all the toes the flexion recovered and tiptoeing was possible. All patients had a good flexion strength as shown by the grip of a pencil (fig 1).

Table II. — Number of hammer and curly toes and their preoperative deformity grade (2)

	hammer toe	Grade	Curly toe	Grade
toe 2	n = 5	2	N = 0	
toe 3	n = 0		N = 3	4
toe 4	n = 0		N = 6	4
toe 5	n = 0		N = 1	3

In all patients the deformity grade improved, although the improvement was less in the fourth and the fifth toe. Ten toes in 7 patients had excellent to good results (table III). The results were not related with age at the time of surgery, gender or follow-up period. The second toe had a significantly ($p < 0.05$) better postoperative deformity grade, better outcome and better AOFAS-scores compared to the third toe. The results of the third toes were better than the results of the fourth toes ($p < 0.05$). There was a good correlation between the outcome results according to Biyani *et al* (2) and the AOFAS (6). Half of the patients who were operated on the fourth toe had a good result and half had a poor result.

Poor results (Biyani score < 14) were noted in 4 toes (1 hammer toe).

In the patient with a poor result after treatment for hammer toe, a Z-lengthening of the FDL and an additional release of the palmar plate of the DIP joint was performed. This patient still had occasional discomfort and there was recurrence of the deformity.

One patient, who was treated for a curly fourth toe bilaterally, had a poor result on both sides. In this patient Z-lengthening of the FDL and the FDB



Fig. 1. — Boy, 8 years old. Two years after lengthening of the FDL for hammer deformity of the second toe.

(not a tenotomy of the FDB) was performed. She still had occasional discomfort because of recurrence and mild stiffness.

The third patient with a poor result was operated on his third and fourth toes bilaterally. The fourth toe on the right side became stiff and the deformity recurred. However the patient was subjectively satisfied with the result.

DISCUSSION

The numbers in our study were small, but we can state that the open flexor tendon lengthening for hammer and curly toes is a safe and reliable procedure. Subjective outcome is not always perfect and it is important to discuss in length with patient and parents what can realistically be expected from this procedure.

Table III. — Pre- and postoperative deformity grade, outcome and AOFAS according to the affected toe

	Deformity grade		Excellent	outcome (table 1)			AOFAS
	Preop grade	Postop grade		Good	Fair	Poor	
toe 2 (n = 5) (all hammer toes)	1	0	4	0	0	1	92
toe 3 (n = 3)	3	0	2	1	0	0	95
toe 4 (n = 6)	3	2	0	3	0	3	85
toe 5 (n = 1)	2	1	0	0	1	0	80

There is not much literature on this subject despite the fact that this pathology is relatively frequent. Ross and Menelaus (7) reported good results with open flexor tenotomy for hammer and curly toes. Hamer *et al* (5) found no difference in outcome after a flexor-to-extensor transfer compared to a flexor tenotomy. Turner (8) stated that the best treatment for curly toes appeared to be open flexor tenotomy.

The deformity grade improved in all patients, but it improved less in the third, fourth and fifth toe. Ross and Menelaus (7) already reported this finding; they related it to the greater rotational deformity in the fourth and fifth toe. Biyani *et al* (2) also found that poor results were related to the fourth and fifth toe. They also found that the age at operation and the severity of the deformity were contributory factors to poor result. We found however no correlation between poor outcome and patient age at operation or severity of deformity. It is possible that our numbers are too small to reveal a correlation.

One patient had recurrence of the deformity and a poor result in 2 curly toes (fourth toe). In this patient a Z-lengthening of both the FDL and FDB was performed (instead of the usual FDB tenotomy), because the desired toe correction was obtained with a Z-lengthening of the FDB. We therefore recommend as a routine for curly toes an open Z-lengthening of the FDL combined with a tenotomy of the FDB.

Ross and Menelaus (7) reported good results with tenotomy of the FDL and FDB for curly and hammer toes. In hammer toes, we performed only a Z-lengthening of the FDL. Our results show an excellent outcome after only Z-lengthening of the FDL.

In one patient presenting a hammer toe, the result was poor, possibly because of scar tissue formation in the palmar plate following an associated palmar plate release in order to complete correction after Z-lengthening. Therefore we recommend doing simple Z-lengthening of the FDL for hammer toe deformity. If a satisfying correction is not

obtained, it may be better to add a passive manipulation at the time of the procedure.

Poor results were reported after a longitudinal incision, because of scar tethering (7). We had no similar problems in our series as we used transverse incisions.

Ross and Menelaus (7) did not find any difference in outcome for hammer toe compared to curly toe. In our small series correction of hammer toe of the second toe was more successful than correction of a curly toe of the third, fourth and fifth toe.

In all our patients the flexion and flexion strength returned to normal.

In conclusion we think that open flexor tendon lengthening for hammer and curly toes is a safe and reliable procedure. We recommend a transverse skin incision, Z-lengthening of the FDL in hammer toes and its combination with tenotomy of the FDB in curly toes.

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