THE TREATMENT OF CHRONIC FLEXION CONTRACTURES OF THE PROXIMAL INTERPHALANGEAL JOINT

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A method of treatment of chronic flexion contractures of the PIP joint is presented, with the results obtained in 19 patients treated between 1989 and 1992 after a follow-up of from 6 to 53 months. The flexion contractures, with an extension deficit which ranged between 70 and 90°, had been present for a period of between 2 months and 24 years.

Our treatment program involves the surgical release of the unreducible PIP joint followed by the use of static and/or dynamic splints. Surgery is performed using a midlateral approach; the accessory collateral ligament and the flexor sheath are incised and, after the volar plate and check-rein ligaments have been excised, forced hyperextension is applied. The main collateral ligaments are carefully spared and freed from the condyle if there are any remaining adhesions.

In our 19 patients, complete extension of the finger was achieved in 11 cases (57.9%); in the remaining 8 cases (42.1%) the residual extension deficit ranges from 10 to 15°. In our experience this combined surgical and rehabilitative approach had led to consistently good results with minimal complications.

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Flexion contractures of the PIP joints may be caused by alterations in the capsulo-ligamentous or peri-articular structures. Eaton (1971) attributed an important role in the pathogenesis of stiffness to the check-rein ligaments, and Watson et al (1979) reported good results in 115 patients whose check-rein ligaments were resected. Mansat et al (1990) have confirmed the importance of extraarticular resection of the check-rein ligaments as the first surgical procedure, since it is often all that is needed. However, Curtis (1984) claimed that, although useful, check-rein ligaments resection is insufficient in most cases. Curtis (1969 and 1984), Tubiana (1984), and Tubiana and Dubousset (1988) operated on the joint capsule, performing a sequence consisting of capsulectomy, arthrolysis, tenolysis and resection of the superficial flexor tendons, until extension of the finger was obtained.

Other authors have advocated total or partial resection of the collateral ligaments. Sprague (1976) used sub-total incision of the collateral ligaments and repair of the transverse retinacular ligament; Gould and Nicholson (1979) resected 50% of the collateral ligament; Young et al (1978) resected two-thirds of the ligament; and Diao and Eaton (1993) totally excised the collateral ligaments, often bilaterally. Jackson and Brown (1970) advocated excision of the volar plate combined with a cross-finger flap and K-wire immobilization. We prefer complete excision of the volar plate with the attached check-rein and accessory collateral ligaments, followed by a prolonged period of splintage and exercises.

MATERIAL

Between January 1989 and December 1992, we operated on 26 patients, 19 of whom were seen again in June 1993 for a long-term evaluation of the results. These 19 patients consisted of ten women and nine men aged 13 to 52 years. The minimum follow-up was 6 months and the maximum 4.5 years (an average of 2 years and 1 month).

The patients had presented with flexion deformity following intraarticular fractures, sprains and contusions with no other causes of stiffness (tendon injuries, burns, etc.); all had previously been treated elsewhere by prolonged immobilization followed by an insufficient course of physiotherapy. Only one finger was affected in all of our cases, and there were no skin contractures or flexor tendons lesions. The stiffness had been present without modification for between 2 months and 24 years.

Five of the patients (25%) had previously undergone corrective surgery (anterior capsulectomy in two, arthrolysis in two and check-rein ligament resection in one); nine (47%) had undergone forced mobilization under local anaesthetic with a complete return of the previous stiffness in a few weeks.

METHOD

Surgery was performed using a digital nerve block in order to allow active movements of the finger to be observed during the operation. The skin incision followed the mid-lateral line; the transverse retinacular ligament was incised and both the lateral band of the extensor apparatus and the oblique retinacular ligament were reflected dorsally.

Access to the joint was obtained by incising the accessory collateral ligament and the flexor tendon sheath, which closely adheres to the volar plate. In some cases, the main collateral ligament also presented adhesions to the condyle, which were freed without damaging the ligament. The volar plate was totally

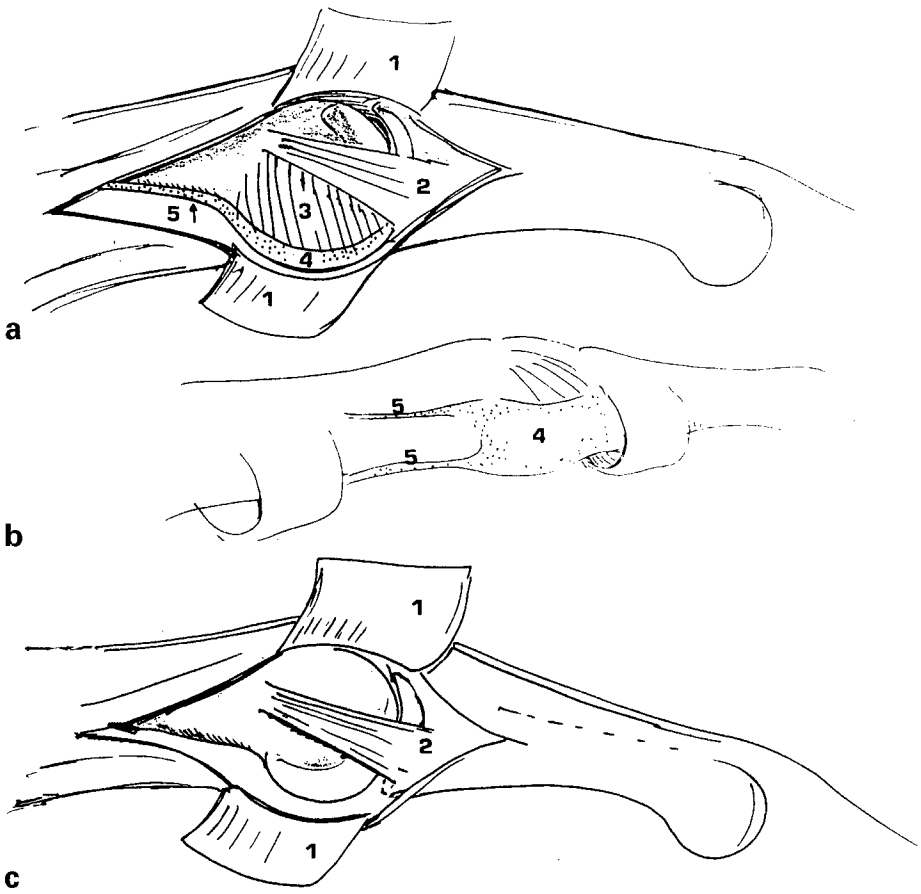

Fig 1 (a: lateral view) and (b: palmar view) 1) Reflected transverse retinacular ligament. 2) Collateral ligament. 3) Accessory collateral ligament. 4) Volar plate. 5) Check-rein ligaments. (c) Lateral view with resection of the volar plate, check rein ligaments and accessory collateral ligament.

Table 1

Case no.	*Injured finger*	*Pre-operative deficit*	*Immediate post-operative active extension deficit**	*Rehabilitation time (months)*	*Late extension deficit (>6 months)*
1	Little	75°	+	2	10°
2	Index	75°	+ +	4	0°
3	Little	90°	+ + +	3	0°
4	Little	70°	+	2	0°
5	Ring	85°	+ +	4	15°
6	Ring	80°	+ +	3	10°
7	Index	80°	+	4	0°
8	Index	75°	+ +	4	0°
9	Index	70°	+ +	3	10°
10	Middle	70°	+ +	3	0°
11	Index	90°	+ +	3	0°
12	Little	80°	+ +	3	10°
13	Middle	85°	+	2	10°
14	Index	80°	+ +	2	0°
15	Index	85°	+ +	3	0°
16	Little	75°	+ +	2	0°
17	Ring	80°	+ + +	3	15°
18	Little	90°	+ +	2	0°
19	Ring	75°	+ +	3	0°

*These data were subjectively assessed by the examiner. They ranged from about 45° (+ + +) to 15° (+).

removed, its lateral processes (check-reins) were resected, and volar subluxation of the joint was obtained by means of hyperextension overcoming any remaining resistance due to residual adhesions (Fig 1).

After this operation, active movements were tested. Any limitation of extension (Table 1) was probably due to prolonged inactivity of the extensor apparatus; we have never found it necessary to correct this deficit surgically. Post-operatively, the finger was immobilized in extension for 3 days using an aluminium volar splint that left the MP and DIP joints free. The extension deficit was subsequently corrected using a dynamic splint worn for a few hours during the day and all night (Fig 2) until active extension was regained.

The patients were instructed to perform active and passive PIP mobilization several times a day at home, and to return to the clinic every month until the final result could be considered successful and/or stable.

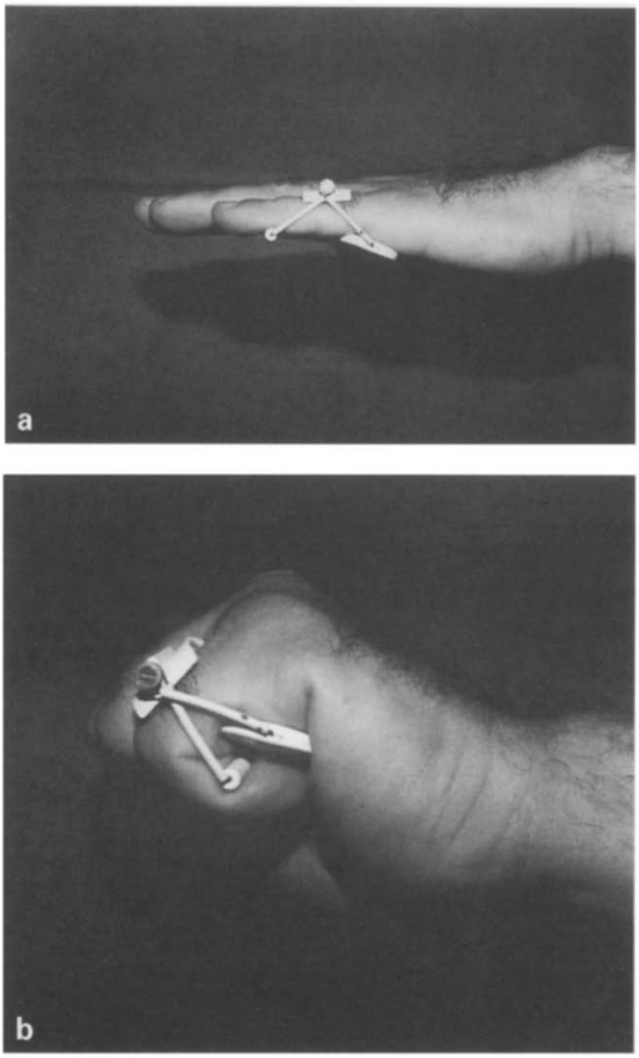

Fig 2 (a and b) The dynamic splint (Model 336, manufactured by Hugh Steeper Ltd of Roehampton Lane, London) corrects the deficit by maintaining the finger in extension and gradually stretches the collateral ligament.

RESULTS

No post-operative complications such as infection or skin necrosis occurred. Complete extension of the finger was obtained in 11 patients (57.9%); in the remaining eight cases (42.1%) the residual extension deficit was between 10 and 15° (Table 1). One patient still had a flexion deficit of about 10°.

In all of the patients, long-term follow-up (6 to 54 months; mean 25 months) showed that the correction achieved at the end of the rehabilitation program has been maintained. Eight patients experienced persistent pain for about 2 months after the operation, and could not tolerate the dynamic splint; in these cases, periodic changing from a more comfortable static extension splint to a dynamic one was recommended. Provided they are closely followed during the early rehabilation period, we have found that even these patients can regain satisfactory long-term function.

No volar instability of the finger was observed in any patient. Hyperextension of the PIP joint occurred during the early stages of treatment in four cases, and was corrected by reducing the time of application of the dynamic splint. Rehabilitation required 2 to 4 months (Table 1). There was no reduction in grip strength, and previous pain failed to disappear entirely in only one patient.

All of the patients declared their satisfaction with the obtained result, and many of them were able to work during the rehabilitation period. An example is shown in Figure 3.

DISCUSSION

We believe that excision of the volar plate automatically leads to the release of the check-rein and accessory collateral ligaments. In order to gain access to the joint, the transverse retinacular ligament is incised while the oblique retinacular ligament is retracted and protected.

Lateral stability of the finger is maintained by the main collateral ligament, which is never severed (although it is probably almost always pathologically contracted in chronic flexion) because it can easily be progressively stretched using the dynamic splint. Because the extension deficit is associated with chronic inactivity of the extensor apparatus, we feel that there is no need for shortening (Mansat et al, 1990) or tenolysis operations (Diao and Eaton, 1993) if the dynamic splint is correctly used.

We do not advocate post-operative immobilization in extension with a K-wire, as proposed by Curtis (1969), Tubiana (1984) and Mansat et al (1990), as this may cause further damage to the joint surfaces or cause stiffness in extension.

The dynamic splint we use allows the gradual recovery

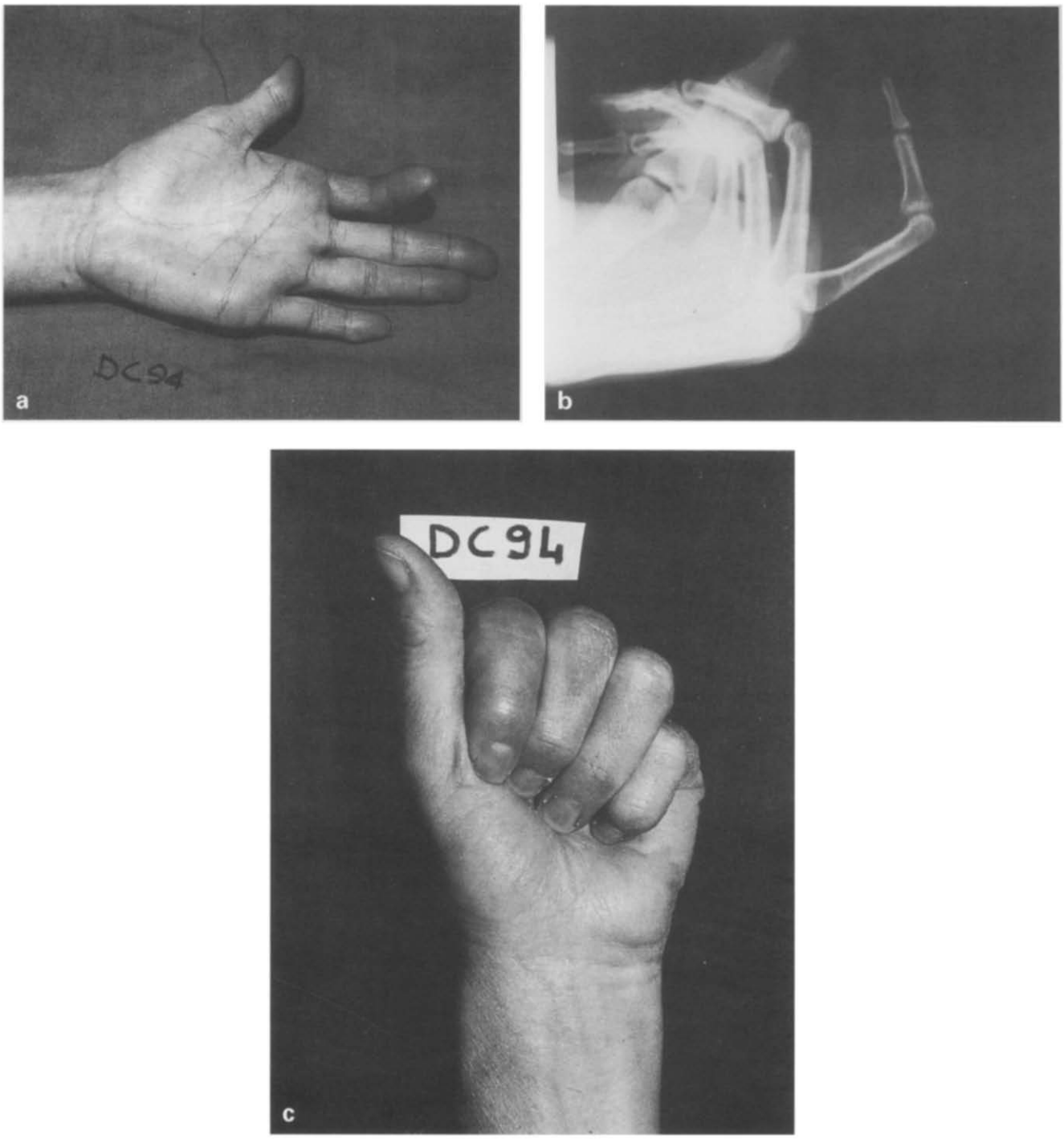

Fig. 3 Please see p. 389 for legend.

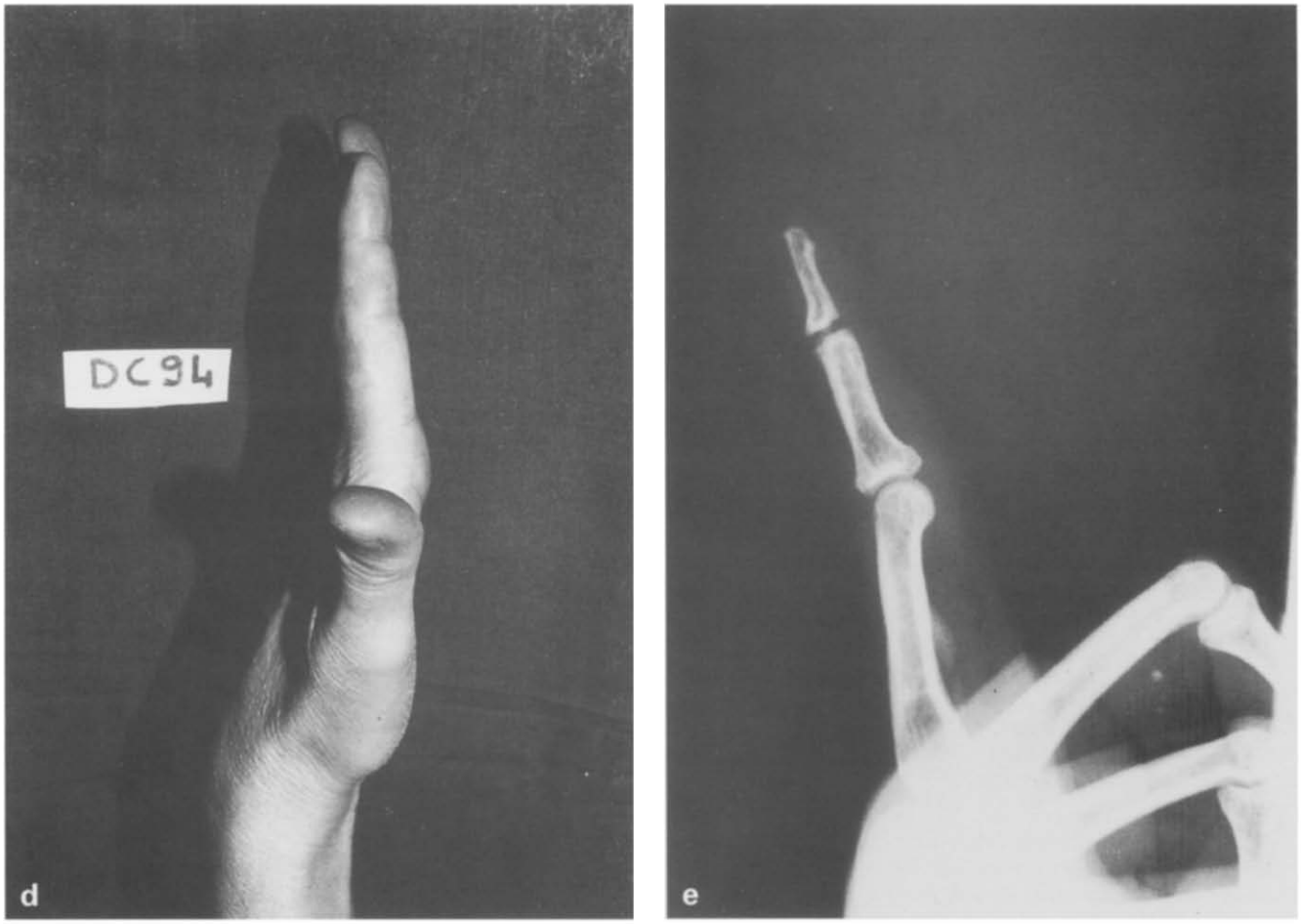

Fig 3 continued. (a) Pre-operative condition in a 25-year-old man, with an 80° flexion contracture of the PIP joint of the index finger of the left hand following a sprain and contusion 3 years earlier. (b) Pre-operative X-ray. (c and d) Results 6 months after the operation. (e) Post-operative X-ray.

of active extension, restores the correct balance between the extensor and flexor tendons, and permanently stretches the main collateral ligament. The combination of surgery with post-operative rehabilitation is essential in releasing chronic flexion contracture of the PIP joint.

References

CURTIS, R. M. (1969). Management of the stiff proximal interphalangeal joint. The Hand, 1, 32–37.

CURTIS, R. M. Raideur des Articulations Interphalangiennes des Doigts. In: Tubiana, R. (Ed). *Traite de Chirurgie de la Main*, Vol 2, Paris, Masson, 1984: 925–932.

DIAO, E. and EATON, R. G. (1993). Total collateral ligament excision for contractures of the proximal interphalangeal joint. Journal of Hand Surgery, 18A: 3: 395–402.

EATON, R. G. *Joint Injuries of the Hand.* Springfield, Thomas, 1971: 32.

GOULD, J. S. and NICHOLSON, B. G. (1979). Capsulectomy of the metacarpophalangeal and proximal interphalangeal joints. Journal of Hand Surgery, 4: 5: 482–486.

MANSAT, M., DELPRAT, J. and CHAFFAI, M. A. (1990). *Raideurs Post-traumatiques des Doigts.* Encyclopédie Medico-Chirurgicale (Paris); Techniques Chirurgicale Orthopédie, 1990: 4–14.

SPRAGUE, B. L. (1976). Proximal interphalangeal joint contractures and their treatment. Journal of Trauma, 16: 4: 259–265.

TUBIANA, R. Traitement des Raideurs des Doigts. In: Tubiana, R. (Ed). *Traité de Chirurgie de la Main,* Vol 2, Paris, Masson, 1984: 911–925.

TUBIANA, R. and DUBOUSSET, J.-F. *Raideurs des Doigts.* In: Encyclopédie Medico-Chirurgicale (Paris); Techniques Chirurgicales Orthopédie, 1988: 3-23-10.

JACKSON, I. T. and BROWN, G. E. D. (1970). A method of treating chronic flexion contractures of the fingers. British Journal of Plastic Surgery, 23: 4: 373–379.

WATSON, H. K., LIGHT, T. R. and JOHNSON, T. R. (1979). Check-rein resection for flexion contracture of the middle joint. Journal of Hand Surgery, 4: 1: 67–71.

YOUNG, V. L., WRAY, R. C. and WEEKS, P. M. (1978). The surgical management of stiff joints in the hand. Plastic and Reconstructive Surgery, 62: 6: 835–841.

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