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Evaluation of the Outcome of Combining Skin Excision with Limited Fasciectomy in the Treatment of Dupuytren's Disease and its Histopathological Assessment

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Abstract

Background: The palmar aponeurosis is extremely adherent to the skin superficial to it. Many pretendinous coarse fibers enter the dermis at an angle in the whole palm, not only at the palmar creases. It is difficult to distinguish whether Dupuytren's disease (DD) starts in the dermis or the palmar aponeurosis since the skin adheres so closely to the palmar fascia.

Objectives: In this work, we investigate the clinical and histological origin of DD, as well as its impact on disease management.

Patients and Methods: A prospective clinical study was conducted on 47 patients, 42 males and 5 females, who presented with Dupuytren's contracture (29 cases were bilateral and 18 were unilateral) between April 2012 and September 2020. We surgically removed all the diseased tissue and cords together with 2-3 mm of the adherent overlying skin, and then the excised tissue was submitted to histopathological examination.

Results: All our specimens showed chronic inflammatory skin lesions with hyperkeratotic epidermal covering and dermal infiltration with aggregates of chronic inflammatory cells, mainly lymphocytes and plasma cells, as well as proliferated vascular spaces and fibrous stroma. Clinical satisfaction was excellent in 67 (88.2%) hands, good in six (7.8%) hands, fair in three (4%) hands, and there were no poor results. We had no recurrence in any of our cases after an average follow-up period of 4.2 years.

Conclusions: DD is a chronic inflammatory disease that affects both the palmar fascia and skin, as we have seen histologically and surgically. The adhering skin and accompanying cord must be removed for a considerable reduction in recurrence. Whether it originates from fascia or skin, needs further investigation.

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Ethical Considerations: This research was carried out in accordance with the principles of the Helsinki Declaration. Approval was obtained for this study from the Ethical Committee of Faculty of Medicine, Tanta University. An informed written consent was obtained from all patients regarding surgical procedures and publication of their photos.

Introduction

Dupuytren's disease (DD) is a fibroproliferative condition that affects between 2 and 17% of the world's population **[1]**. Despite its high morbidity and related medical expenses, numerous facets of its pathogenesis, categorization, and therapy are still under debate **[2]**. The palmar aponeurosis is extremely adherent to the skin above it. Many pretendinous coarse fibers enter the dermis at an angle in the whole palm, not only at the palmar creases. These differ from the multiple small vertical bands superficial to the palmar fascia, which likewise enter the dermis **[3]**.

It is difficult to distinguish whether DD starts in the dermis or the palmar aponeurosis since the skin adheres so closely to the palmar fascia. DD was postulated to be a benign palmar fascia neoplasm infiltrating surrounding tissues **[4]**. However, it was later proven to be not a neoplasm but a reactive proliferation **[5]**. Elevated stem cell markers in the skin and hypodermis of DD patients have been shown, which suggests that these cells are a source of proliferating fibroblasts and myofibroblasts **[6]**.

Because neither the etiology nor the pathogenesis of DD have been explained, the assessment remains valid. In this work, we investigated the clinical and histological origin of DD, as well as its impact on disease management.

Patients and Methods

Study design:

A cohort study:

Study population and sampling:

The study was conducted in the period between April 2012 and September 2020 at the Plastic Surgery Department in our University Hospital or a private clinic on patients (n=47) who presented with Dupuytren's contracture.

Inclusion criteria:

This study included all patients who presented with Dupuytren's contracture in the form of a cord or nodule causing flexion of the proximal interphalangeal joints (PIP) of hands or metacarpophalangeal joints (MCP) above 30 degrees. All patients provided information regarding their family history, ectopic sites of the disease, bilateral affection, and age at the onset of the disease.

Exclusion criteria:

Patients with immune problems, those who had already undergone surgery on the affected hand, and those with rheumatoid arthritis or other connective tissue illnesses were all excluded from the study. Each patient in this study signed a written consent form that contained details about the potential for negative results, consent to clinical photography, and the possibility of their data being published in medical journals.

Setup:

Intravenous antibiotics were given before the start of anesthesia. The patient was positioned supine with the help of a hand table. An inflatable tourniquet and an Esmarch elastic bandage were used to exsanguinate the extremity. Operative procedures are performed under local, intravenous anesthesia and regional peripheral nerve blockade.

Skin incisions:

Two to three mm of the adherent skin were marked along the whole length of the cord, as well as two Z-shaped limbs on the skin on both sides of the cord (Fig. 1-A). Two parallel longitudinal skin incisions, two to three mm apart, along the previously marked area, were made, commencing just proximal to the cord and finishing just distal to the cord or nodule (Fig. 1-B). The flaps of Z-plasty of healthy tissue over the palm and digits are dissected away to allow good exposure of the structures in-between (Figs. 1-B&C).

Dissection:

The preoperative evaluation of the hand guides the surgeon to the location of abnormal cords to anticipate during the surgical procedure, thereby reducing the chance of neurovascular injury. The pretendinous, central, natatory, and other cords were commonly removed. Because there was a layer of fat underneath the cord in the area from the natatory ligament to the terminal end, the cord was resected from distal to proximal en-mass with two to three mm of adherent skin (Fig. 1-D). This simplified the dissection, offered good exposure, and helped safeguard all the important structures underneath the cord. Sharp dissection was performed at the proximal end of the cord since the skin was tightly adhered to the palmar fascia (Fig. 1-E).

The surgical removal of diseased tissue and cords can consistently and dramatically correct MCP and PIP joint contractures. However, multiple Z-plasties were performed over the healthy skin on both sides of the original incision along the cord to achieve the anticipated degree of improvement and allow easy skin closure. At the conclusion of the operation, the tourniquet was deflated, and hemostasis was meticulously ensured. Before closure, the vascularity of all digits was checked.

Interrupted 4-0 polypropylene sutures were used to close the wound (Fig. 1-F). A volar plaster slab was applied over soft gauze and maintained in place with sustained pressure until the plaster splint hardened and the MCP, PIP, and DIP joints were in the proper extension position.

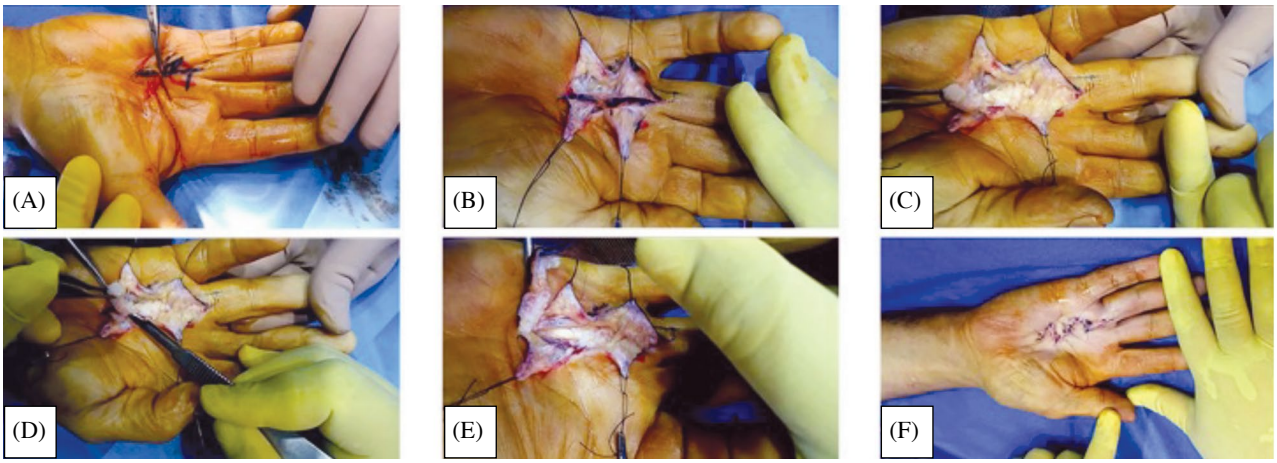

Fig. (1): Surgical technique.

Histological examination of the resected cord in its entirety, together with the adhering skin, was performed by the histopathology department at our university.

Results

This study comprised 47 patients with Dupuytren's contracture, which was bilateral in 29 (61.7%) patients and unilateral in 18 (38.2%) others. The condition affected 76 hands in total, with the left hand being involved in 47 (61.8%) cases and the right hand being involved in 29 (38.2%) of patients. The ring finger was affected alone in 31 (40.8%) hands, the little finger was affected in 8 hands (10.5%), the ring and little fingers were affected in 27 (35.5%), and the ring and middle fingers were affected in 10 hands (13.2%).

Forty-two (89.4%) patients were men, whereas five (10.6%) were women. Before the patient was presented to us, the condition had lasted three years in 28 (59.6%) patients, four years in nine (19.1%) patients, five years in six (12.8%) patients, and six years in four (8.5%) patients (Table 1).

Eleven (23.4%) patients were diabetic, seventeen (36.1%) had a hard time with their hands, and seven (14.9%) were habitual smokers. Nine (19.1%) patients had a positive family history of DD in a close relative. There was no disease on the plantar surface of the patient's feet.

We monitored our patients for a median of 4.2 years (range: 1–7 years). During this follow-up period, 67 (88.2%) of the 76 hands had a complete range of motion in flexion and extension, while 9 hands (11.8%) had 5-10 degrees of residual PIP flexion contracture. One of these patients had a finger that was fixed (a 5-degree correction) at the time of surgery, whereas the other eight had fingers that were only partially cured (residual contracture >5 degrees) (Figs. 2,3).

Table (1): Descriptive analytic data of different patient variables, including age, sex, duration of the disease before it was presented to us, number of affected hands, affected hand side, affected fingers.

Variable	Total number of patients (47)	Percentage
Age:		
40-50 y	7	14.9
50-60 y	31	66
Above 60 y	9	19.1
Sex:		
Male	42	89.4
Female	5	10.6
Duration of the disease before presented to us:		
Three years	28	59.6
Four years	9	19.1
Five years	6	12.8
Six years	4	8.5
Number of affected hands:		
Unilateral	18	38.3
Bilateral	29	61.7
Side of the affected hands:		
Left hand	47	61.8
Right hand	29	38.2
Fingers affected:		
Ring	31 fingers	40.8
Little	8 fingers	10.5
Ring and little	27 fingers	35.5
Ring and middle	10 fingers	13.2

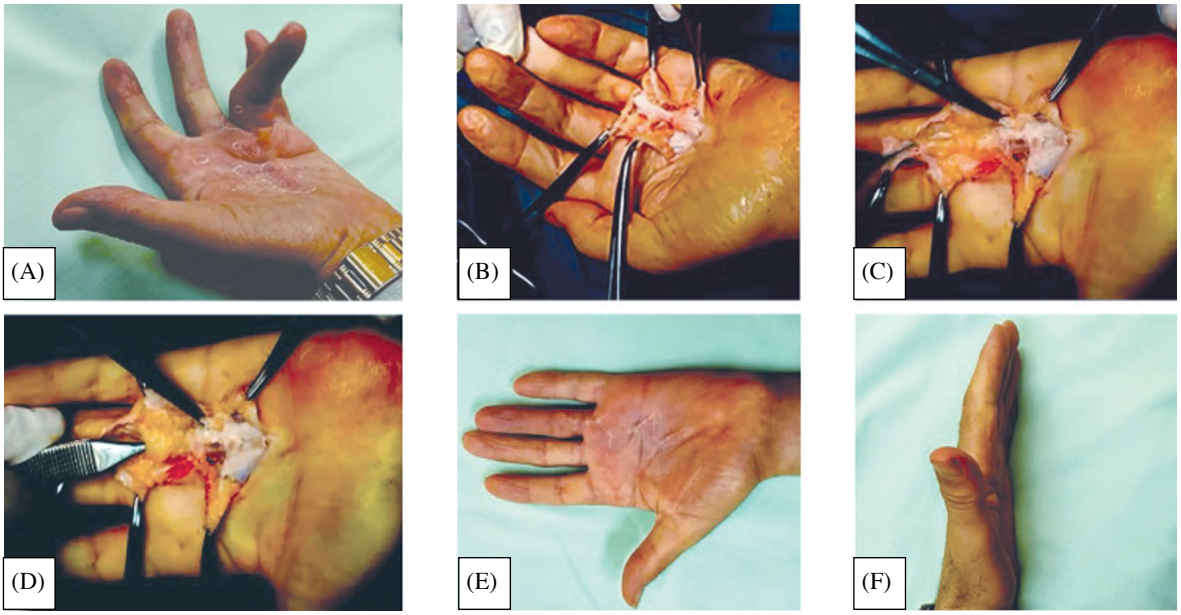

Fig. (2): (A): Preoperative photos of the right hand of a 62-year-old patient with DD affecting the MPJ and PIPJ in the left ring finger. (B): The cord is entirely exposed once the adherent skin is removed, with no subcutaneous fat in between. (C&D): The subcutaneous fatty layer beneath the cord is seen. (E&F): Three years after surgery, showing complete correction of the deformity.

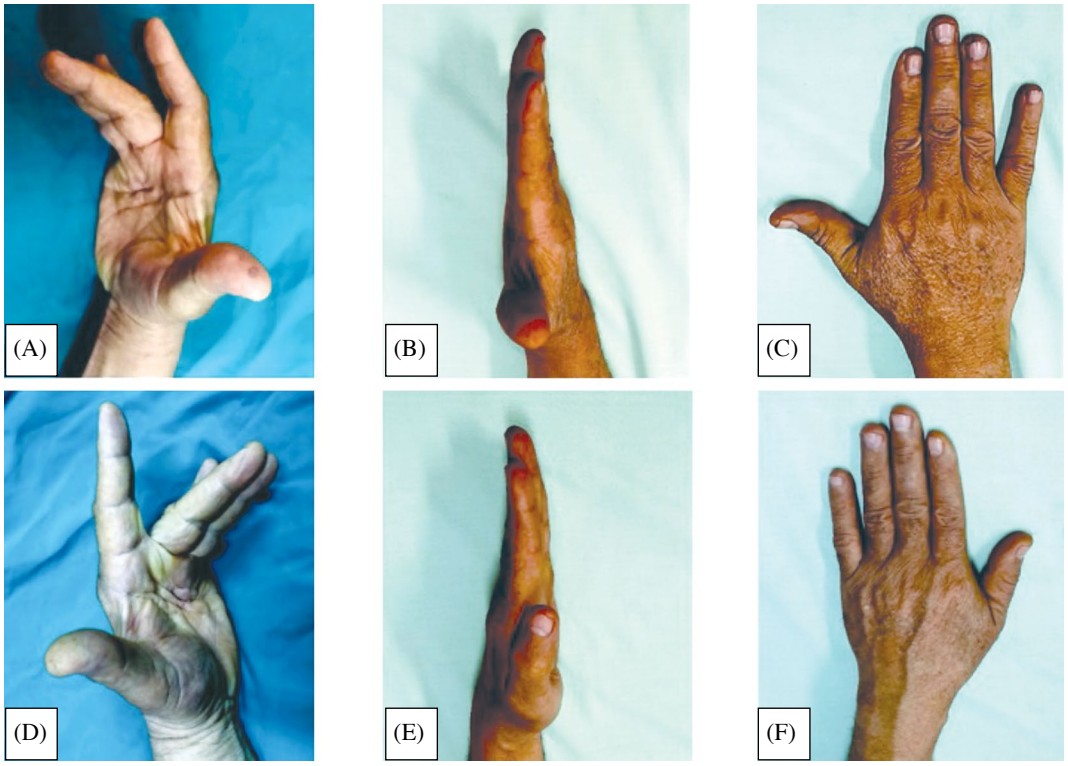

Fig. (3): (A&D): Preoperative images show a 59-year-old patient with DD in both the right and left ring and middle fingers and the MPJ and PIPJ. (B&C) & ∈ & (F): One year after surgery, the deformity is completely corrected.

None of our cases developed iatrogenic tendon, vascular, or nerve injuries. There were two (2.6%) occurrences of hematomas that formed shortly after surgery but responded promptly to repeated aspiration, anti-inflammatory drugs, and antibiotics. Wound infection occurred in two cases (2.6%), and infection was controlled in both cases with wound care and antibiotics, and the wound healed without complications. Three of the repaired hands developed wound dehiscence, which healed without incident with daily dressing using povidone-iodine.

Three plastic surgeons, who did not participate in the study, assessed the results by comparing preoperative, follow-up, and late photos. The outcomes were rated as excellent, good, fair, and poor on a scale of one to four. The result was judged excellent when the score was 4, good when it was 3, fair when it was 2, and poor when it was 1. Clinical assessment was excellent in 67 (88.2%) hands, good in six (7.8%) hands, and fair in three (4%) hands. We had no poor results.

Patient satisfaction with their restored hand function, lifestyle, remarks from family, and overall contentment were evaluated by using patient-reported outcome measures (PROMs). The results are presented according to a score from 0 to 4 as follows: 0–1 indicates poor performance, 2 indicates fair performance, 3 indicates good performance, and 4 indicates excellent performance. Patient satisfaction was excellent in 63 (82.9%) hands, good in seven (9.2%) hands, and fair in six (7.9%) hands (Table 2).

Table (2): The results of our study regarding the clinical assessment, patient satisfaction, and complications encountered.

Clinical assessment	Number of hands	Percentage
Excellent	67 hands	88.2
Good	6 hands	7.8
Fair	3 hands	4
Poor	0	0
Patient satisfaction:		
Excellent	63 hands	82.9
Good	7 hands	9.2
Fair	6 hands	7.9
Poor	0	0
Complications encountered:		
Hematoma	2	2.6
Infection	2	2.6
Wound disruption	3	4
Under correction	9	11.8

Histologically, all our specimens showed inflammatory lesions showing hyperkeratotic epidermal covering and dermal infiltration with aggregates of chronic inflammatory cells, mainly lymphocytes and plasma cells, proliferated vascular spaces, and fibrous stroma. No granuloma or malignant changes could be detected (Fig. 4).

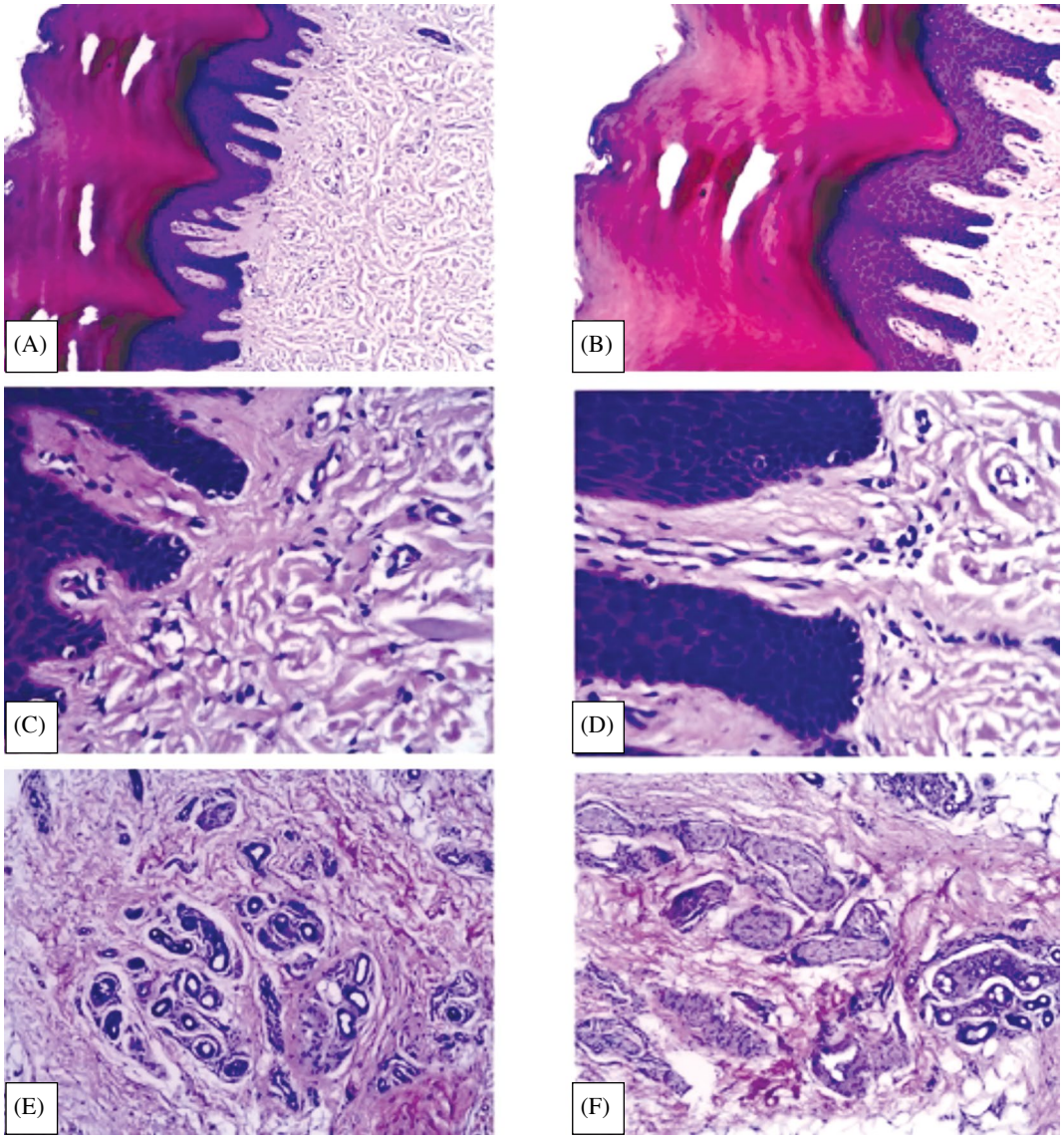

Fig. (4): (A&B): Histologically, all our specimens showed inflammatory lesions with hyperkeratotic epidermal covering. (C&D): Dermal infiltration with aggregation of chronic inflammatory cells, primarily lymphocytes and plasma cells. (E&F): Proliferating vascular spaces and fibrous stroma.

Discussion

Controversy remains about the role of the palmar skin in the development, progression, surgical treatment, and potential recurrence of DD. DD patients can be treated with many different methods. Only mild degrees of the disease can be observed. Intralesional collagenase injection, percutaneous needle fasciotomy, and selective aponeurectomy are all options, although progression or recurrence occurs in up to 85% of instances **[7,8]**.

Although up to 40% of patients experience recurrence, limited fasciectomy (LF) is the most widely used procedure for moderate to severe disease **[9]**. Hueston **[10]** proposed skin replacement as a treatment for recurrent DD in the 1960s. Gonzalez **[11]** confirmed this theory, emphasizing the need to remove all involved skin, fat, and fibrous tissue and resurface the area with a full-thickness skin graft (FTSG) **[12,13]**. The same team later discovered fibromatosis in the skin of individuals with recurrent DD, so they recommended dermo-fasciectomy (DF) as the best surgical procedure **[14]**.

Since then, studies have shown that DF and FTSG can reduce the incidence of recurrence by up to 33% **[15,16]**. The recurrence rate following DF was reported to be as low as 8.4% within a 6-year follow-up period **[1]**. Ketchum **[17]** demonstrated that DF primarily excised skin, fat, fascia, aponeurosis, scar, and diseased tissue, significantly improving the range of motion. However, they could not fully explain why their DF patients have

straighter digits, and they advised that this issue should be researched further.

There is not much data correlating the clinical and histological characteristics of skin DD [18], or microscopically analyzing clinically unaffected skin [11].

In our research, we removed 2-3mm of adhering skin along with the entire cord. At the beginning of the cord, we also removed the adhering fascia. We did not remove any fascia beyond the natatory ligament since we found a good subcutaneous layer deep to the cord and superficial to the fascia of the digits. All our specimens showed inflammatory lesions with hyperkeratotic epidermal covering and dermal infiltration with an aggregation of chronic inflammatory cells, primarily lymphocytes, and plasma cells, proliferating vascular spaces, and fibrous stroma. This finding supports our hypothesis that DD involves the dermis in addition to the fascia. There was no recurrence in any of our cases. This is because we assumed that disease is present in both the skin and the fascia, so we removed both.

Wade et al., histologically examined the excised skin during DF for DD patients. They found 61% skin involvement by the disease, even in cases with no preoperative clinically involved skin. Additionally, they stated that this percent is considered an underestimation of the actual one due to the small piece of skin examined, and they hypothesized that skin possibly plays a greater role in the initiation and progression of the pathology than originally believed and that a preoperative biopsy of the involved skin would be of value in evaluating the disease burden and accordingly predicting the recurrence risk and stratifying patients for certain interventions [19].

Hueston hypothesized that the role of skin in DD may not be simply secondary involvement but it may act as a neurovascular mediator that poses certain control over the disease process [20]. Likewise, Hoopes et al., observed that the dermis overlying nodules and bands had different enzymatic activity from that overlying normal fascia [21].

Denkler et al., reported that DF resulted in a higher rate of complications than LF, where neurapraxia or paraesthesia occurred in 5-9% of cases in LF versus 41-51% in DF, nerve injury occurred in 2-4% of cases in LF versus 2-25% in DF and hematoma occurred in 2% of LF cases versus 15% in DF [22]. According to anecdotal evidence, some surgeons advise against using DF because of the claimed potential for graft failure, the supposed difficulty of the surgery, and the prolonged rehabilitation period. The risk of graft failure has not been shown in any study to be statistically or clinically significant [23].

Previous studies describing fasciectomy for DD either performed LF with a reported high recurrence rate or DF with its reported common previously mentioned complications, in addition to delayed functional recovery and skin graft donor (scarring) and recipient site (sensory loss) morbidity [1]. In our study, we combined the benefits of both procedures while avoiding their potential disadvantages by removing the diseased fascia and only the amount of skin that is necessary to prevent recurrence without the need for skin grafting. Our patients began working one to two weeks after the stitches were removed. Additionally, we histologically confirmed skin involvement.

Numerous studies have recommended employing hand therapy in the treatment of DD. Hand therapy as a prophylactic treatment for DD has insufficient evidence. Hand therapy is individualized to each patient's needs after corrective treatment and includes orthotics, exercise, edema control, and pain or scar management [24]. Because we had limited surgery and did not touch the fibrous flexor sheath in our study, we did not refer our patients to the physiotherapy department.

Conclusions:

Based on our findings, it is essential to remove both the diseased skin and fascia to prevent the recurrence of DD. However, to confirm the origin of DD, whether from skin or fascia, we think it is necessary to take multiple biopsies from skin and fascia at intervals throughout the course of the disease to evaluate the difference between skin and fascia involvement and to decide from where the disease primarily originates.

Our study's primary flaw is the relatively small number of cases overall, which may have been improved by including individuals who had undergone prior operations for DD.

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