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Literature review

## Management of posttraumatic finger contractures in adults

### Traitement des raideurs post-traumatiques des doigts chez l'adulte

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#### ARTICLE INFO

*Article history:*

Received 17 July 2017  
Received in revised form 18 May 2018  
Accepted 8 June 2018  
Available online xxx

*Keywords:*

Contracture  
Stiffness  
Finger  
Proximal interphalangeal  
Metacarpophalangeal  
Arthrolysis  
Tenoarthrolysis.

*Mots clés :*

Raideurs  
Doigt  
Interphalangienne proximale  
Métacarpophalangienne  
Arthrolyse  
Ténolyse

#### ABSTRACT

This lecture will focus on posttraumatic finger contractures affecting the metacarpophalangeal (MCP) and proximal interphalangeal (PIP) joints in adults. The pathophysiology, main causes and essential rehabilitation methods that can be used before resorting to surgical treatment are described, along with the clinical examination. The goal is to define the surgical indications, even though the literature shows the functional outcomes are disappointing. While there is little to no change in a joint's angular amplitude, the functional range of motion can be improved. There is practically no functional improvement except in cases of MCP extension contracture. For the PIP joint, the aim is to shift the range of motion into the functional range. Surgical approaches, surgical techniques and rehabilitation protocols are described in detail.

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#### R É S U M É

Les raideurs des doigts intéressant les articulations métacarpo-phalangiennes (MCP) et interphalangiennes proximales (IPP) d'origine post-traumatiques chez l'adulte sont développées dans cette conférence d'enseignement. Les aspects physiopathologiques, les causes principales et les méthodes de rééducation indispensables à utiliser avant de proposer un geste chirurgical sont exposées, ainsi que l'évaluation clinique. Le but poursuivi était de préciser les indications chirurgicales, sachant que la littérature montre que les résultats fonctionnels sont décevants. Les gains angulaires sont nuls, seul le secteur de mobilité utile peut être amélioré. L'amélioration est quasi nulle sur le plan fonctionnel, sauf pour les raideurs en extension des MCP ; pour les IPP, on déplace le secteur de mobilité vers un secteur plus utile. Les voies d'abord, les techniques chirurgicales et la prise en charge par les rééducateurs sont détaillées.

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### 1. Definitions and scope

A finger contracture occurs when the active and passive range of motion (ROM) between two finger segments is reduced. The scope of this lecture will be limited to posttraumatic finger contractures (excluding the thumb) in the metacarpophalangeal (MCP) and proximal interphalangeal (PIP) joints in adults.

A review of literature on Pubmed was done with the keywords "Contracture; Stiffness; Finger; Proximal interphalangeal;

Metacarpophalangeal; Arthrolysis; Tenoarthrolysis". Recent publications were favored except for seminal works, in particular the 1980 SoFCOT symposium on this topic [1].

Contracture must be differentiated from finger deformity. This excludes a locked trigger finger and PIP flexion deformity due to Dupuytren's disease or skin adhesions (unless the joint itself is stiff). Also excluded are contractures due to malunion or posttraumatic osteoarthritis, which is where imaging comes into play, and fixed posttraumatic flexion contractures, which are very challenging to treat.

Thus, finger contractures have a predominant articular component and sometimes a tendinous one [1]. It is also important to

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<https://doi.org/10.1016/j.hansur.2018.06.003>

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consider—both in terms of causes and surgical technique—the trophicity and tissue balance, hence the health of the skin, blood vessels and nerves in the affected finger, along with bone structures.

Very few new or innovative ideas have been introduced since the 1980 SoFCOT symposium [1].

## 2. Pathophysiology and anatomical pathology

From simple PIP sprains to crush injuries, the sequence of events is the same. The injured hand and fingers bathe in a fluid rich in proteins and macrophages that encompasses not only the injured structure, but the adjacent uninjured structures. The edema and hematoma infiltrate the tendon sheaths, ligaments, capsule and synovial spaces, which limits finger movement. Edema settles in and the swollen hand settles into a pain-free position due to filling of the soft tissues. Contrary to the functional balanced position (intrinsic-plus), the hand is in a position in which the MCPs are slightly flexed and the PIPs are in subtotal extension at  $-10^\circ$ . The hand is held up by the contralateral arm. What we see in our offices is a stiff patient, not an isolated case of finger contracture.

Studies on stretching of the dorsal skin have shown the PIP only needs 12 mm lengthening to flex  $90^\circ$ . In the case of dorsal edematous thickening, 19 mm of skin lengthening is required to achieve  $90^\circ$  flexion, which is impossible. Thus the intrinsic-plus position is useful not only for preventing MCP extension contracture, but also for keeping the PIP extended since the extensor mechanism is stretched by the tenodesis effect. The opposite can lead to MCP extension and PIP flexion contracture [2,3]. These events are also associated with pain.

Mansat and Delprat [4] described three factors responsible for PIP contracture—pain, edema and prolonged immobilization in the wrong position—which contribute to creating adhesions between the ligaments and bones. This results in a vicious circle of “pain, edema, pain-free position, stiffness, pain, etc.”

The ligament and capsule structures are always affected, which means that a finger contracture is first and foremost a joint contracture. The specific anatomy of the fingers can explain the contracture and can be used as a basis to infer treatments.

In the study presented at the 1980 SoFCOT symposium [1], the contributing elements were identified:

- skin: particularly the dorsal aspect after deep wounds, leading to restrictive skin–tendon–bone adhesions; this situation was found in only 12% of cases; however, it is essential to consider the skin when selecting the surgical approach, especially when bone needs to be exposed;
- extensor mechanism: this was involved in 25% of PIP contracture and 20% of MCP extension contracture cases; however joint involvement was responsible for more than 70% of contracture cases;
- flexor tendons: PIP flexion contracture was implicated in 20% of cases and should always be evaluated.

Contracture following complex regional pain syndrome is often extensive and affects multiple fingers. The treatment strategy is completely different to posttraumatic contracture and surgery should be delayed until the acute stage is over.

## 3. Clinical and imaging assessments

Like in the wrist and elbow, the functional ROM for the MCP and PIP joints has been defined as  $33^\circ$  to  $73^\circ$  flexion for the MCP, and  $36^\circ$  to  $86^\circ$  flexion for the PIP [5]. MCP extension contracture may not be very problematic if some flexion is still present; a flexion

contracture is very rare. However, PIP flexion contracture of  $-80^\circ$  is very disabling, as is a severe extension contracture that prevents any and all movement. It is well known in rheumatoid arthritis cases that a finger set in the boutonniere position is better than a finger contracture with a swan neck deformity.

Thus simple cases of contracture—the most common are purely articular with occasional tendon involvement—must be differentiated from complex cases that are the sequelae of severe trauma involve the bone, joints, tendons, nerves and blood vessels. This latter condition will not be addressed here (see SoFCOT symposium) [1].

The type of contracture is defined based on the position in which the finger has become stiff (not the residual angular sector):

- extension contracture: the finger has good extension (for example PIP or MCP with  $-10^\circ$  extension), but its flexion does not exceed  $40^\circ$ .
- flexion contracture: the joint can be flexed actively beyond  $90^\circ$ , but its extension is limited to  $-60^\circ$ .

The injury mechanism, treatments applied urgently and secondarily, rehabilitation and splint use are documented. A clinical examination is used to specify the type and extent of the contracture. This examination starts by evaluating the skin. An analysis of scars, gliding areas, burn sequelae and flexibility is important to choosing a surgical approach and/or thermoplastic splints needed to shorten but not restrain the movement. X-rays are done to rule out intra-articular malunion, which would require an additional procedure (one or two phases) and that bone fixation material be left in place.

It is essential for the finger to have good sensation, good vascularization and good metabolism. Everything possible must be done to restore these functions. Smoking habits, the ability to participate in the orthotic and surgical treatment, and the patient's psychological profile must be evaluated. While a splint treats the hand, it takes the patient “in hand” at the same time. The surgeon's role as a therapist is to “tame” the hand.

Grip strength and ROM (active and passive) are measured preoperatively. This will help determine the best time for a surgical intervention if the rehabilitation fails. If the passive ROM is better than the active one, the muscle–tendon unit is implicated, and the cause is extrinsic. If passive and active ROMs are equal, there is likely a ligament, capsule or bone problem and the cause is intrinsic.

The following clinical tests can be used for each type of contracture:

- for PIP in extension, the standard Finochietto–Bunnell (intrinsic tightness) test is used. The PIP is easier to flex if the interosseous muscles are relaxed, thus with the MCP flexed, and it will be harder to flex when the MCP is extended. If the PIP joint does not flex in this position, a procedure is required on the interosseous muscles;
- the Colditz lumbrical tightness test determines whether the lumbricals are also involved because distal interphalangeal (DIP) joint flexion is also limited by extending the MCP.
- the Haines–Zancolli test identifies tightness of the oblique retinacular ligament in PIP flexion contracture cases when extending the PIP prevents DIP flexion.
- the Kilgore extrinsic test is positive when the extensor tendons are involved and adhered: flexing the wrist and MCP prevents PIP extension.

With a significant flexion contracture, it is important to rule out damage to the central slip of the extensor apparatus resulting in chronic boutonniere deformity, which is more difficult to treat. A

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