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Two-stage treatment of severe Dupuytren's contracture with an external fixator

Dear Editor,

Problems arise in the treatment of patients with severe forms of Dupuytren's disease, when the deformed finger really 'lies on the palm', and deformation is associated with arthrogenic contracture. In such forms of the disease, the acute elimination of the deformity can lead to tension of the vessels and nerves, ischaemic disorders in the finger, and even necrosis and subsequent amputation.

To reduce the risk of such complications, a number of surgeons proposed a two-step method for the treatment of severe Dupuytren's contracture (Hodgkinson, 1994; Messina and Messina, 1991, 2017; Rajesh et al., 2000). At the first stage, an external fixator is applied for slow gradual extension of the deformed finger. At the second stage, a typical partial fasciectomy is performed. Often, authors use an original device of their own design, which is not affordable for many surgeons.

We report a staged method of Dupuytren's contracture surgery in the treatment of four patients. In these patients, we used an Ilizarov mini-apparatus assembled from the standard set. In addition, at the first stage, simultaneously with the application of the apparatus, we performed a palmar needle aponeurotomy for partial reduction of deformation. Our surgical methods are as follows.

The needle aponeurotomy is performed in the palm before an external device is applied. This procedure may partially or completely eliminate the deformity at the level of the metacarpophalangeal (MP) joint. Then two K-wires (1 mm in diameter) are inserted transversely through each of the proximal and middle (or distal) phalanges. The K-wires are fixed to the distraction device in two arcs (35 mm in diameter). Gradual distraction (1–2 turns per day) are carried out to complete (or almost complete) extension of the finger. At the second stage, the frame and K-wires are removed and a partial fasciectomy is performed. Subsequently, patients receive physiotherapy, and night splinting of the operated finger is recommended.

This staged method of Dupuytren's contracture surgery was applied in the treatment of four male patients, aged from 44 to 72 years. In all cases, the small fingers were involved (Figure 1(a)). The deficit of extension (sum of the extension deficits for MP, proximal interphalangeal, and distal interphalangeal joints) ranged from 140° to 205° (mean 185.8° SD 14.4° standard deviation). The period of distraction lasted for 3–4 weeks (Figure 1(b)). During this period, a complete or almost complete extension was achieved. At the second stage, we used one of a Bruner approach (two patients), mid-line approach with the formation of local triangular flaps (one patient), and an atypical access through old scars for a patient with severe, recurrent deformity after previous surgery (Figure 1(c)). The stitches were removed after 3 weeks. Wound healing was uneventful. Ischemic disorders were not observed.

Figure 1. Clinical presentations of a patient: (a) before treatment; (b) in process of the first stage; (c) after open fasciectomy.

Table 1. Pre- and postoperative deficits of finger extension and follow-up lengths.

Patients	Ages (years)	Deficit of extension pre-treatment (degrees)	Deficit of active extension post-treatment (degrees)	Deficit of passive extension post-treatment (degrees)	Follow-up (months)
1	44	190	35	0	4
2	72	205	30	10	6
3	62	190	55	0	24
4	46	170	35	10	18
Mean (SD)		186 (14)	39 (11)	5 (6)	13 (10)

SD: standard deviation.

Results were evaluated between 4 months and 2 years after surgery (Table 1). The deficit of active extension after treatment decreased to a mean of 39° (range 30° to 55°) with a standard deviation of 11°. The passive extension in two cases recovered completely. In the other two cases, the deficit in passive extension was only 10°. This phenomenon is probably associated with a weakness of the extensor apparatus of the fingers, following many years in which the fingers were held in a flexed position.

Different external devices are proposed for the two-stage treatment of severe forms of Dupuytren's disease. The mini-Ilizarov has some advantages for us. It is serially produced. It is inexpensive, stable, elegant, easy to use, and controllable. The apparatus we use consists of a minimum number of components: arcs (2), rods (2), K-wire fixators (4) and nuts (12). The cost of such set is about 40 US dollars. K-wires are more affordable compared with special threaded pins, which are used in some devices. Needle aponeurotomy during the first stage of the treatment resulted in partial or complete correction of the deformity at the level of the MP joint. This allows easier application of the

mini-apparatus and greater ease of subsequent distraction.

In a small number of patients, we have found that staged treatment of severe forms of Dupuytren's contracture using the standard Ilizarov mini-apparatus and needle aponeurotomy at the first stage is effective and safe.

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The effect of knot position in Adelaide flexor tendon repairs

Dear Editor,

Core suture failure in flexor tendon repairs most commonly occurs around the knot, by suture breakage or unravelling of the knot. Knot strength depends on the suture material and the knotting technique. Several studies have reported on the effect of suture knot location on the tensile strength of a flexor tendon repair.

The purpose of this study was to investigate the effect of suture knot location on Adelaide flexor tendon repair strength and mode of failure.

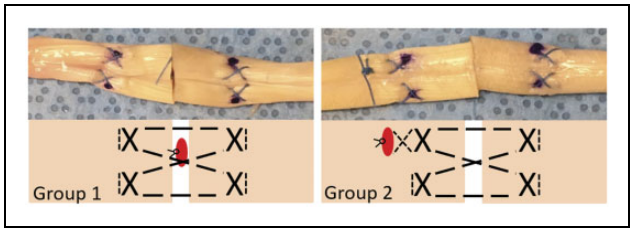

Figure 1. Knot position – Group 1: internal knot positioned in the repair site; Group 2: external knot positioned away from the repair site.

Twenty-four flexor digitorum profundus tendons (index, middle, ring and little) were harvested from six fresh-frozen human cadavers and randomly assigned to one of two treatment groups. All tendons were sharply transected and repaired with a four-strand, one-window Adelaide configuration as the core suture, using a 4-0 Ticron (Covidien, Dublin, Leinster, Ireland) suture. No epitenon suture was used. In Group 1 ($n = 12$), the knot was positioned in the repair site; in Group 2 ($n = 12$) the knot was positioned away from the repair site (Figure 1). The repaired tendons were secured in pneumatic clamps and were loaded at 40 mm/min until failure, after pretensioning at 1 N. A camera captured images at a frequency of 1 Hz.

The mean force at failure of repair in Group 1 (internal knot) was 42.9 N (SD 5.9). In all 12 tendons, the repair failed due to the suture breaking at the knot site. The mean force at failure of repair in Group 2 (external knot) was 65.7 N (SD 7.2), statistically significantly higher than that of Group 1 ($p < 0.05$). Two repairs failed at the knot, seven failed elsewhere within the suture construct and three sutures pulled out.

Our study indicated that knot placement away from the repair zone generates a stronger construct. External knot placement has a lower incidence of failing at the site of the knot, suggesting that the placement protects this weakest component of the repair by decreasing tension on the knot. The Adelaide repair is a locking configuration, thus the four strands might not all be loaded evenly during testing, as the load cannot be transferred between strands. A knot, known to be the weakest part of the core suture, located in one of these strands, might therefore be more prone to peak loading and/or failure. Whereas, a knot located behind one of the four cross-locks in the Adelaide configuration, is most protected from any peak loading.

Previous reports, using Savage and modified Lim/Tsai repairs, showed greater strength with knots placed outside compared with inside (Aoki et al., 1995; Chang et al., 2018). Pruitt et al. (1996), using