



# Minimally invasive partial fasciectomy for Dupuytren's contractures

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## Abstract

**Background** Numerous options exist for the treatment of Dupuytren's contracture. This study describes the technique and early results of partial fasciectomy through a mini-incision approach as an additional treatment option for Dupuytren's disease.

**Methods** This procedure involves the excision of diseased Dupuytren's tissue with the use of multiple 1 cm transverse incisions. Patient demographics, digit involvement, the number of incisions required to release each digit, and complications were recorded for all patients. Range of motion data was obtained from a subgroup of patients that had at least 6 months of follow-up. A paired *t* test was used to compare preoperative and postoperative contracture.

**Results** Sixty-seven patients underwent 75 procedures that involved 119 digits. The mean patient age at the time of surgery was 63 years (range, 33–95 years). A total of 32 digits (47 joints) were available for range of motion analysis. After a mean of 2.2 years following surgery, metacarpophalangeal joint contractures maintained correction (34° preoperatively, 19° postoperatively,  $p=0.008$ ). After a mean postoperative duration of

2.0 years, proximal interphalangeal joint contractures trended worse than preoperative levels (39° preoperatively, 45° postoperatively,  $p=0.319$ ). There was one major complication, which consisted of a nerve laceration that was identified and repaired intraoperatively.

**Conclusions** Partial fasciectomy through the described mini-incision approach provides an additional surgical option for patients who desire a less invasive surgical procedure than traditional fasciectomy. Although this procedure is safe and effective at achieving immediate cord release, maintenance of correction for proximal interphalangeal joint contractures remains problematic.

**Keywords** Dupuytren's contracture · Minimally invasive · Fasciectomy

## Introduction

Numerous options exist for the treatment of Dupuytren's contracture, and the success of each procedure varies greatly throughout the reported literature [5]. Complete fasciectomy is the most invasive intervention with the highest rate of complications [1, 6, 10, 17], but has consistently lower recurrence rates [6, 10, 17]. Percutaneous aponeurotomy provides a less invasive alternative, ideal for patients with smaller contractures; however, contractures tend to recur more rapidly and more frequently than in those patients who undergo open fasciectomy [8, 16]. Injectable collagenase recently became available and has shown promise as a nonoperative approach [9, 16, 18]. While recent studies show that injectable collagenase results in adequate correction for metacarpophalangeal (MCP) joint contractures, its effectiveness at the proximal interphalangeal (PIP) joints is less successful, particularly in patients with more severe contractures [2–4, 9, 11]. In this study, we describe the

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technique of partial fasciectomy performed through a mini-incision approach and provide an analysis of our complications and report on early outcomes in a series of patients treated at our institution.

## Materials and Methods

The study was a retrospective review of patients who underwent partial fasciectomy for Dupuytren's disease. Patient demographics, digit and joint involvement, the number of incision required to release each digit, and complications were noted for all patients. Thumbs were excluded because of inconsistent reporting methodology. Range of motion data was obtained from a subgroup of patients that had at least 6 months of follow-up and available range of motion data. Patients that had a subsequent surgical or nonsurgical intervention for the same digit following initial surgery were noted. A two-tailed paired samples *t* test was used to compare preoperative and postoperative contracture. Statistical significance was set at a *p* value less than 0.05.

### Technique

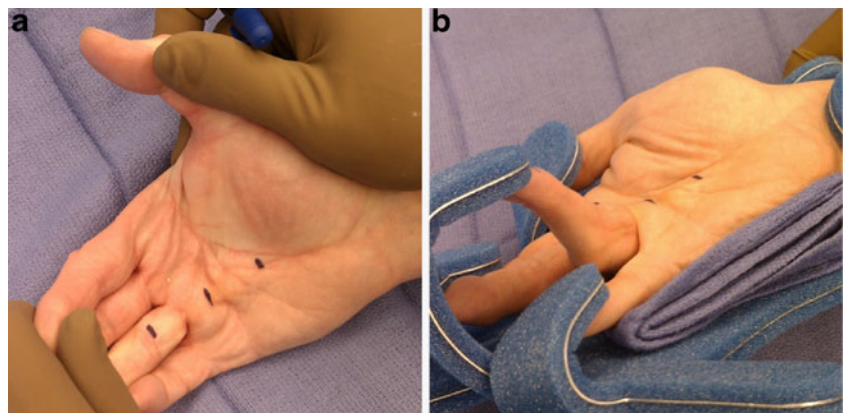
One senior author performed or supervised all procedures. The surgery was performed under either regional or general anesthesia. A well-padded pneumatic tourniquet was utilized to minimize bleeding and enhance surgical visualization. Separate 1 cm transverse incisions were marked out over the cord in the areas of maximum tension. Potential incisions ranged from the proximal palmar crease and when necessary to beyond the PIP joint (Fig. 1a, b). The number of incisions that was required to obtain near complete correction varied depending on the level and degree of joint involvement (Table 1). The skin was sharply incised over the transverse markings and hemostasis was obtained with bipolar electrocautery. Neurovascular bundles were identified and carefully protected with reverse Hohmann retractors before 1–2 cm segments of Dupuytren's cords were excised at each incision

site (Fig. 2). In particular, resection of retrovascular cords was performed with care to ensure that the digital neurovascular structures were not at risk for transection. This situation can be problematic as the digital neurovascular bundles are often displaced central, proximal, and superficial. If unable to properly identify the neurovascular structures, the retrovascular cord may not be released in its entirety. As always, this technique allows the surgeon to see what they are releasing; if visualization is inadequate, discretion over valor is the rule. If preoperative findings indicate that severe PIPJ contractures could be problematic with regard to this particular procedure, patients were offered the option of full open fasciectomies. Skin incision and cord excision were completed in a proximal to distal sequence (Fig. 3). In each case, maximal extension was achieved prior to skin closure with 4-0 nylon sutures and application of a soft dressing. In certain cases, especially those that involved longstanding PIP involvement, residual contractures persisted despite complete release of the cord. In these cases, the extent of correction with regard to this specific technique was discussed with the patient to ensure that their expectations were consistent with a minimally invasive approach that would not necessarily result in full PIP correction.

### Indications/Contraindications

Partial fasciectomy through a mini-incision approach provides an additional treatment option for patients with Dupuytren's contractures. Patients with severe PIPJ contractures were counseled that this procedure would not be the best surgical option given its limited incision and the potential need for more extensive dissection. However, a severe PIPJ contracture was not an absolute or relative contraindication to performing the procedure, and many patients preferred to have this surgery performed rather than an open fasciectomy, primarily because of its minimally invasive nature and faster expected recovery. With regard to collagenase injection, not all patients may be suitable candidates and some patients prefer to avoid the risks associated with the enzyme injection. Additional obstacles may include health insurance coverage and related

**Fig. 1** Incision locations are marked preoperatively over the cord. **a** Frontal plane; **b** oblique plane



**Table 1** A breakdown of the number of incisions made for each clinical scenario

Clinical scenario	Number of incisions	Percentage	Mean number of incision
Concurrent MPJ, PIPJ, and DIPJs (6 digits)	2 Incisions (4/6)	66.7	2.5
	3 Incisions (1/6)	16.7	
	4 Incisions (1/6)	16.7	
Concurrent MPJ and PIPJs (47 digits)	1 Incision (9/47)	19.2	2.5
	2 Incisions (10/47)	21.3	
	3 Incisions (24/47)	51.1	
	4 Incisions (4/47)	8.5	
Incisions to release MPJ only (40 digits)	1 Incision (12/40)	30.0	2.2
	2 Incisions (11/40)	27.5	
	3 Incisions (15/40)	37.5	
	4 Incisions (2/40)	5.0	
Incisions to release PIPJ only (26 digits)	1 Incision (10/26)	38.5	1.9
	2 Incisions (10/26)	38.5	
	3 Incisions (5/26)	19.2	
	4 Incisions (1/26)	3.9	

*PIPJ* proximal interphalangeal joint, *MPJ* metacarpophalangeal joint, *DIPJ* distal interphalangeal joint

financial concerns including co-pays, which can limit the use of injectable collagenase for certain patients. The major contraindication to this technique is a previous total fasciectomy because tissue planes are usually distorted. In this scenario, it may be more prudent to opt for a wide open revision surgery rather than small incisions, which may limit the ability to visualize the neurovascular bundles.

#### Rehabilitation

At postoperative week 1, the surgical dressing was removed and patients were placed in an extension splint for the involved digits. Active range of motion exercises for both the wrist and digits was started either through a home exercise program or formal therapy. Sutures were removed at 2 weeks with continuation of active/active-assisted range of motion exercises and splinting. Patients were also instructed on appropriate scar massage techniques. Strengthening as tolerated began at postoperative week 4. At 6 weeks, patients were instructed to return to all normal activities and continue all therapy exercises and splinting as needed.

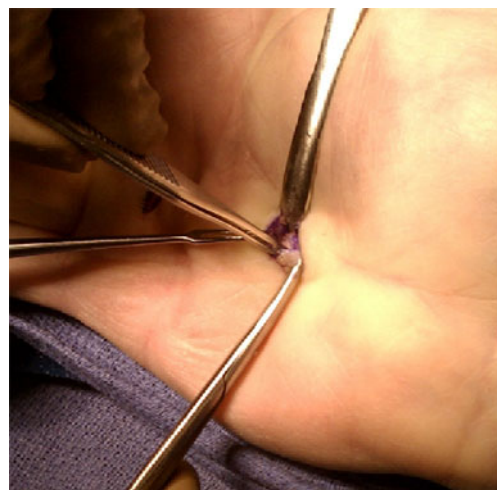
#### Results

Sixty-seven patients underwent 75 procedures that involved 119 digits (8 index; 11 long; 45 ring and 55 small fingers). Eight patients underwent the same surgery more than once (seven operated on twice and one operated on three times). In addition, eight patients underwent subsequent collagenase injection (seven PIPJs, one MPJ) at a mean of 1.9 years after surgery. The mean patient age at the time of surgery was 63 years (range, 33–95 years). There were 53 males

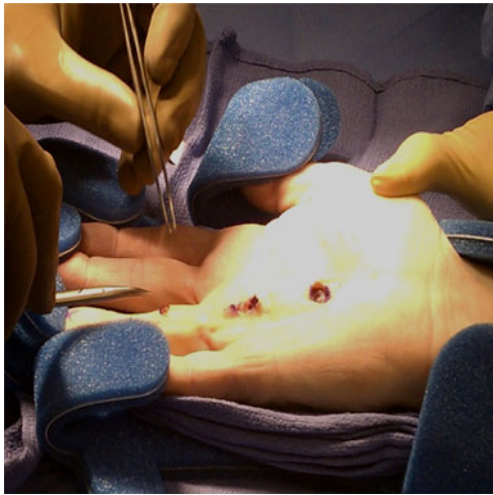
(79 %) and 14 females (21 %). The number of incisions made during surgery is presented in Table 1.

#### Contracture Correction

After excluding patients with unavailable data or with a follow-up duration less than 6 months, the data of the remaining 25 patients were available and used for further analysis. A total of 32 digits and 47 joints were involved in this subgroup. Table 2 presents the patient characteristics as well as the preoperative and final postoperative joint contracture. The results indicate an improved and maintained contracture for MP joints after a mean of 2.2 years following surgery. After a mean postoperative duration of 2.0 years, the results for PIPJ contractures became worse than preoperative levels.



**Fig. 2** Intraoperative photograph depicting the excision of part of a Dupuytren's cord through a 1-cm transverse incision



**Fig. 3** Intraoperative photograph after multiple incisions and release of all cords to achieve maximum extension

### Complications

Seventeen complications developed after a total of 75 procedures. The most common complication, which occurred a total of 12 times, was paresthesias. By the sixth week of the postoperative follow-up, however, the symptoms had resolved in 8/12 patients. Additionally, there was one epineural injury (digital nerve encased within cord) that was repaired with a single 8.0 nylon suture, two cases with serous drainage or slight erythema that resolved with oral antibiotics, two cases of wound dehiscence that resolved with local wound care and oral antibiotics, and one hypertrophic scar.

### Discussion

Partial fasciectomy through the described mini-incision approach provides an additional surgical option for patients who desire a less invasive surgery than traditional operative measures. The purpose of this study was to describe our technique and clinical outcomes.

Our data suggest that minimally invasive partial fasciectomy for Dupuytren's disease represents a safe and effective treatment option with encouraging short-term data, especially for MP joints. The results of PIP joint contractures at a

mean postoperative duration of 2 years following surgery were actually worse than preoperative levels, but these data should be interpreted in a more comprehensive context. First, it should be noted that immediately after surgery, the contracture was released and reached its optimal degree of extension. As is well known about this process, Dupuytren's disease is a progressive disease with no cure, and disease progression occurs in almost all patients, albeit to varying degrees. It should also be noted that our available data consisted primarily of patients who returned to the clinic for further care, and patients that did not return for follow-up in all likelihood experienced better outcomes. Furthermore, PIP joint contractures in Dupuytren's disease tend to have uniformly worse outcomes when compared to MPJ contractures regardless of the treatment modality [1, 7, 9, 11–14, 16, 19]. Other minimally invasive surgical techniques have been described in the literature. Moermans performed 213 segmental aponeurectomies on 175 patients through multiple, 1.5 cm curved incisions [12]. Most patients were seen for nearly 6 weeks (range, 2–30 weeks) and the reported MCP contracture decreased from 37.1° to 1.1° following surgery, and from 45.1° to 13.7° for PIP joints [12]. The author reported a 5.6 % complication rate that included hematomas, skin necrosis, nerve laceration, and sympathetic dystrophy. In a subsequent report where Moermans studied the outcomes of 173 procedures, after an average of 2.9 years following surgery, he found a 38 % recurrence rate and noted that 13.8 % of patients chose to undergo a revision procedure within the same follow-up period [13]. Shin and Jones reported their outcomes on 34 digits using a minimally invasive technique involving multiple transverse incisions [15]. At a minimum follow-up duration of 2 years, the authors reported an improvement of MCP joint extension improved from a mean of 32.5° to 2.2°, while PIP joint extension improved from 22.9° to 4.1°. Two patients experienced paresthesias, which eventually resolved, and no recurrences were noted, although three patients experienced disease extension to adjacent digits. It is important to note that it is difficult to compare the rate of recurrence between different studies because numerous and variable definitions have been used throughout the literature [20].

A relatively novel and noninvasive treatment option that is quickly gaining widespread acceptance is collagenase injection. Gilpin and colleagues conducted a randomized

**Table 2** Joint contracture stratified by joint involvement

Number of patients	Joint	Age at surgery (years)	Mean preoperative contracture (°)	Mean contracture at final follow-up (°)	<i>p</i> value	Follow-up (years)
17	MPJ ( <i>n</i> =27)	65	34	19	0.008	2.2 (0.5–4.3)
19	PIPJ ( <i>n</i> =20)	62	39	45	0.319	2.0 (0.9–3.6)
All=25	MPJ and PIPJ ( <i>n</i> =47)	63	36	31	0.196	2.1 (0.5–4.3)



controlled trial comparing collagenase injection to a placebo and found clinically meaningful improvements in PIP and MCP joint contractures in a population of 66 patients [9]. However, over a period of 12 months, and after receiving multiple injections, only 26/72 (36 %) of PIP joints achieved a reduction of contracture to 0° to 5°, as compared to 42/62 (68 %) of MCP joints. Although the early results of this intervention appear to be promising for MCP joints, long-term outcomes have been rarely reported. Watt et al. looked at the clinical outcomes of eight patients (six MCPJs and two PIPJs), 8 years after a one-time collagenase injection [19]. The mean MCP joint contracture was 57° and this was reduced to 9° 1 week after injection but eventually increased to 22° 8 years later. The authors reported a recurrence rate of 67 % for MCP joint contractures. In addition, both PIP joint contractures recurred and became worse than the pre-injection levels, which averaged 45° before injection and 60° 8 years after injection [19].

Relative to percutaneous needle fasciotomy, our described procedure allows the operating surgeon to visualize critical structures prior to their removal and in theory should reduce the risk of injury to neurovascular bundles and nearby flexor tendons. Proponents of needle fasciotomy, however, have specific guidelines to help reduce the risk of neurovascular injury and optimize the release. These guidelines include operative nerve monitoring, tendon monitoring, needle maneuvering, cord palpation, needle feel, and final manipulation [8]. Pess et al. reported the outcomes of patients treated with needle aponeurotomy after a minimum of 3 years from surgery [14]. For MCP joint, the authors reported an improvement of contracture from a mean 35° preoperatively to 11° at final follow-up. On the other hand, PIP contractures only improved from 50° preoperatively to 35° at final follow-up. In addition, complications were rare with an incidence of 3.4 % for skin tears, 1.2 % for temporary neuropraxia, and 0.1 % for nerve laceration [14].

Open fasciectomy and its variants require more extensive dissection and usually result in lower recurrence rates, although higher complication rates often develop. Anwar et al. looked at the results of the fasciectomy, fasciectomy with local flaps, and dermatofasciectomy in 109 women. The mean preoperative MCP contracture in 34 patients was 35° and 1° postoperatively. The mean PIPJ contracture in 66 patients was 42° preoperatively and reached a mean of 7° postoperatively. The overall complication rate was 15 %, including infection (2 %), digital nerve or digital artery injury (3 %), flare reaction (2 %), and chronic regional pain syndrome in one patient. Recurrence was seen in 22 % of patients, usually by 18 months following surgery [1]. Ullah et al. conducted a prospective randomized trial to determine whether an autologous full thickness skin graft after dermatofasciectomy altered the rate of PIPJ contracture recurrence, compared to fasciectomy followed by z-plasty. Forty patients underwent z-plasty, while 39 patients had dermatofasciectomy followed by skin grafting. All patients were followed for 3 years. The mean range of

motion at the PIPJ for all patients improved from 35° preoperatively to 65° after 3 years. However, complications occurred at a relatively high rate and were diverse. Ten of 79 patients received oral antibiotics for wound erythema, one patient with z-plasty had necrosis of the skin tip, and four patients with skin grafts had minor skin dehiscence. All these complications resolved uneventfully. In addition, hypoesthesia was experienced in 41 of 90 fingers immediately postoperatively, although this resolved in all patients by 3 months. Recurrence of PIPJ was seen in 12 % of all fingers [18].

The limitations of this study include the retrospective methodology and the potential for selection bias of the patients that returned to the clinic because of worse outcomes. The strengths of this study include a large number of cases and an acceptable duration of follow-up. Treatment of Dupuytren's disease remains a difficult problem, primarily because the disease can be relentless and progressive. Similar to numerous other investigators, we have observed significantly better results when treating MCP joint contractures as compared to PIP joint contractures. Future studies directed at understanding the long-term results of this technique and prospective clinical trials comparing various surgical techniques may be useful in furthering our understanding of the surgical treatment of this disease.

**Conflict of interest** The authors declare that they have no conflicts of interest, commercial associations, or intent of financial gain regarding this research.

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