

Finger Joint Contractures 5 Years After Treatment for Dupuytren Disease: A Comparative Cohort Study of Collagenase Injection Versus Surgical Fasciectomy

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Purpose To compare collagenase injection with surgical fasciectomy in Dupuytren disease (DD) for the prevalence of contracture in treated fingers 5 years after treatment.

Methods This was a single-center, comparative cohort study comprising 2 cohorts of patients treated for DD in 1 or more of 3 ulnar fingers with collagenase injection (159 patients) or surgical fasciectomy (59 patients). At 5 years after treatment, 13 collagenase-treated and 8 fasciectomy-treated patients had undergone subsequent treatment on the treated fingers and were considered to have current contracture. Of the remaining patients, 112 collagenase-treated patients (128 hands, 180 fingers) and 46 fasciectomy-treated patients (49 hands, 63 fingers) attended follow-up evaluation performed by 2 independent examiners (participation rate 84% and 93%, respectively). We defined current contracture in a treated finger as an active extension deficit of $\geq 20^\circ$ in the metacarpophalangeal (MCP) or proximal interphalangeal (PIP) joint or a total (MCP + PIP) active extension deficit (TAED) of $\geq 30^\circ$. We used linear mixed models to analyze differences between the cohorts over time.

Results In the collagenase cohort, current contracture was present in 45 (25%) MCP and 60 (33%) PIP joints, and in the fasciectomy cohort, current contracture was present in 12 MCP (19%) and 30 PIP (48%) joints; a TAED of $\geq 30^\circ$ was present in 79 (44%) of the collagenase-treated and 30 (48%) of the fasciectomy-treated fingers. In MCP and PIP joints with $\geq 20^\circ$ pretreatment contracture, complete correction was observed in 82 (56%) MCP and 30 (30%) PIP joints in the collagenase cohort and 23 (70%) MCP and 5 (16%) PIP joints in the fasciectomy cohort. There was no statistically significant difference between the 2 cohorts in the TAED change over time.

Conclusions In patients with DD, collagenase injection and surgical fasciectomy improved finger joint contracture over the pretreatment status but had a high prevalence of joint contracture in the treated fingers 5 years after treatment. (*J Hand Surg Am.* 2022;47(9):834–842. Copyright © 2022 by the American Society for Surgery of the Hand. Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Type of study/level of evidence Therapeutic IV.

Key words Collagenase, Dupuytren contracture, fasciectomy.



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DUPUYTREN DISEASE (DD) PRESENTS WITH varying degrees of severity and impact on daily activities.^{1,2} Surgical treatment is still considered the standard treatment method.^{3,4} Although surgical treatment has been reported to have the lowest rate of disease recurrence, it is associated with several complications.^{5–7} Treatment with collagenase injection has been shown to be simple and safe, with a shorter recovery time and favorable short-term cost effectiveness.⁸ Other research suggests that the costs of surgical fasciectomy would be lower in the long term.⁶ Recurrence of contracture is common but may differ according to the type of treatment.^{9–12}

Similar to surgery, collagenase injections can be used to treat multiple joints and fingers in 1 session; however, they are performed in the office setting.^{13–15} Although collagenase has shown good short-term efficacy, studies have reported high long-term recurrence and reintervention rates compared with those with fasciectomy.^{6,9,12} This study aimed to compare the status of joint contractures in treated fingers 5 years after collagenase injection with that after surgical fasciectomy. We hypothesized that the prevalence of joint contractures 5 years after treatment would be higher in fingers treated with collagenase than in fingers treated with fasciectomy.

MATERIALS AND METHODS

Study design and eligibility criteria

This comparative cohort study was conducted from 2018 to 2020 at an orthopedic university department (Department of Orthopedics, Håssleholm-Kristianstad Hospitals), the primary facility that treats patients with DD in a region with 300,000 inhabitants. The study comprises 2 cohorts of patients treated for DD: a prospective cohort treated with collagenase injection and a retrospective cohort treated with fasciectomy. The inclusion criteria of this study were as follows: (1) patients with DD involving 1 or more of the 3 ulnar fingers with a joint contracture of $\geq 20^\circ$ in the metacarpophalangeal (MCP) or the proximal interphalangeal (PIP) joint and (2) treatment with collagenase injections from September 2013 to October 2014 or with surgical fasciectomy from January 2013 to July 2014. The study periods were chosen to obtain 2 comparable cohorts with at least 5 years of follow-up. The exclusion criteria were treatment for contracture in the thumb or index finger, which was rare, and surgery performed exclusively for nodules or knuckle pads.

At the study center, surgical fasciectomy was the only treatment method used to treat DD until the introduction of collagenase in October 2011. During 2013 and 2014, one hand surgeon (I.A.) performed treatment with collagenase injection using the same indications as those previously used for surgical fasciectomy. All collagenase-treated patients were enrolled in a prospective cohort study of treatment effectiveness.^{16,17} Patients were also treated with fasciectomy according to the preference of the department's other surgeons who performed only fasciectomy. These patients had not been considered for collagenase injections by the treating surgeons. No other treatment methods for DD were used. The study was approved by the ethical review board of Lund University, Lund, Sweden.

Study cohorts

During the 2 study periods, 159 consecutive patients (177 hands) were treated with collagenase injections and 59 patients (62 hands) were treated with surgical fasciectomy. At the time of the 5-year follow-up, 13 patients (12 men and 1 woman; mean age, 71 years [SD 2.9]) were deceased (all in the collagenase cohort). In the collagenase cohort, 13 patients who had subsequent surgical fasciectomy in the treated fingers were considered to have current contracture and were not asked to attend the examination. Similarly, in the fasciectomy cohort, 8 patients who had subsequent intervention (surgical fasciectomy or collagenase injection) in the treated fingers were considered to have current contracture and were not asked to attend examinations.

In the collagenase and fasciectomy cohorts, 133 and 51 patients, respectively, were asked to attend follow-up 5 years after the first treatment received during the respective study periods (Fig. 1). Letters with information about the study were mailed to the patients who were followed, when necessary, by telephone contacts. We attempted to have all the eligible patients examined, allowing them to come for delayed follow-up.

Examined participants

In the collagenase cohort, follow-up examination was conducted on 112 patients (128 hands, 180 treated fingers) between November 2018 and March 2020. In the fasciectomy cohort, follow-up examination was conducted on 46 patients (49 hands, 63 treated fingers) between August 2019 and December 2020. The mean follow-up time in the collagenase group was 62 months (SD 3.4, range 54–74) and in the

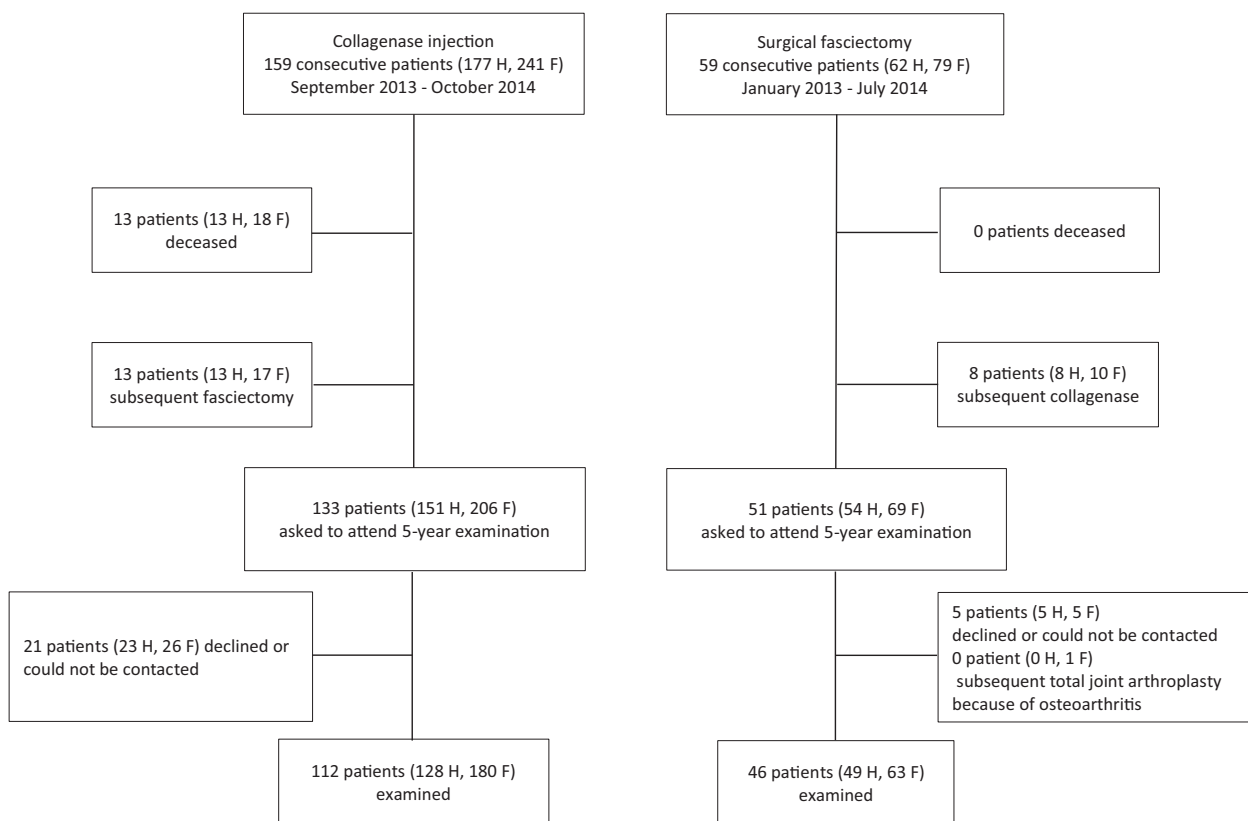


FIGURE 1: Flow chart of patients in both cohorts. F, fingers; H, hands.

fasciectomy group was 72 months (SD 4.7, range 64–79) (Table 1).

Interventions

Collagenase: After administering local anesthesia with 10 mL of 10 mg/mL mepivacaine as a nerve block, a single hand surgeon (I.A.) injected 0.8 mg collagenase divided into several locations in the Dupuytren cord.^{15,18} Patients with multiple joint contractures received 2 injections (mostly in the same session). Finger manipulation to the best achievable extension was performed 1 or 2 days after injection by the same surgeon under local anesthesia, which was administered similarly to the administration before the injection. The patients received a static orthosis from a hand therapist to be used at night for 2 months. Skin tears were treated with wound dressings until they healed. Most patients had a follow-up visit with the hand therapist approximately 1 week after the finger extension procedure for possible adjustment of the night orthosis.

Further therapy visits were only scheduled when deemed necessary. The treating surgeon made decisions about additional injections in discussion with the patient. No other injections were provided for patients satisfied with the degree of correction. In the

entire cohort, repeat injections were administered to 17 patients (18 hands, 23 fingers). The time to reinjection was 3–59 months (mean, 25 months; SD 18).

Surgical fasciectomy: All procedures were performed in the operating room under regional or general anesthesia. A tourniquet was used, and the surgeon chose the type of skin incision. Surgical fasciectomy was then performed with excision of all the diseased fascia that was possible to remove in the palm and finger. In 13 hands (14 of the 79 treated fingers), the surgeon also performed PIP capsulotomy, usually when a PIP contracture of $\geq 40^\circ$ remained after fasciectomy. The procedures were performed by 8 surgeons who were experienced in surgical fasciectomy (3 hand surgeons who performed 25 procedures [40%] and 5 orthopedic surgeons who were experienced in upper-extremity orthopedics). Nurses changed the dressings at 5–7 days, and sutures were removed about 14 days after surgery. Patients were treated by a hand therapist and used a night orthosis for up to 3 months.

Measurements

In the collagenase cohort, all baseline measurements were recorded using a standard protocol. The

TABLE 1. Patient Characteristics of the Included Patients in Both the Cohorts

Patient characteristics	Collagenase	Fasciectomy
No. of patients	112	46
Age, mean (SD) y	69 (8)	65 (10)
Sex, n (%)		
Men	100 (89)	38 (83)
Women	12 (11)	8 (17)
Diabetes n (%)	11 (10)	5 (11)
Smoking/snus n (%)	17 (15)*	11 (24)
Treated hand, n (%)		
Right	74 (58)	25 (51)
Left	54 (42)	24 (49)
Treated finger, n (%)		
Small	84 (47)	33 (52)
Ring	66 (37)	26 (41)
Middle	30 (17)	4 (6)
All	180 (100)	63 (100)
Pretreatment little finger PIP AED, mean (SD)	39 (28)	42 (30)
Time since treatment, mean (SD)	62 (3)	72 (5)
Previous treatment n (%)		
Fasciectomy	16 (9)	10 (16)
Collagenase/PNF	7 (4)	9 (14)

PNF, percutaneous needle fasciotomy.
*No data available for 5 patients.

measurement of active extension deficit (AED) for all joints in the affected fingers was performed by a hand therapist using a hand-held metal goniometer immediately before injection and independent of the treating surgeon. In the fasciectomy cohort, data about baseline contracture were extracted from the medical records as stated by the examining or operating surgeon. The exact degrees of joint contractures in the fingers that were operated on were not routinely documented in the medical records.

At the 5-year examination of both the cohorts, a hand therapist (A.L.) or orthopedic resident (D.E.) measured the AED in the treated fingers. Before starting the examinations, the resident was trained by a hand therapist and the 2 examiners agreed on a uniform measurement technique using a standard 6-inch metal goniometer with 5° increments (Baseline, Fabrication Enterprises). All patients completed the shortened version of the Disabilities of the Arm, Shoulder, and Hand (*QuickDASH*) questionnaire.

Statistical analysis

The primary outcome was the proportion of fingers with $\geq 20^\circ$ joint contracture 5 years after treatment. The secondary outcome was the total active extension deficit (TAED), defined as the AED of MCP plus PIP joints in the treated finger. In a previous 3-year follow-up study of collagenase injection, complete contracture correction was observed in 73% of MCP and 35% of PIP joints.¹⁶ We assumed that these values would be lower at 5 years and that the corresponding values would be higher after fasciectomy. To detect a between-group difference of 30% in current joint contracture, a sample of 39 per group would be needed, and to detect a difference in the TAED of $\geq 20^\circ$ (SD 25), a sample of 25 per group would be needed (power, 80%; α , 0.05). To account for missing data and dropouts and to capture complications, we chose to include all the patients who were treated during the study period. For the treated finger joints, we calculated the mean and SD of AED at baseline and 5 years and baseline to 5-year differences with 95% confidence intervals. Hyperextension was recorded as 0° extension deficit. Because no contracture measurements were documented early after fasciectomy, we described contractures at 5 years in both the cohorts as current instead of recurrent. We considered a contracture of $\geq 20^\circ$ as clinically important, a definition used in previous studies and proposed by an expert group.^{9,17,19} Complete correction is commonly defined as a passive extension deficit (PED) of $\leq 5^\circ$; we considered complete correction as a AED of $\leq 5^\circ$.^{9,20} We calculated the prevalence of current contracture on the basis of the number of examined hands with fingers that had an AED of $\geq 20^\circ$ in the MCP joint, PIP joint, or both the joints or had a TAED of $\geq 30^\circ$ and the number of hands that had received subsequent treatment for contracture in a treated finger. We used the paired *t* test to analyze changes in the AED from baseline to 5 years. We performed a linear mixed model analysis to compare the 2 cohorts in terms of the change in joint contracture over time, including an interaction term between cohort and time (before treatment as reference and 5 years) as a fixed effect. We performed both an unadjusted model and a model adjusting for age, sex, little finger treatment, previous injection, and previous fasciectomy. In 2 additional similar models, we included joint contracture values before subsequent treatment as the 5-year values (in addition to corresponding pretreatment values), adjusting for the same variables as in the

TABLE 2. Prevalence of Current Contracture According to Treated Fingers*

Joint	Collagenase			Fasciectomy		
	All (n = 180)	Little (n = 84)	Ring/middle (n = 96)	All (n = 63)	Little (n = 33)	Ring/middle (n = 30)
MCP	45 (25)	20 (24)	25 (26)	12 (19)	6 (18)	6 (20)
PIP	60 (33)	41 (49)	19 (20)	30 (48)	21 (64)	9 (30)
MCP + PIP [†]	79 (44)	49 (58)	30 (31)	30 (48)	18 (55)	12 (40)
MCP and/or PIP [‡]	88 (49)	52 (62)	36 (38)	36 (57)	22 (67)	14 (47)
Subsequent treatment [§]	17 (7)	7 (6)	10 (8)	10 (13)	7 (17)	3 (8)

*Values are n (%) fingers.

[†]Fingers with contracture in both the MCP and the PIP joint.

[‡]Fingers with contracture in the MCP only, PIP only, or both joints. The collagenase cohort includes 16 (of the 23 fingers) who received a repeat injection after the first injection (9 MCP and 13 PIP joints).

[§]Percentages of all treated fingers (collagenase: little 115, ring/middle 126; fasciectomy: little 41, ring/middle 38).

first models. The linear mixed models were chosen to account for patients providing data from more than 1 finger/hand. Statistical significance was defined as a *P* value of <.05.

RESULTS

Prevalence of current joint contractures in treated fingers

In the collagenase cohort, a current contracture of $\geq 20^\circ$ in the treated fingers was present in 45 (25%) MCP and 60 (33%) PIP joints, and in the fasciectomy cohort, a current contracture of $\geq 20^\circ$ in the treated fingers was present in 12 (19%) and 30 (48%) joints (Table 2). A contracture of $\geq 20^\circ$ in the MCP, PIP, or both joints was present in 88 (49%) of the collagenase-treated fingers and 35 (56%) of the fasciectomy-treated fingers, and a TAED of $\geq 30^\circ$ was present in 79 (44%) and 30 (48%) of the collagenase-treated and fasciectomy-treated fingers, respectively. In both the cohorts, contracture in the treated finger was most common in the PIP joint of the little finger (41 joints [49%] in the collagenase and 21 joints [64%] in the fasciectomy cohort). Among the 40 participants (53 treated fingers) in the surgical fasciectomy cohort who had first-time surgery, current contracture was present in 11 MCP (21%), 23 PIP (43%), and 29 MCP and PIP (55%) joints.

In the collagenase cohort, 72 (56%) of the examined hands had a contracture of $\geq 20^\circ$ in at least one treated finger and with the hands that had subsequent treatment added, the overall number of hands with current contracture in a treated finger was 85 (66%); the corresponding values in the fasciectomy cohort were 30 (61%) and 38 (67%).

Of the MCP and PIP joints with a baseline contracture of $\geq 20^\circ$, complete correction was observed in 82 MCP (56%) and 30 PIP (30%)

collagenase-treated and 23 (70%) MCP and 5 (16%) PIP fasciectomy-treated joints. In the fasciectomy cohort, no significant differences in the prevalence of contracture were found according to the treating surgeon (hand or orthopedic).

Improvement of joint contracture

In both cohorts, mean baseline contracture of the MCP and PIP joints and the TAED had improved significantly at 5 years (Table 3). The estimated (marginal) mean contracture from the mixed model analyses at baseline was greater in the collagenase than in the fasciectomy cohort for the MCP joints but lower for the PIP joints and at 5 years was similar for the MCP but somewhat more significant in the fasciectomy cohort for the PIP joints (Figure 2). The model that included patients with subsequent treatment gave generally similar results. The mean baseline and 5-year values for TAED were similar in the 2 cohorts. In the adjusted analysis, no statistically significant differences between collagenase and fasciectomy were found in the change in the AED (baseline to 5 years) in MCP or PIP joints or in the TAED (Table 4). The mean *QuickDASH* score was 10 (SD 12) in the collagenase and 10 (SD 11) in the fasciectomy cohort.

Proximal interphalangeal capsulotomy

In the 14 PIP joints (10 little and 4 ring fingers) on which capsulotomy was performed, the mean AED was 38° (SD 23) as compared with the 20° (SD 23) for the no capsulotomy PIP joints (*P* < .05). The mean preoperative contracture was also more severe (61° [SD 26] vs 38° [SD 29]).

TABLE 3. AED in the Treated Fingers of Hands Examined at 5-Year follow-up*

Joint	Collagenase			Fasciectomy		
	Baseline (n = 180)	5 years (n = 180)	Mean difference (95% CI) [†] (n = 180)	Baseline (n) [‡]	5 years (n = 63)	Mean difference (95% CI) [†] (n) [‡]
MCP	43 (24)	11 (17)	31 (28 to 35)	36 (25)	11 (18)	26 (17 to 35)
PIP	29 (29)	16 (22)	13 (10 to 17)	45 (29)	24 (25)	16 (7 to 24)
TAED [§]	72 (37)	27 (30)	45 (40 to 49)	75 (27)	35 (34)	37 (24 to 51)

CI, confidence interval.

*Data are unadjusted mean (SD) degrees or mean difference (95% CI).

[†]All *P* values are <.05

[‡]Baseline data available for 43 MCP, 46 PIP, and 36 TAED; mean difference based on these fingers only (mean 5-year values for these joints is the mean baseline value minus the mean difference value).

[§]For the 23 fingers that had received a repeat collagenase injection after the first injection, the mean (SD) TAED was 89° (38) at baseline and 43° (32) at 5 years (MCP 42° [27] and 15° [16], and PIP 47° [31] and 27° [28], respectively).

Subsequent treatments

In the collagenase cohort, 13 patients (7.3% of treated hands) had contracture recurrence in the treated fingers and chose to undergo fasciectomy (Supplementary Table 1, available online on the *Journal's* website at www.jhandsurg.org). In the fasciectomy cohort, 8 patients (12.9% of treated hands) had received subsequent treatment for contracture in the treated fingers (all collagenase). Most subsequent treatments were performed by a different surgeon.

Adverse events

In the collagenase cohort, skin tears occurred in 62 hands (35%). One patient developed persistent swelling and pain, which was diagnosed as a possible mild complex regional pain syndrome and resolved with hand therapy. In the fasciectomy cohort, no follow-up visits occurred for 8 hands (13%), and, therefore, possible adverse events among those patients are unknown. Postoperative wound infection was recorded in 3 hands (4.8%), which was healed with oral antibiotics in all the 3 hands. In the remaining 48 (81%) patients, there was no mention of adverse events in the medical records.

Nonparticipants

Of the eligible patients in the collagenase cohort who were asked to attend the examination, 21 patients (23 treated hands [15%]) did not participate (Supplementary Table 1). In the fasciectomy cohort, 5 eligible patients (5 [8%] treated hands) did not participate. The nonparticipants in the collagenase cohort were, on average, older than those in the fasciectomy cohort. The medical record review showed

no subsequent interventions among deceased patients or nonparticipants.

DISCUSSION

This 5-year follow-up study of patients with DD who were treated with either collagenase injection or surgical fasciectomy with a high participation rate (examination performed on 84% of eligible fingers in the collagenase and 93% in the fasciectomy cohort) showed that despite significant improvement in finger joint contracture over the pretreatment status, there was a similarly high prevalence of joint contracture in the treated fingers after both the treatments. The *QuickDASH* scores were also similar 5 years after both the treatments.

In a previous study of collagenase injection with a 5-year follow-up, the mean TAED (including distal interphalangeal joints) was 48° (57% of baseline).²¹ In our study, the mean TAED (MCP + PIP) at 5 years after collagenase injection was 27° (38% of baseline) and after surgical fasciectomy at 35° (47% of baseline). A TAED of at least 30° was found in 79 (44%) fingers after collagenase injection and in 30 fingers (48%) after surgical fasciectomy. It has previously been shown that contractures in the PIP joint of the little finger are predictors of recurrence.¹⁷ As in previous studies, we found a higher frequency of current contracture in the PIP joint of the little finger than in the PIP and MCP joints of the middle or ring finger.^{5,9}

Our study showed a relatively high rate of long-term contracture in fasciectomy-treated fingers. A study based on telephonic follow-up reported lower rates of perceived recurrence after fasciectomy versus collagenase injection.¹² A study that reviewed the medical records of patients treated by a single

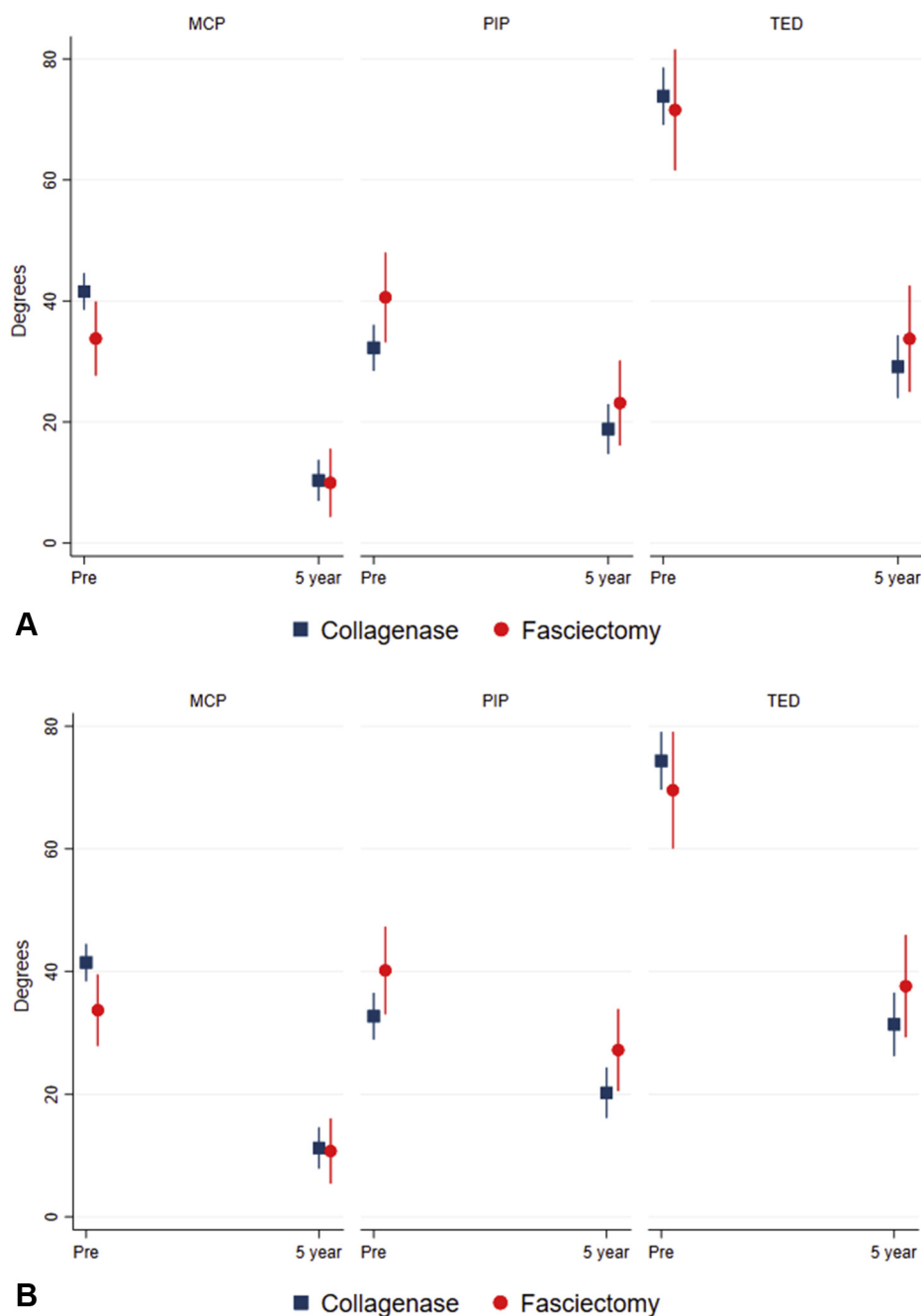


FIGURE 2: A Estimated (marginal) means and 95% confidence intervals were derived from the linear mixed model that excluded patients with subsequent treatment and **B** the model that included the contracture values before subsequent treatment as the 5-year values. TED, total (MCP + PIP) active extension deficit.

surgeon reported a 4% reintervention rate after fasciectomy.⁶ However, a randomized controlled trial of fasciectomy with a 5-year follow-up examination showed a recurrence rate of 39% with MCP joint at 33%, PIP joint at 44%, and PED at 11° and 28°, respectively.¹¹

Although our study was not randomized, the cohorts included consecutive patients referred from primary care to the same institution. Patient

characteristics did not differ substantially in the 2 cohorts, and the indications for treatment were similar. Different surgeons provided the 2 treatments, almost all of whom performed only 1 of the treatments. Despite this, the risk of bias at baseline related to selection, ascertainment, and recording of data in the fasciectomy group would need to be considered when interpreting the results. Because fasciectomy was performed by different surgeons, the level of expertise

TABLE 4. Difference Between the Collagenase and Fasciectomy Cohorts in the Change in AED (degrees) in Treated Fingers Over Time

Analysis	MCP		PIP		TAED	
	β (95% CI)	P values	β (95% CI)	P values	β (95% CI)	P values
Hands with subsequent treatment excluded						
Nonadjusted	7.4 (0.03 to 14.8)	<.05	-4.02 (-11.5 to 3.5)	.30	6.9 (-3.9 to 17.7)	.21
Adjusted	7.1 (-0.3 to 14.4)	.059	-4.1 (-11.6 to 3.4)	.28	6.2 (-4.5 to 16.98)	.25
Hands with subsequent treatment included						
Nonadjusted	7.3 (0.3 to 14.3)	<.05	-0.5 (-8.02 to 7.04)	.90	11.0 (0.4 to 21.6)	<.05
Adjusted	6.9 (-0.1 to 13.9)	.054	-0.7 (-8.2 to 6.8)	.86	10.4 (-0.1 to 20.9)	.053

CI, confidence interval.

β coefficient represents the mean difference between the groups in contracture reduction over time, estimated from the linear mixed model analysis (positive value indicates larger contracture reduction in collagenase vs fasciectomy). The adjusted model included age, sex, little finger treated, previous injection or needle fasciectomy on the treated finger, and previous fasciectomy on the treated finger.

of the surgeons might have had an impact on the rate of recurrence. The missing baseline contracture data for many patients in the fasciectomy cohort are a limitation. Although this was addressed with the mixed model analysis that accounted for the missing baseline values and adjusted for several potential confounders, the lack of consistent preoperative measurements in the surgical cohort may have still had an impact on the comparison with the collagenase group.

The lack of early postoperative measurements in the fasciectomy cohort precluded the estimation of recurrence ($\geq 20^\circ$ worsening of postoperative contracture).¹⁹ However, the aim was to determine the prevalence of current contracture, irrespective of whether it was recurrence or disease extension. Because PED was not measured in the collagenase cohort, we could not calculate complete correction as previously established.^{9,20} Instead, we chose to calculate complete correction using the AED, which implies that the rate is probably underestimated compared with those in the studies.

Another limitation is the higher rate of prior surgical treatment in the fasciectomy cohort (16% vs 9%), with outcomes possibly different from primary fasciectomy. This difference was adjusted for in all multivariate analyses, and the analyses restricted to first-time fasciectomy still showed high rates of current contracture. Although baseline severity was adjusted for in the analyses, the higher severity of PIP contracture in the fasciectomy group may have been a factor in the high contracture rate after surgery and subsequently the comparison with collagenase. Given that DD can be steadily progressive, the fact that the fasciectomy patients were followed, on average, 10 months longer could introduce some bias in the observed recurrence rate.

Considering the nature of the treatments, the need for a repeat treatment would be more likely after collagenase injection than after surgery. However, injection is a simpler treatment with quick recovery, and patients may have been satisfied with the initial improvement and chose to defer further injection. However, the need for repeat intervention is important when comparing long-term cost effectiveness.

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