

The use of skeletal traction in the treatment of severe primary Dupuytren's disease

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In 13 patients (18 fingers) we used two types of external fixator as progressive static splints for the preoperative correction of the deformities of severe Dupuytren's disease before conventional fasciectomy. The duration of treatment was from one to four weeks.

At a mean follow-up of 18 months the mean total fixed flexion deficit had been reduced from 138° to 39° and the mean proximal interphalangeal joint contracture from 80° to 29°. The mean total active range of movement had increased from 123° to 175°. These preliminary results are promising, but continued follow-up is needed since recurrence is common.

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The treatment of severe Dupuytren's disease of the hand involves problems of skin cover, the neurovascular supply and joint contracture. Attempts have been made to achieve correction by progressive static splinting, with the aim of reducing preoperative deformity especially at the proximal interphalangeal (PIP) joint, stretching the skin to obviate skin grafting or flaps, and gradually elongating the neurovascular structures.

In 1879, Adams¹ described the use of a rack-and-pinion splint to straighten the fingers after a fasciotomy, but only limited pressure can be applied to the skin, and only the advent of external fixation allowed further advances to be made. Workers using Ilizarov techniques showed that correction of joint contractures, including those in the fingers, was possible, but did not use his method specifically for

Dupuytren's disease.² They showed that mechanical distraction could stimulate bone and soft-tissue growth. In 1989, Motta, Errichiello and Crovalla³ described an apparatus for the correction of Dupuytren's contracture, but did not analyse their cases or results.

In 1989, Messina⁴ reported the results of using a square frame, and later described his technique and findings in detail.^{5,6} His method is based on continuous longitudinal traction on the fascia at an elongation of 2 mm per day. When the digit has been brought to full extension, a fasciectomy is performed. Bailey et al⁷ and Brandes, Messina and Reale⁸ studied the biochemical changes during continuous distraction of Dupuytren's tissue and showed that there was a metabolic activation causing weakening and lengthening, rather than a simple mechanical stretching. There is remodelling of the internal organisation of the tissue, but when distraction is removed the disease process resumes. Traction alone is not enough.

We describe our experience and our early results of the treatment by traction of patients with severe flexion deformities of the fingers due to primary Dupuytren's disease.

Patients and Methods

We reviewed retrospectively the records of 13 consecutive patients with severe Dupuytren's disease in 18 fingers which had been treated between January 1994 and January 1996. They were all in grades III and IV of Tubiana⁹ (Table I). All suitable patients (21) had been offered skeletal traction, but only those who agreed were included in the series. The nature of the treatment was explained in detail with particular reference to the postoperative demands.

All 13 patients were men with a mean age of 62 years (44 to 73). Ten of them had either a positive family history, a heavy alcohol intake or both (Table II).

Twelve patients were treated by preliminary skeletal distraction followed by fasciectomy; one had three stages, with a preliminary fasciotomy and mobilisation before the application of the fixator. One patient had an additional grade-II contracture treated with an elongation device positioned for his more deformed fingers.

We used two types of fixator, the 'Tecnica di Estensione Continua' (TEC) described by Messina and Messina⁶ and

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Table I. Classification of Dupuytren's disease according to Tubiana⁹

Grade	Total fixed deformity (degrees)
I	0 to 45
II	45 to 90
III	90 to 135
IV	Over 135 (hyperextension at DIP joint is added to total deformity)

the 'Verona' apparatus designed and made for the senior author (NC). The TEC is a large device which can apply longitudinal traction to several fingers simultaneously, and to the various joints in that finger independently (Fig. 1), with the possibility of varying the direction of traction from a straight pull. The Verona fixator (Fig. 2) is less bulky; it

can apply an angular corrective force as well as distraction if required. It can be used on only one joint at a time, and was employed only for the PIP joint. After the application of a fixator, the hand was rested to allow initial pain and swelling to subside, usually in two to three days.

Distraction was then applied at the maximally tolerated rate until correction was complete, or for four weeks, whichever was soonest. The patient himself applied the pressure, using a screw in the TEC fixator or a worm gear in the Verona model. In some of our later cases, we used guanethidine preoperatively to try to reduce the incidence of algodystrophy, since early cases had a high incidence of stiffness in extension.

Fasciectomy was performed under tourniquet control with primary skin closure by YV plasties.¹⁰ Full primary

Table II. Details of the 13 patients (18 fingers) and their treatment

Case	Age (yr)	Tubiana grade	Side	Finger*	Treatment	
					Type	Duration (wks)
1	69	II	L	I	TEC	3
2	67	III	R	L	TEC	3
		III	R	R	TEC	3
3	70	III	R	M	TEC	4
4	55	III	L	R	Verona	2
5	52	III	L	L	Verona	2
6	44	III	R	L	Verona	3-stage
1		IV	L	L	TEC	3
		IV	L	R	TEC	3
3		IV	L	L	TEC	3
		IV	R	L	TEC	4
7	53	IV	R	L	Verona	2
8	62	IV	R	L	Verona	1
9	72	IV	R	L	Verona	2
10	62	IV	L	L	TEC	3
11	67	IV	R	L	Verona	1
12	61	IV	R	R	TEC	4
13	73	IV	L	L	TEC	4
Mean						
62						

* I, index; M, middle; R, ring; L, little

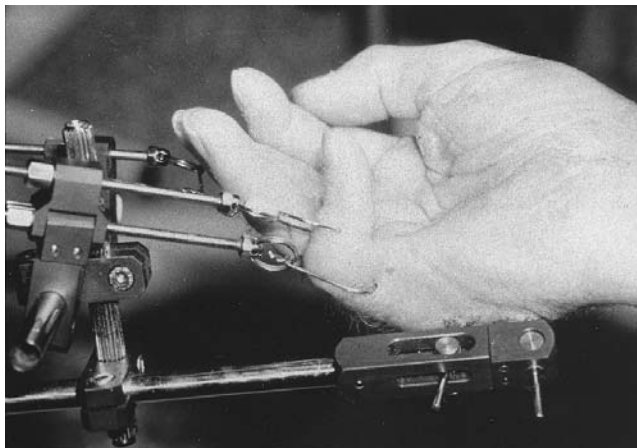


Fig. 1

The TEC apparatus. The device is anchored in the fifth metacarpal by two strong threaded pins. Traction is applied by turning the screws on the threaded rods attached to the skeletal traction rings.

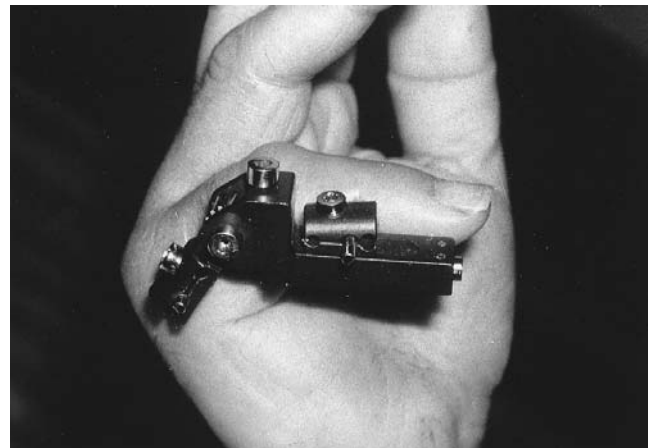


Fig. 2

The Verona apparatus. The device is anchored by two threaded pins in the bone on each side of the PIP joint. The patient uses a small Allen key to turn a worm gear and apply a corrective force.

coverage was always obtained, but the operations were technically demanding because of oedema of the Dupuytren tissue and skin which became extremely fragile. Movement was allowed from five to seven days after fasciectomy, but night splintage was used to retain full extension and prevent recurrence of the deformity. Incompetence of the active extensor mechanism due to the chronically flexed position of the finger made this essential.^{11,12} Splinting continued until the finger lost this tendency to flex, but was replaced if there was any recurrence of the deformity. The minimum duration of splinting was six weeks.

We measured the total range of active movement (TRAM) and the flexion contracture at the PIP joint in all patients pre- and postoperatively using a manual goniometer.

Results

The mean follow-up was 18 months (2 to 30) and the results are shown in Table III. The mean total preoperative extension deficit was 139°, which improved to 39° after operation. The PIP joint improved from a mean of 80° to 29°. The mean TRAM increased from 160° to 202° for grade-III and from 96° to 150° for grade-IV deformities. The numbers were too small to allow a comparison of the two types of fixator.

Three patients had recurrence, two of them with fixed flexion deformity. One of these had a reoperation and the other was lost to follow-up. One patient developed an

extension contracture due to adhesions to the flexor tendon which required two-stage grafting of the tendon.

Five patients had algodystrophy with joint stiffness, pain and autonomic dysfunction. The preoperative administration of guanethidine did not appear to influence the incidence of algodystrophy.

Discussion

Few similar reported series allow a comparison of results. Hoet et al¹³ treated 80 patients with stage-III disease; 35% had a perfect and 40% a good result, where a good result was total flexion deformity of 45° or less. In 53 stage-IV patients, 15% had a perfect and 39% a good result. They did not report postoperative ranges of flexion.

Rives et al¹⁴ described the treatment of severe contractures of the PIP joint: one subgroup had a preoperative mean deformity of 81°, but other finger deformities were not reported. Their follow-up was longer and they showed that compliance with postoperative splinting was essential to maintain correction. The results deteriorated slightly with time, but were stable after six months and similar to those which we report. Our main problem with splinting was stiffness in extension with loss of flexion while the attenuated extensor mechanism was protected with a night splint. Smith and Breed¹² describe an intraoperative test for central slip attenuation during fasciectomy for Dupuytren's disease. Their patients had a mean preoperative deformity

Table III. Details of the results in 13 patients (18 fingers)

Case	Total flex contract (degrees)		TRAM (degrees)		PIP flex contract (degrees)		Follow-up (mth)	Guanethidine*	RSD*	Comments
	Preop	Postop	Preop	Postop	Preop	Postop				
1	60	0	200	290	60	0	13	N	Y	
2	100	20	180	250	80	20	30	N	N	
	90	15	200	225	90	15	30	N	N	
3	110	50	180	95	70	30	29	Y	Y	Lost to follow-up
4	120	50	170	220	80	50	8	N	Y	
5	90	40	140	200	60	10	18	N	N	Old DIP injury
6	130	10	90	220	90	10	4	Y	N	Seen at 6 mth.
Mean grade III	107	30	160	202	78	22.5				Recurrence PIP 70° reoperated
1	145	55	145	85	85	60	22	N	Y	Severe algodystrophy
	145	40	145	90	95	20	22	N	Y	Severe algodystrophy
3	150	40	140	95	100	20	22	Y	Y	Severe algodystrophy
	200	160	10	40	100	90	29	Y	Y	Preop tract min effect. Moved away
7	160	40	110	60	80	20	2	N	Y	Two-stage tendon graft
8	190	40	70	210	70	30	18	Y	N	
9	190	60	50	210	80	60	12	Y	N	Slow recurrence despite splinting at PIP
10	170	0	110	240	80	0	16	N	N	
11	140	30	100	220	60	30	15	Y	Y	
12	150	30	140	210	90	30	20	N	N	
13	160	20	40	190	70	20	7	Y	N	
Mean grade IV	164	47	96	150	82	34.5				
Overall mean	139	39	123	175	80	29	18			

*N, no; Y, yes

of 87° in the PIP joints, slightly more severe than those in our series, and the mean postoperative deformity was 27° at four years. They do not report overall deformity or postoperative range of flexion. They also describe excellent results after gentle intraoperative passive manipulation of the PIP joint, but do not report the final range of flexion or the preoperative Tubiana grades.¹⁵

Rolland et al¹⁶ described some long-term results in patients with grade-IV disease, but for only 19 of 44 patients. Hodgkinson¹⁷ treated a mixed group of patients with primary and recurrent disease using an original external skeletal traction device, but reported only the results of preoperative traction, not of the fasciectomy.

Beard and Trail¹⁸ used the 'S-Quattro' device immediately after operation with mixed results for both primary and recurrent disease. We have also had poor results using traction in this way, with a high incidence of reflex sympathetic dystrophy (RSD).¹⁹ There appears to be a threshold for injury to the hand, above which RSD tends to occur. Fasciectomy followed by traction provides too great an insult to the hand, with resultant stiffness.

Preoperative guanethidine block has been 'discredited'²⁰ as a preventative measure, but seems to be effective in certain situations. When one hand develops RSD after an operation, the use of a guanethidine block on the second side appears to be of value. Guanethidine also seems to be effective in reducing the autonomic pain of RSD, allowing dynamic splintage for the correction of deformities in the early stages.

Messina and Messina⁶ included both primary and recurrent cases in their series of 85 fingers with grade-III or grade-IV disease. After treatment, of 62 seen at follow-up, 45 had full flexion and extension, ten had mild limitation of flexion and normal extension and seven had significantly limited flexion and residual PIP joint contracture. Our results were worse and it seems possible that we applied traction too rapidly. Messina insisted that the traction at 2 mm per day be subdivided into four increments of 0.5 mm to allow physiological softening of the contracted bands. All our patients wished to finish this phase of their treatment as soon as possible; we asked them to extend the finger at the maximum tolerated rate. Our shortening of the traction time may have inadvertently led to algodystrophy in some patients.

In our high-risk patients, recurrence was a problem, and it is intended in future to perform skin grafting as soon as the maximal range of movement has been obtained. We asked our patients to seek early advice for recurrence, but none responded and all the recurrences were diagnosed at routine reviews.

Our patients were generally difficult to treat, and some showed self-neglect possibly related to excessive alcohol intake. The method of treatment is demanding, but full compliance is essential for success. Full-thickness skin grafting to prevent recurrence was not used because the

extra immobilisation to allow healing often leads to extension contracture.

Treatment by corrective external fixation may be indicated for severe primary Dupuytren's disease in suitably co-operative patients, but it must be only one component of a carefully planned programme.

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