Dupuytren Disease: Planning Surgical Approaches

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ABSTRACT
Dupuytren disease is a fibroproliferative disorder of the palmar fascia that causes flexion contractures and functional impairment. Its course is variable, and recurrence rates are high; therefore, surgery remains the mainstay of treatment for patients with advanced disease. The anatomical complexity of the palmodigital region and the heterogeneous presentation of the disease make careful planning of the surgical approach essential to optimizing outcomes. Knowledge of the anatomy of the palmar aponeurosis and its digital extensions allows the cords and their relationship to the neurovascular structures to be identified, which is crucial for safe resection. The choice of skin incision should be based on the extent of the disease, the number of digits and joints involved, the anatomical pattern, and the condition of the skin, rather than on the degree of contracture. The main incision options (longitudinal, transverse, and combined) as well as dermofasciectomy in selected cases are discussed, together with the authors' preferences. Although minimally invasive alternatives are available, fasciectomy continues to provide more durable results. Appropriate planning can improve exposure, reduce complications, and optimize functional outcomes.
Keywords: Dupuytren contracture; fasciectomy; palmar fascia; flexion contracture.
Level of Evidence: V

Enfermedad de Dupuytren: planificación de los abordajes quirúrgicos

RESUMEN
La enfermedad de Dupuytren es un cuadro fibroproliferativo de la fascia palmar que genera contracturas en flexión y deterioro funcional. Su evolución es variable y la tasa de recurrencia es alta, por lo que la cirugía sigue siendo el tratamiento principal en pacientes con estadios avanzados. La complejidad anatómica de la región palmodigital y la presentación heterogénea hacen que la planificación del abordaje quirúrgico sea determinante para optimizar los resultados. El conocimiento de la anatomía de la aponeurosis palmar y sus prolongaciones digitales permite identificar las cuerdas y su relación con las estructuras neurovasculares, lo que resulta clave para una resección segura. La elección del abordaje cutáneo debe basarse en la extensión de la enfermedad, la cantidad de dedos y articulaciones comprometidos, el patrón anatómico y el estado de la piel, más que en el grado de contractura. Se analizan las principales opciones de incisión (longitudinales, transversales y combinadas), así como la dermofasciectomía en casos seleccionados, junto con las preferencias de los autores. Aunque existen alternativas mínimamente invasivas, la fasciectomía sigue ofreciendo resultados más duraderos. Una adecuada planificación permite mejorar la exposición, reducir complicaciones y optimizar los resultados funcionales.
Palabras clave: Enfermedad de Dupuytren; fasciectomía; fascia palmar; contractura en flexión.
Nivel de Evidencia: V

INTRODUCTION

Dupuytren's disease is a condition of the hand characterized by pathological proliferation of the palmar fascia, with the formation of nodules and cords that cause flexion contractures and functional impairment.[1] Its course is variable and unpredictable, with varying degrees of severity and a tendency to recur. Several treatment options are available; however, surgery remains the most commonly used treatment.

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The anatomical complexity of the palmodigital region and the variability in disease extent make surgical approach planning essential to achieve adequate release and optimize outcomes. Despite the numerous techniques described, there is no clear systematic approach to guide the selection of the surgical approach for each patient.

The objective of this article is to present a practical approach to planning surgical approaches in patients with Dupuytren's disease.

SURGICAL ANATOMY

A detailed understanding of the anatomy of the palmar aponeurosis and its digital extensions is essential for appropriate surgical planning in patients with Dupuytren's disease, in order to achieve complete resection of pathological tissue and reduce the risk of injury to neurovascular structures, which are frequently displaced by the disease.

The palmar aponeurosis is a complex three-dimensional system whose primary functions are to protect the deep structures and stabilize the skin during grasping.[2] Anatomically, it is divided into three regions: the central, thenar, and hypothenar palmar aponeuroses, with the central region being the most frequently affected (Figure 1).[2,3]

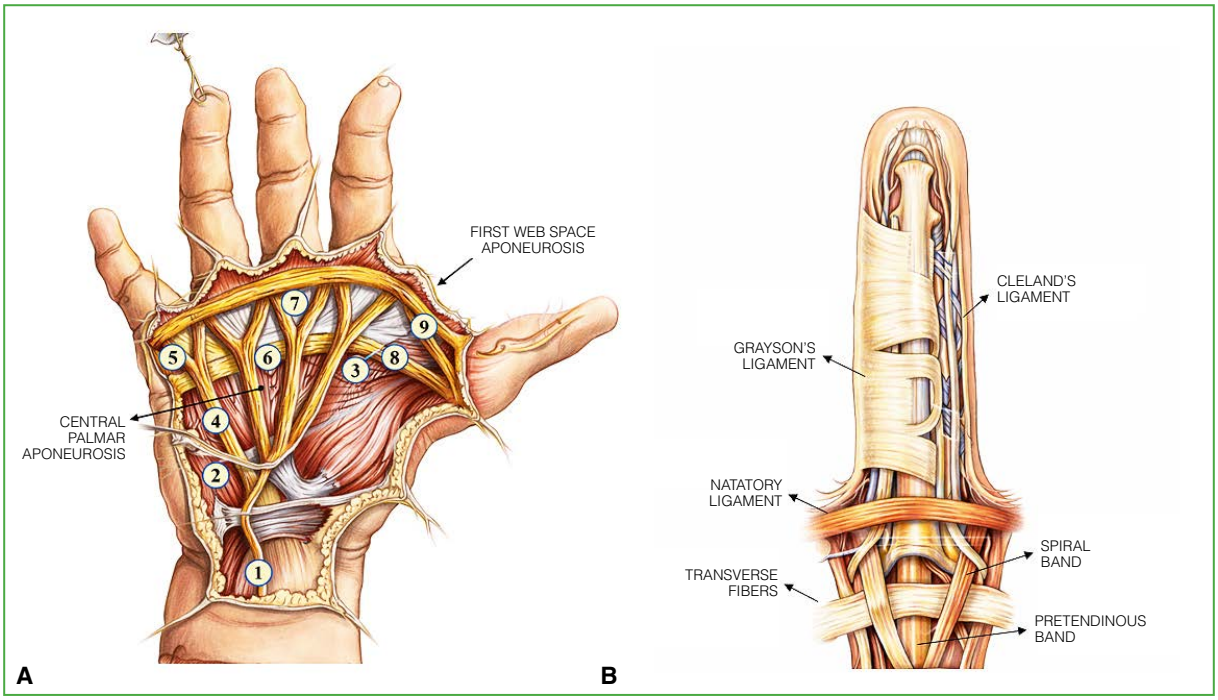

Figure 1. A. Middle palmar aponeurosis. 1. Palmaris brevis. 2. Hypothenar aponeurosis. 3. Thenar aponeurosis. 4. Pretendinous bands. 5. Spiral band. 6. Deep transverse fibers. 7. Natatory ligament. 8. Proximal commissural ligament. 9. Distal commissural ligament. **B.** Palmodigital aponeurosis.

Central Palmar Aponeurosis

It is shaped like an inverted triangle, with its proximal apex at the palmaris longus tendon, when present, and consists of three fiber systems:

• *Longitudinal fibers (pretendinous bands):* These run from proximal to distal toward the fingers and constitute the main anatomical substrate for cord formation in Dupuytren's disease. Some terminate in the skin of the distal palmar crease (Grapow fibers), whereas others attach to the flexor tendon sheath and extend toward the vicinity of the extensor tendon. Most divide into two bands that surround the metacarpal heads, forming the spiral band (Gosset fibers), which continues into the natatory ligament and the lateral digital sheet.[2,3]

• *Transverse fibers:* Located deep at the level of the distal palmar crease, these fibers have a stabilizing function and, unlike other structures, are rarely affected by the disease.[2,3]

• *Vertical or sagittal fibers (septa of Legueu and Juvara):* These connect the dermis to the deep planes, delimiting compartments through which the tendons and neurovascular bundles run alongside the lumbrical tendon.[2,3]

Palmodigital Aponeurosis

This is a critical transition zone from a surgical standpoint, where multiple structures intersect:

• *Natatory ligament:* A system of transverse fibers that forms the interdigital commissures. Its involvement may result in commissural cords that limit finger abduction.[2,3]

• *Spiral bands and lateral digital sheet:* Derived from the pretendinous bands, these structures pass deep to the neurovascular bundle and the natatory ligament before inserting into the lateral digital sheet. They contribute to the formation of spiral cords, which can encircle and displace the neurovascular bundle, thereby increasing the risk of injury during surgery.[2,3]

Digital Aponeurosis

In the fingers, the fascia is organized in relation to the neurovascular bundle and the extensor mechanism:

• *Grayson's ligament (volar) and Cleland's ligament (dorsal):* These stabilize the digital skin and delimit the neurovascular tunnel. Thomine also described a retrovascular fascia consisting of fibers located dorsal to the neurovascular bundle and volar to Cleland's ligament.[2,3]

• *Lateral digital sheet and retinacular structures:* These structures contribute to force transmission and the progression of contracture toward the interphalangeal joints. The lateral digital sheet originates at the commissure from fibers of the natatory ligament and spiral band. Some of these fibers insert into the periosteum of the adjacent phalanx, the joint capsule, and the tendon sheaths.[2]

Anatomical Implications of the Disease

From a surgical standpoint, it is essential to recognize the different types of cords (pretendinous, central, lateral, abductor digiti minimi, retrovascular, and spiral), as their anatomical arrangement determines:

- the pattern of contracture,
- the relationship with the neurovascular bundle, and
- the risk of injury during dissection.

In particular, spiral cords can displace the neurovascular bundle into a more superficial and central position, creating one of the highest-risk scenarios during surgical dissection.[2,3]

Planning the Surgical Approaches

The surgical goals in patients with Dupuytren's disease, as proposed by Tubiana, include correction of deformities, prevention of complications, reduction of recovery time, and, ideally, reduction of the risk of recurrence.[4]

Since there is no curative treatment, management is essentially symptomatic and aimed at correcting contractures. However, no treatment has completely eliminated the risk of recurrence or disease progression.[5]

Three fundamental aspects must be considered in surgical planning: 1) management of the skin, 2) management of the fascia, and 3) management of joint contracture, particularly at the proximal interphalangeal joint.[5] In this article, we focus specifically on the cutaneous component.

Planning the skin incision is one of the main challenges in the surgical treatment of this disease, as it determines exposure of the underlying structures, the possibility of complete resection of pathological tissue, and the final functional outcome. Incisions should be planned individually for each patient, taking into account the location of the disease (palmar or digital), the type of contracture (metacarpophalangeal or interphalangeal), the number of involved fingers, associated deformities, and skin quality.

Skin management options include incision or excision, the latter performed en bloc with the fascia as a dermo-fasciectomy.[5] When skin replacement is required, a full-thickness skin graft harvested from various donor sites is usually the first option considered.

Since Dupuytren's original description, numerous incision techniques have been proposed for the surgical treatment of this disease (Figure 2).[2] Transverse incisions, which were initially used, were gradually replaced because they were associated with scar contracture and greater vascular compromise. Currently, longitudinal incisions are preferred because they allow the exposure to be extended as needed. In cases of advanced disease involving multiple fingers, combined incisions incorporating both longitudinal and transverse components may be used.[5]

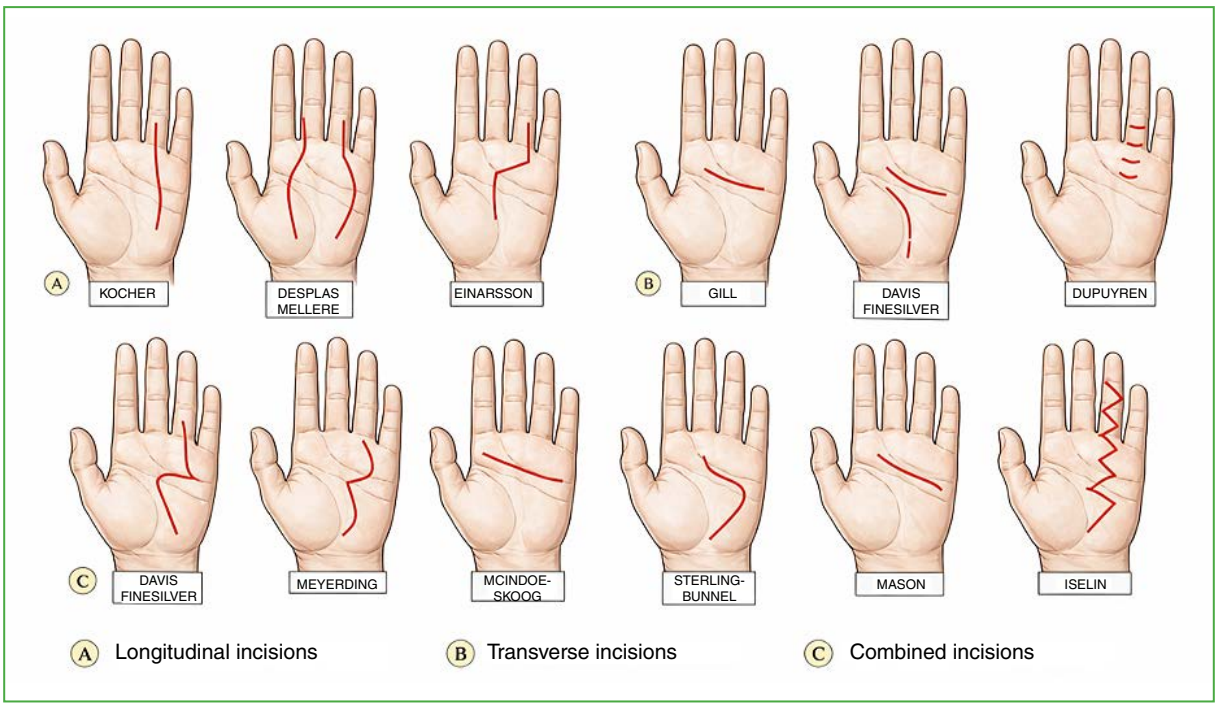

Figure 2. Incisions described by different authors for the treatment of Dupuytren's disease.

Longitudinal Incisions

All longitudinal incisions share several general principles: avoiding scars that cross concavities (e.g., the palmar midline), creating flaps that provide adequate exposure, and allowing skin lengthening through Z-plasty or V-Y plasty when necessary.[5]

Longitudinal incisions are the approach of choice when a single finger is involved. The most commonly used patterns include:

a) *Straight incision with multiple Z-plasties*: This allows progressive exposure of the neurovascular structures and lengthening of the scar through transposition of triangular flaps.[6] Its effectiveness depends on the angle and length of the limbs. Angles of 45° and 60° are most commonly used, providing approximate increases in length of 50% and 75%, respectively (Figure 3).[6,7]

In *first web-space contracture* secondary to commissural cords, more complex Z-plasty variants may be used, such as the four-flap or five-flap Z-plasty (jumping man flap), which provide adequate release and widening of the web space (Figure 4).[7,8]

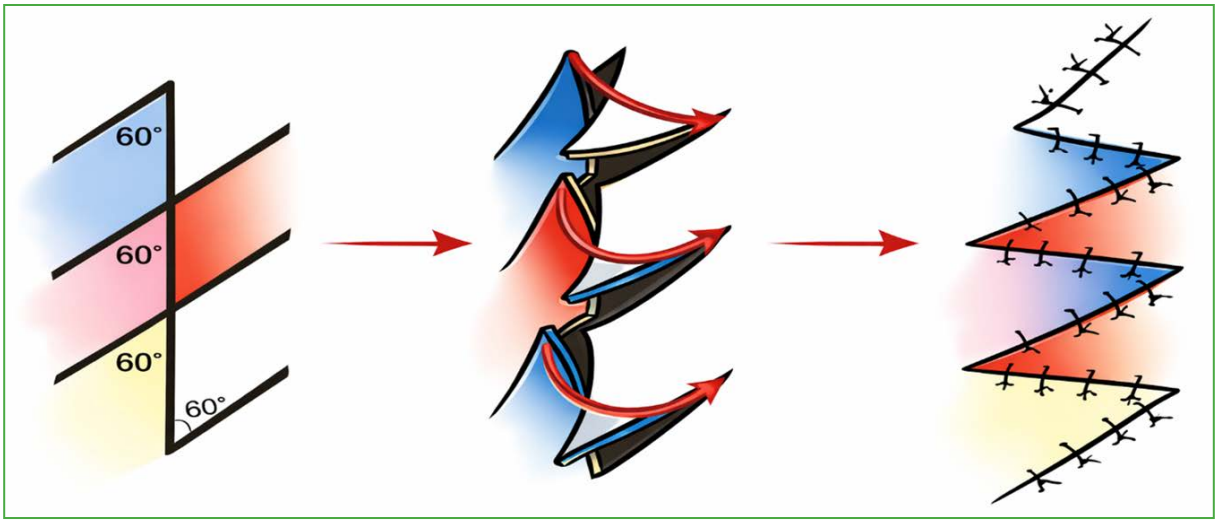

Figure 3. Design of multiple Z-plasties.

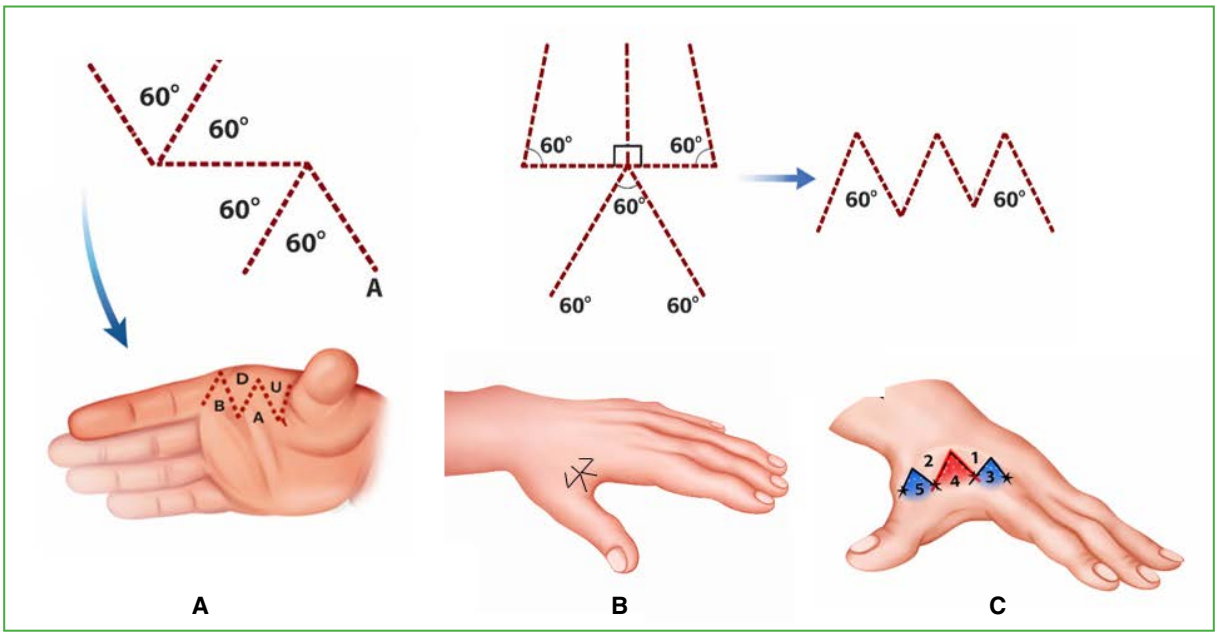

Figure 4. A. Four-flap Z-plasty. **B.** Five-flap Z-plasty (trident or *jumping man flap*).

b) *Bruner-type zigzag incision:* This incision is widely used in surgery for Dupuytren's disease. It provides adequate exposure while avoiding scar contracture across flexion creases. It does not provide skin lengthening and may be associated with ischemia at the tips of the flaps in cases of severe contracture. It is used primarily when involvement is moderate and tension-free closure can be achieved (Figure 5A).[5]

c) *V-Y advancement flaps:* These provide additional skin lengthening and may be combined with zigzag incisions as needed (Figure 5B).[5]

d) *Moermans' small curved incisions:* These consist of small, intermittent longitudinal incisions along the cord, allowing segmental resection in selected cases (Figure 5C).[9]

e) *Lateral approach:* This approach is indicated when there is predominant involvement of the proximal interphalangeal joint and may be supplemented with distal or proximal zigzag extensions, depending on the exposure required (Figure 5D).

Figure 5. A. Bruner-type incision. **B.** V-Y plasty (Shaw RB Jr, Chong AK, Zhang A, Hentz VR, Chang J. Dupuytren's disease: history, diagnosis, and treatment. *Plast Reconstr Surg* 2007;120(3):44e-54e). **C.** Moermans' curved incisions (Dias JJ, Aziz S. Fasciectomy for Dupuytren contracture. *Hand Clin* 2018;34(3):351-66.). **D.** Lateral incision.

Transverse Incisions

Transverse incisions are associated with a higher risk of scar contracture; therefore, their use as isolated incisions has gradually been abandoned, and they are now generally reserved for combination with longitudinal incisions. The open-palm technique described by McCash[10] consists of leaving the transverse wound open to heal by secondary intention; however, it is associated with prolonged healing times and a higher risk of contracture. It may be supplemented with a full-thickness skin graft.

Combined Incisions

Combined incisions are most appropriate when two or more fingers are involved, as they provide broad exposure of the palmar region and can be extended into the fingers. Typically, an incision is made along the distal palmar crease and extended into the fingers using longitudinal or zigzag incisions.

The transverse palmar incision extended into the digits with Z-plasties, as described by Skoog, provides excellent exposure and skin lengthening (Figure 6A).[11]

When skin involvement is moderate, the incision may be continued with Bruner-type zigzag incisions, without the need for additional plasties (Figures 6B and 7A).

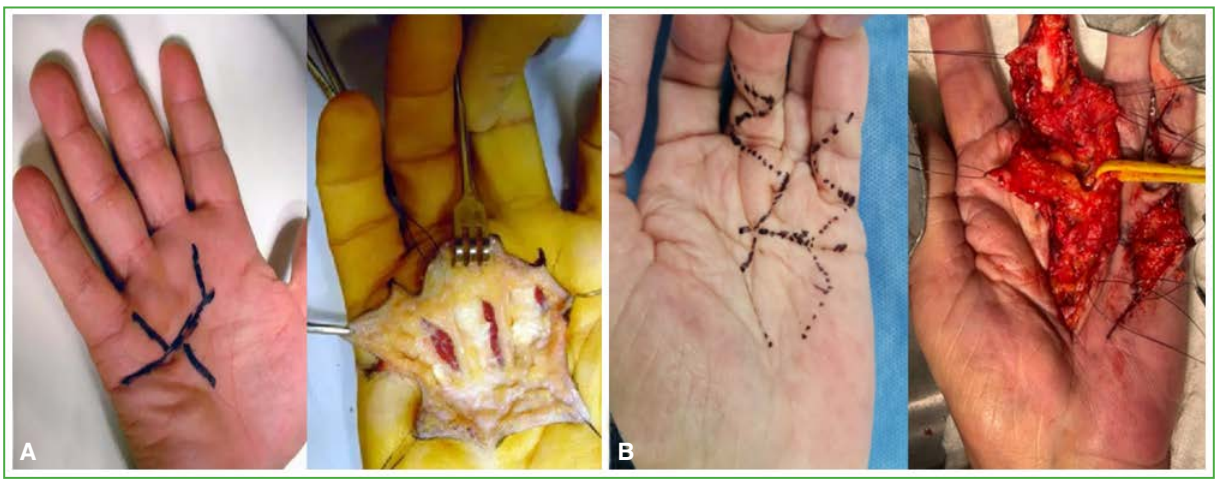

Figure 6. A. Combined Skoog incision for palmar Dupuytren's disease. **B.** Combined Skoog incision for Dupuytren's disease with palmodigital involvement.

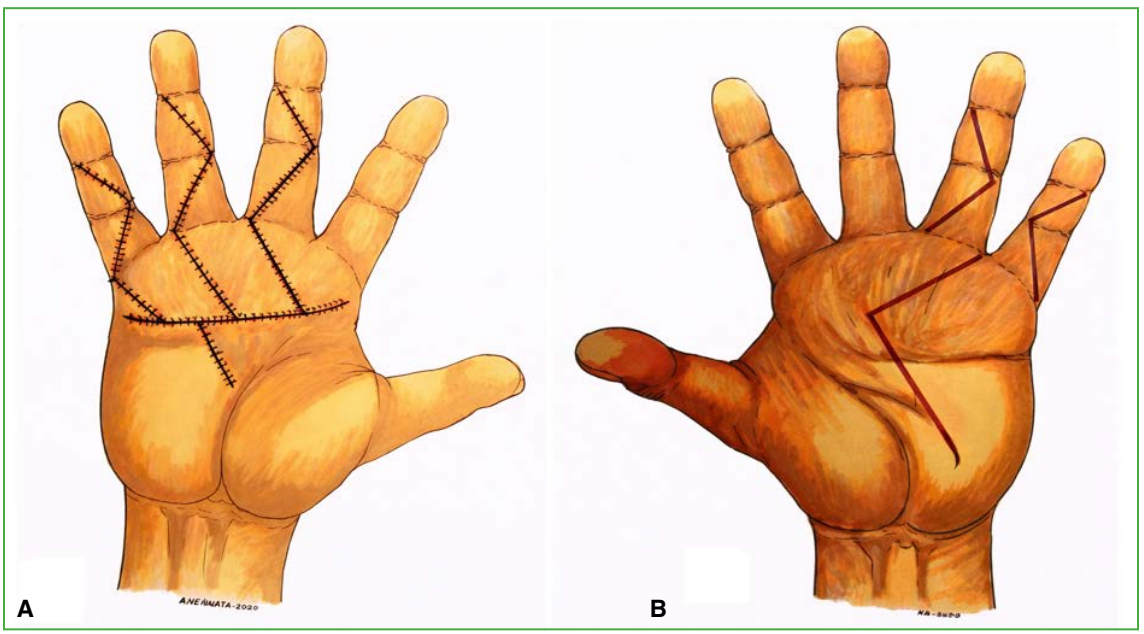

Figure 7. Combined incisions. **A.** Combined Skoog incision with zigzag extensions into the digits. **B.** V-V incision for palmodigital disease involving the fourth and fifth digits.

In patients with extensive palmodigital disease involving the ulnar digits, the "V-V" incision, described by one of the authors of this article, may be used. This technique combines a palmar "V" incision with digital "V" incisions, facilitating exposure and redistribution of the skin during closure (Figures 7B and 8).[2]

Figure 8. Patient with palmar Dupuytren's disease treated using a V-V approach in the palm.

Skin Excision: Dermofasciectomy

Dermofasciectomy is indicated in cases of significant skin involvement or recurrent disease and allows en bloc resection of the affected skin and fascia. This technique was popularized by Hueston[5] as an alternative for addressing skin shortening or replacing dermis infiltrated by myofibroblasts. Although it does not completely eliminate the risk of recurrence, some studies suggest lower recurrence rates compared with fasciectomy alone, although the evidence is inconsistent.[12,13] Coverage is achieved with a full-thickness skin graft, usually harvested from the hypothenar region or the arm. Split-thickness skin grafts are not recommended because of their greater tendency to contract during healing (Figure 9).[14]

Figure 9. A 58-year-old man treated with dermofasciectomy. **A.** Preoperative images. **B.** Intraoperative images. Graft harvested from the medial aspect of the arm. **C.** Four months after treatment.

Authors' Preference

In our practice, the choice of surgical approach for Dupuytren's disease is based on the extent of the disease, the number of involved fingers and joints, the anatomical pattern of the cords, and the condition of the skin, with the strategy tailored to each individual case. The degree of contracture according to the different classification systems is not a primary criterion in decision-making.

Single-finger involvement: We prefer Bruner-type zigzag incisions. When involvement of the proximal interphalangeal joint predominates and retrovascular cords are suspected, we use a lateral approach, which may be supplemented with zigzag extensions. In cases of significant skin contracture, we use longitudinal incisions combined with Z-plasties.

Involvement of two or more fingers: We typically use a Skoog-type transverse palmar incision with extensions into the fingers. Alternatively, particularly when the ulnar digits are involved, we use "V-V" incisions.

First web-space contracture: We release the first web space using a five-flap Z-plasty (*jumping man flap*) (Figures 4B and 10).

Recurrent disease: We consider dermofasciectomy with a full-thickness skin graft, typically harvested from the proximal forearm (Figures 9 and 10).

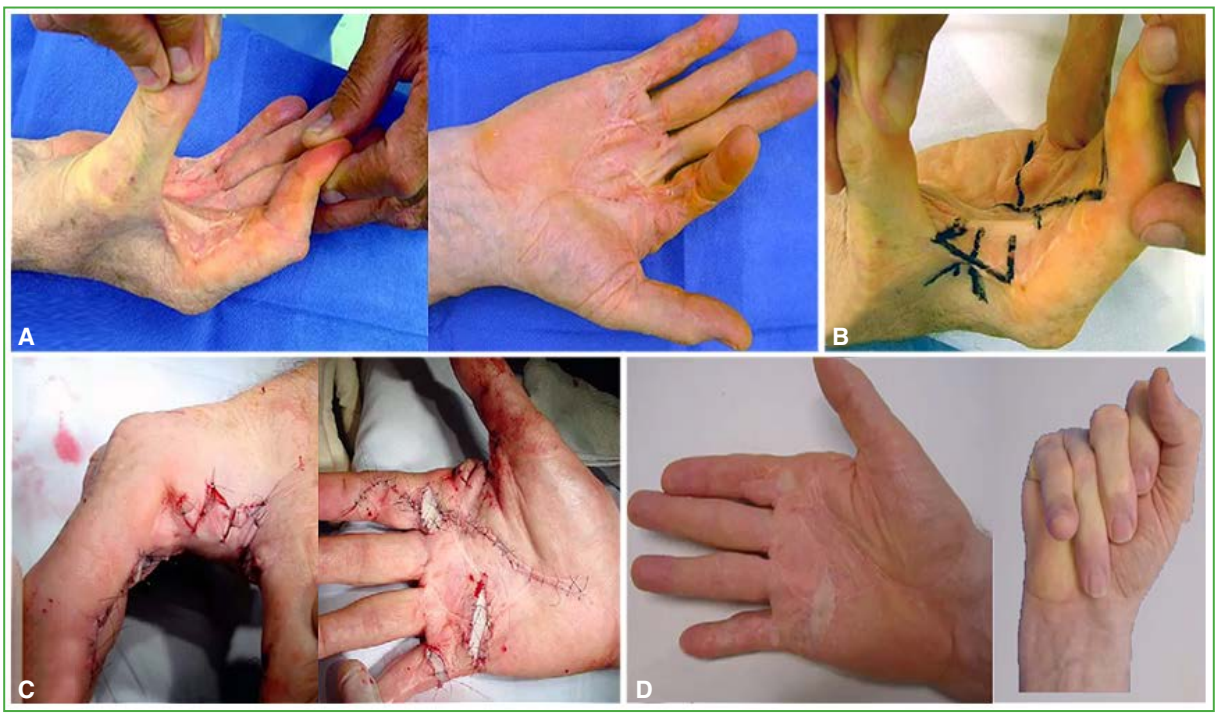

Figure 10. A 67-year-old man who underwent seven surgeries for recurrent Dupuytren's disease with flexor tendon involvement. **A.** Preoperative images. **B.** Design of the five-flap Z-plasty (*jumping man flap*) for the first web space. **C.** Intraoperative images. A five-flap Z-plasty of the first web space and dermofasciectomy with skin grafting were performed. **D.** Functional images 4 years after surgery.

Other Treatments

In addition to open surgery, there are less invasive alternatives, such as percutaneous aponeurotomy and injection of *Clostridium histolyticum* collagenase, which can release the contracture in selected patients.[15,16] Evidence shows that both achieve comparable outcomes, with no significant differences in correction, recurrence, or patient-reported outcomes. However, collagenase is associated with a higher rate of local complications.[15]

In our setting, the use of these treatments may be limited by their high cost and availability.

Compared with these minimally invasive techniques, limited fasciectomy results in a smaller residual extension deficit and a lower long-term recurrence rate, with better functional outcomes and no differences in serious complications.[16]

Overall, although minimally invasive techniques are valid options in selected cases, fasciectomy continues to provide more durable results. In this context, careful planning of the surgical approach is essential.

The Future

In recent years, advances in our understanding of the pathophysiology of Dupuytren's disease have led to the identification of multiple therapeutic targets aimed at modulating fibroblast proliferation, myofibroblast differentiation, and extracellular matrix production. In this context, several pharmacological strategies are currently under investigation, including transforming growth factor-β antagonists, Wnt pathway inhibitors, tyrosine kinase inhibitors, anti-tumor necrosis factor therapies, interferons, and antifibrotic agents (5-fluorouracil), as well as the development of new collagenases.[17]

Among the therapies that have advanced furthest in clinical development, tumor necrosis factor inhibition with intranodular adalimumab injections has significantly reduced nodule hardness and size in patients with early-stage disease in phase 2b clinical trials.[18]

Other emerging lines of research propose a paradigm shift in the treatment of fibrosis, focusing not only on its elimination but also on its reversal. In *in vitro* and *in vivo* models, therapies based on adipose-derived stem cells combined with platelet-rich plasma have shown the ability to reduce markers of fibrosis and promote the conversion of myofibroblasts into adipocytes, potentially leading to less invasive therapeutic strategies with lower recurrence rates.[19]

However, despite these advances, *Clostridium histolyticum* collagenase remains the only pharmacological therapy approved for clinical use in patients with Dupuytren's disease, and the available evidence supporting the other strategies remains limited. Consequently, surgery continues to be the mainstay of treatment for advanced disease, further emphasizing the key role of surgical planning in its management.

Conflicts of interest: The authors declare no conflicts of interest.

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