OPEN

PRS GLOBAL OPEN

ORIGINAL ARTICLE

Hand

Dupuytren Disease: A Retrospective Cohort Study Comparing Collagenase Injection and Percutaneous Needle Fasciotomy

Turkhan Mehdiyev, MD*
Davide Maffei, MA†
Verena Müller, BSc*
Waltraud Mair, BSc*
Robert F. Zimmermann, MD*
Eva-Maria Baur, MD*

Background: Collagenase *Clostridium histolyticum* (CCH) injection and percutaneous needle fasciotomy (PNF) are minimally invasive procedures aiming to relieve Dupuytren disease (DD) by disrupting the cord and restoring the normal functionality of the hand. The purpose of this study is to compare the outcomes and recurrence rates for treatment of DD in the proximal interphalangeal (PIP) and metacarpophalangeal (MCP) joints with either collagenase or percutaneous needle at 3-year follow-up. Moreover, we aim to determine the role of these therapeutic modalities and their impact on hand functionality and quality of life.
Methods: In this retrospective analysis, we compare treatment outcomes in 35 patients, of whom 22 were treated with PNF and 13 with CCH injection.
Results: The mean outcome in contracture degrees at 3-year follow-up was 9 degrees for MCP joints for both treatment groups, 34 degrees for PNF, and 28 degrees for CCH for PIP joints. There was no statistical significance between the treatment groups in MCP joints ($P = 0.786$) or in PIP joints ($P = 0.474$). Contracture recurrences were similar in PIP joints of both groups and greater in MCP joints in the CCH group compared to PNF. The Disabilities of the Arm, Shoulder, and Hand and the Unité Rhumatologique des Affections de la Main scores showed a reduction in impairment in both groups without significant differences between the two groups.
Conclusions: The results of this study show that PNF appears to be as effective and minimally invasive as CCH injection, but at significantly lower cost. Considering these factors, the authors prefer and recommend the use of PNF over CCH. *(Plast Reconstr Surg Glob Open 2022;10:e4604; doi: 10.1097/GOX.0000000000004604; Published online 24 October 2022.)*

INTRODUCTION

Collagenase *Clostridium histolyticum* (CCH) injection and percutaneous needle fasciotomy (PNF) are minimally invasive procedures for the treatment of Dupuytren disease (DD) with palpable and well-defined palmar cords. In 2011, CCH injection was approved by the European Medicines Agency for the treatment of DD. In comparison, PNF was first described by French rheumatologists in the middle of the 20th century and was modified by Lermusiaux and Debeyre[1] in 1980 by disrupting the cord with a needle instead of a blade. Foucher and Lermusiaux described the current method using a needle in up-and-down movement without cortisone injection.[2,3]

These two methods are not curative and do not affect the natural history of DD, yet CCH and PNF are effective alternative treatment options for the release of Dupuytren cords. Although the recurrence rates for CCH and PNF are substantially higher than for open fasciectomy,[4,5] these modalities have gained in popularity. These nonsurgical methods are reported to have low complication rates and to allow patients to recover functionally in a shorter period of time than open fasciectomy.[6,7] The difference in costs between treatments is reported to be significant, with collagenase treatment being more expensive than PNF or open fasciotomy.[6] In

*From the *Department of Plastic, Reconstructive and Aesthetic Surgery, Medical University of Innsbruck, Innsbruck, Austria; and †Faculty of Business Management, University of Innsbruck, Innsbruck, Austria.*

Received for publication February 18, 2022; accepted August 22, 2022.

DOI: 10.1097/GOX.0000000000004604

Disclosure: *The authors have no financial interest to declare in relation to the content of this article.*

Related Digital Media are available in the full-text version of the article on **www.PRSGlobalOpen.com**.

advanced and recurrent DD, PNF or partial fasciectomy is recommended,[8] the latter being the most commonly used surgical procedure.[7] According to Coleman et al,[9] CCH injections are feasible in adult patients in up to two cords or two affected joints in the same hand at a time, in contrast to PNF where multiple cords can be treated at one time.[10] Both of these treatments are reported to show better results for the metacarpophalangeal (MCP) joints than for the proximal interphalangeal (PIP) joints like in open procedures.[11]

The aim of our data analysis is to compare the outcomes and recurrence rates for treatment of DD in the PIP and MCP joints with either CCH or PNF at 3-year follow-up. This study has been conducted to address a lack of literature on the subject, and can also be of high interest economically, as the two treatment methods have different costs. Unlike the already existing papers, this study considers two joints per finger and looks at both Disabilities of the Arm, Shoulder, and Hand (QuickDASH) and the Unité Rhumatologique des Affections de la Main (URAM) scores to assess treatment efficacy.

Takeaways

Question: What are the recurrence rates for treatment of DD in the PIP and MCP joints with either collagenase or percutaneous needle? How do these therapeutic modalities impact patients' quality of life?

Findings: Contracture recurrences were the same in PIP joints of both groups and greater in MCP joints in the collagenase group. The QuickDASH and URAM scores showed a reduction in impairment in both groups.

Meaning: PNF appears to be as effective and minimally invasive as collagenase injection, but at significantly lower cost.

METHODS

Study Design and Setting

This study was designed as a retrospective cohort study to compare clinical outcomes and recurrence rates as well as patients' reported outcome measurements in hand functionality and quality of life after treatment with CCH or PNF.

From January 2012 to September 2016, all patients with a PIP or MCP joint passive extension deficit (PED) of 20 degrees or more with palpable cords were eligible for a minimally invasive procedure and were offered treatment options with CCH or PNF. The final decision on the procedure was made together with the patient. It was not feasible and meaningful to opt for randomization, as some patients came to us with a specific request for therapy, for example, for CCH injection. They were informed about the analysis of their data and asked to give written informed consent for the therapeutic procedure as well as for documentation, photography, assessment of their data, and use in scientific publications.

Patients with other hand diseases, previous treatment of DD of the affected finger, use of anticoagulants, or who did not attend the follow-up visits were excluded from the study. All treatment costs were covered by the Austrian national health care system.

All procedures were rendered at the Department of Plastic, Reconstructive and Aesthetic surgery of the Medical University of Innsbruck, Austria, by two senior hand surgeons with the level of expertise being "expert" for both treatments.[12] The study was approved by the ethics committee of the Medical University of Innsbruck (EK Nr: 1253/2020).

CCH Injection

We injected 0.58 mg dissolved CCH into a solitary palpable strand with a 1-mL syringe and a 27-gauge needle. A volume of 0.25 mL was injected for MCP joints and 0.20 mL for PIP joints. The needle was inserted 2–3 mm into the strand vertically and percutaneously. A soft hand dressing was placed, and patients remained under observation for further 30 minutes to check for potential allergic reactions. At least 24 hours after injection, the surgeon attempted to rupture the cord. Since this step was often painful, it was usually necessary to administer local anesthesia.

Percutaneous Needle Fasciotomy

PNF was performed in patients with one or more palpable strands on both hands. After the hand was sterilely prepared, we injected 0.05–0.1 mL lidocaine 1% with epinephrine ulnar and radial of the cord at multiple levels. The local anesthetic was placed in the skin only for anesthesia of the skin for the bigger needle. We avoided regional anesthesia to decrease the possibility of digital nerve damage. The needle was introduced and moved parallel to the skin to release areas of adherence between the skin and the strand. The cord was repeatedly perforated and released through up-and-down movements with the tip of the 20-gauge needle, whereas the finger was passively stretched. (**See Video 1 [online]**, which illustrates the technique of PNF of a Dupuytren cord in the fifth digit.) Patients were advised to immediately report any paraesthesia and numbness in the treated finger to avoid digital nerve injury.

Hand Therapy

After PNF and the extension of the finger following CCH injection, patients were referred to our hand therapists for a thermoplastic splint with full extension of the treated finger. They were advised to start active finger motion the next day and to wear the splint at night for a 6- to 12-week period.

Follow-up and Measurements

The clinical data and measurements were collected by two senior hand surgeons as well as the occupational hand therapists at our department. Preoperative data collection was performed a few days before or on the day of treatment. As for the postoperative data acquisition, not all patients came to the follow-up appointment, notwithstanding the fact that all of them received a written reminder. PED and the QuickDASH and URAM scores were obtained. Three years and 3 weeks after the respective procedure, PED and the patient-reported outcomes were repeated.

The QuickDASH is an 11-item questionnaire that quantifies physical function and symptoms in patients with upper extremity musculoskeletal disorders. This patient-based questionnaire measures a patient's perception of the impact of a disorder and provides a summative score on a 100-point scale, with 100 indicating the highest disability.[13]

The URAM scale is a nine-item patient-reported questionnaire that assesses physical disability associated with DD, with a total score ranging from 0 (best) to 45 (worst).[14] The URAM scale is highly sensitive to changes in DD and shows a strong correlation with worsening of digit contracture as measured by the Tubiana scale.[15]

Clinical Outcome

Clinical outcome was assessed at two follow-up dates. PED of the treated MCP and/or PIP joint and recurrence rates were documented. To determine the recurrence rates of each affected joint, PED at long-term follow-up was compared to PED at the reference point. The reference point in this trial was defined as the measurement 3 weeks after the intervention. In the case of a PED of 20 degrees or more for each of the treated joints and in the presence of a palpable cord, we considered the case to be recurrent.

A reduction in contracture of 50% or greater from the baseline was considered a clinical improvement. Moreover, we defined 0 degrees to 5 degrees PIP or MCP joint PED at the 3-week follow-up as a clinical success.

Statistical Analysis

Data were assessed with standard summary statistics, including means and SDs for continuous data and counts and percentages for categorical data. We set the treatment method as the independent variable, whereas the PED expressed in degrees of each joint represented the dependent variable, just like the URAM and QuickDASH scores. Through the SPSS software Version 26.0 for Mac (IBM-SPSS, Chicago, Ill.), we first checked for normal distribution of continuous data using the Kolmogorov–Smirnov test. Thereafter, if data distribution was normal, we applied Student's *t* test. Not normally distributed outcome measurements were analyzed using the Mann–Whitney U test. We relied on the chi-square test to check the statistical significance between dichotomous categorical variables. A *P* value of less than or equal to 0.05 was considered significant.

RESULTS

Between September 2012 and April 2016, 101 patients with DD were treated with either PNF or CCH injection. Sixty-six patients, who did not fulfill the inclusion criteria, were excluded from the analysis. The baseline statistics were represented by 40 digits and 54 joints in 35 patients. These patients had an average age of 68 years and completed the long-term follow-up. The mean follow-up of these 35 patients was 39 months. Table 1 shows the descriptive data of the two groups including the number of fingers and joints affected and Tubiana's and Iselin's staging for DD.

There were 22 patients in the PNF group (82% male) with a mean baseline PED of 50 degrees (range 20–90 degrees) for the 15 affected PIP joints and 46 degrees (range 20–76 degrees) for the 20 affected MCP joints. In the CCH group, 13 patients (92% male) with a mean baseline PED of 37 degrees (range 20–65 degrees) for nine affected PIP joints and 41 degrees (range 20–70 degrees) for 10 affected MCP joints were treated (Tables 2 and 3). No statistical significance in the baseline PED for PIP joints was seen between the PNF and the collagenase group ($P = 0.124$) (Table 2). Similarly, no significance was identified in the baseline PED for MCP joints between CCH and PNF ($P = 0.420$) (Table 3).

The mean outcome of contracture degrees at the last follow-up was 9 degrees for MCP joints for both treatment groups, 34 degrees for PIP joints for PNF and 28 degrees for collagenase. Although statistical significance (P =

Table 1. Patient and Contracture Characteristics

	Needle Fasciotomy	Collagenase	*P*
Mean age, y	68	68	0.791
Sex, female/male	4/18	1/12	0.392
Hand affected, left/right	8/14	4/9	0.736
Tubiana's staging for DD			0.494
Stage I	5	5	
Stage II	13	5	
Stage III	3	3	
Stage IV	1	0	
Iselin's staging for DD			0.549
Stage II	9	4	
Stage III	13	9	
Mean follow-up, months	36	45	0.039
No. patients with 1–4 affected joints			0.711
1	12	7	
2	8	6	
3	1	0	
4	1	0	
No. affected digits in patients			0.063
1	17	13	
2	5	0	
Contracture recurrence, joints	3	4	0.221

Table 2. Passive Extension Deficits in PIP Joints

	Needle Fasciotomy	Collagenase	*P*
Baseline			0.124
Mean ± SD, deg.	50 ± 22	37 ± 17	
Median (IQR); range, deg.	52 (30–65); 20–90	33 (22–53); 20–65	
No. joints	15	9	
3 wks Follow-up			0.313
Mean ± SD, deg.	23 ± 20	18 ± 16	
Median (IQR); range, deg.	15 (10–37); 0–65	11 (7–32); 0–50	
No. joints	14	9	
Long-term follow-up			0.474
Mean ± SD, deg.	34 ± 22	28 ± 17	
Median (IQR); range, deg.	30 (18–50); 0–80	25 (14–45); 0–52	
No. joints	15	9	
Clinical improvement (reduction in PED ≥ 50%), (95% CI)			
3 wks follow-up			0.739
Mean ± SD, %	58 ± 25	54 ± 32	
Median (IQR); range, %	62 (33–76); 22–100	50 (33–82); −3 to 100	
No. joints	14	9	
Long-term follow-up			0.327
Mean ± SD, %	35 ± 28	21 ± 44	
Median (IQR); range, %	33 (14–46); −3 to 100	25 (−7 to 41); −58 to 100	
No. joints	15	9	
Clinical success (PED 0 degrees to 5 degrees)			
3 wks follow-up	14%, n = 2	22%, n = 2	0.624
Long-term follow-up	7%, n = 1	11%, n = 1	0.703
Contracture recurrence	21%, n = 3	22%, n = 2	0.964
PED between long-term and			0.574
3 wks follow-up			
Mean ± SD, deg.	13 ± 9	10 ± 13	
Median (IQR); range, deg.	15 (5–16); 0–30	4 (−2 to 23); −5 to 30	
No. joints	13	9	

CI, confidence interval; deg., degrees; IQR, interquartile range.

Table 3. Passive Extension Deficits in MCP Joints

	Needle Fasciotomy	Collagenase	*P*
Baseline			0.420
Mean ± SD, deg.	46 ± 17	41 ± 17	
Median (IQR); range, deg.	50 (26–56); 20–76	34 (30–60); 20–70	
No. joints	20	10	
3 wks follow-up			0.030
Mean ± SD, deg.	11 ± 9	4 ± 5	
Median (IQR); range, deg.	10 (0–19); 0–25	0 (0–8); 0–14	
No. joints	20	10	
Long-term follow-up			0.786
Mean ± SD, deg.	9 ± 8	9 ± 12	
Median (IQR); range, deg.	7 (0–16); 0–25	2 (0–21); 0–30	
No. joints	20	10	
Clinical improvement (reduction in PED ≥ 50%), (95% CI)			
3 wks follow-up			0.036
Mean ± SD, %	77 ± 20	92 ± 14	
Median (IQR); range, %	77 (67–100); 20–100	100 (87–100); 55–100	
No. joints	20	10	
Long-term follow-up			0.735
Mean ± SD, %	78 ± 19	74 ± 36	
Median (IQR); range, %	80 (67–100); 42–100	96 (34–100); 3–100	
No. joints	20	10	
Clinical success (PED 0 degrees to 5 degrees)			
3 wks follow-up	30%, n = 6	70%, n = 7	0.037
Long-term follow-up	50%, n = 10	60%, n = 6	0.605
Contracture recurrence	0%, n = 0	20%, n = 2	0.038
PED between long-term and			0.099
3 wks follow-up			
Mean ± SD, deg.	−1 ± 11	6 ± 9	
Median (IQR); range, deg.	0 (−9 to 5); −25 to 18	0 (0–17); −3 to 21	
No. joints	20	10	

CI, confidence interval; deg., degrees; IQR, interquartile range.

0.030) was given for the MCP joints in the short-term follow-up, no statistical significance in the mean outcome of contracture degrees between the two treatment groups was seen at the long-term follow-up for PIP or MCP joints.

Three of the 15 patients in the PNF group and two of the nine patients in the CCH group met the criteria for recurrence in PIP joints, which was not statistically significant (Table 2). We observed no contracture recurrence

in MCP joints after treatment with needle fasciotomy, whereas two recurrences were seen following collagenase. These two recurrences were indeed statistically significant ($P = 0.038$) (Table 3).

Clinical improvement was accomplished in 15 (35%) PIP joints in the PNF group and in nine (21%) cases in the collagenase group after long-term follow-up. Of the MCP joints in the PNF group, 20 (78%) achieved clinical improvement, whereas in the CCH group, this figure was 10 (74%). No statistically significant difference between the two groups was found for PIP and MCP joints in terms of clinical improvement after long-term follow-up.

Clinical success was achieved in one case in the PNF group and in one case in the CCH group for PIP joints in the long-term follow-up. For MCP joints, success was achieved in 10 (50%) cases in the PNF group (Fig. 1) and six (60%) in the collagenase group (Fig. 2).

Mean QuickDASH score for the 15 needle fasciotomy patients was 16 before treatment and 6 at long-term follow-up, compared with 36 and 11 for the eight collagenase patients. The difference in DASH score between the two groups was not statistically significant either before the treatment ($P = 0.560$) or for long-term follow-up ($P = 0.152$). Mean URAM score before treatment was 16 in the needle fasciotomy group and 15 in the collagenase group. At final follow-up, the score was 3 in the needle fasciotomy group and 8 in the collagenase group. The scores thus showed a reduction in impairment in both groups. No significant differences were found between collagenase and needle fasciotomy after the treatment ($P = 0.226$).

We observed no major treatment-related complications, such as tendon ruptures, anaphylactic reactions, nerve or vessel injuries or complex regional pain syndrome in either treatment group. One patient treated with PNF experienced transient paraesthesia of the finger, which resolved after a few weeks. Skin tears, edemas, and ecchymosis were considered minor complications and treated conservatively.

DISCUSSION

CCH and PNF are methods that can be performed in the outpatient clinic and are becoming generally more accepted. Nevertheless, patient satisfaction and outcomes at long-term follow-up remain unclear. Therefore, we decided to analyze the collected data to compare outcomes as well as patient satisfaction after treating DD in the PIP and MCP joints with either CCH or PNF over 39 months.

Although at the short-term follow-up PED in the MCP joints was greater in the PNF group than in the CCH group and this difference was also statistically significant, we observed a very similar magnitude of outcome in PED of the MCP joints in the long-term follow-up between the two groups. At the level of the PIP joints, CCH resulted in more improvement in extension deficits than PNF, but this was not statistically significant. However, it is important to highlight the fact that the mean preintervention PIP contracture in PNF was much greater than in the CCH group.

At long-term follow-up 35% of the PIP joints showed clinical improvement following PNF compared with 21% in the CCH group. Our findings were similar to those published by Skov et al[16] at 2-year follow-up, showing 32% clinical improvement in PNF compared with 8% in CCH in PIP joints. In another retrospective study with a short-term follow-up of 1 year, the degree of improvement of the extension deficit in the MCP joints was greater in the CCH group. However, this study measured the active extension deficit of the finger joints and classified improvement into

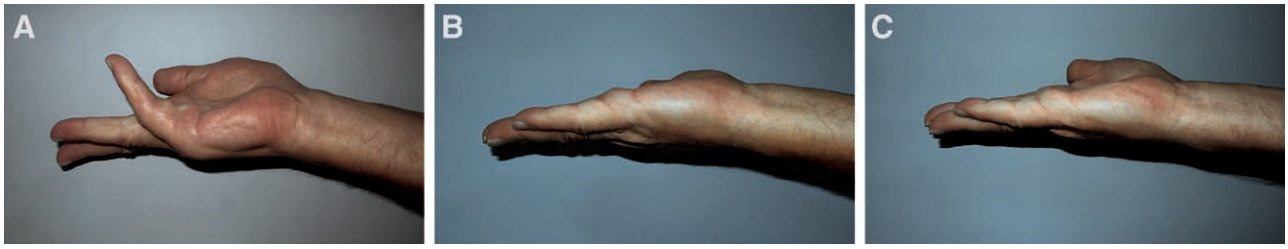

Fig. 1. Treatment progress with PNF. A, Lateral view of a 63-year-old man with Dupuytren contracture of his little finger before the treatment with PNF. B, Same patient at the 2-month follow-up after the treatment with PNF. C, Same patient at the 20-month follow-up after the treatment with PNF.

Fig. 2. Treatment progress with CCH. A, Lateral view of a 65-year-old man with Dupuytren's contracture of his ring finger before the treatment with CCH. B, Same patient at the 2-month follow-up after the treatment with CCH. C, Same patient at the 35-month follow-up after the treatment with CCH.

three different levels, which makes it difficult to compare it to our study. Moreover, the mean follow-up time in this study was significantly shorter in the CCH group than in the PNF group, with late onset of extension deficit being possibly missed.[17]

The results regarding the clinical success in MCP and PIP joints were similar in both treatment groups. As expected, the measurements in the MCP joints were better than in the PIP joints. Our results in MCP joints are comparable with those of Nydick et al,[18] who showed clinical success in PIP and MCP joint contractures in 50% of the cases following PNF and 42% of the cases following CCH after two years of follow-up. In another recently published study, roughly half of the patients still had a PED of less than 5 degrees in the MCP joint 5 years later.[19]

Contracture recurrence rates in PIP joints were 21% in the PNF group and 22% in the CCH group, whereas in MCP joints, we observed no recurrence in PNF and 20% in CCH. In this study, we used the cutoff point of 20 degrees or more in PED for every treated joint after long-term follow-up compared to the result at 3 weeks. Scherman et al[20] reported no significant difference in contracture recurrence rates between the two treatment groups at the 3-year follow-up. However, in their study, the authors defined contracture recurrence as 30 degrees or greater in total PED from the 3-month point. Skov et al reported an 83% recurrence rate (in this study defined as ≥20 degrees PED) after CCH and 68% after PNF in isolated PIP joint contractures at 2 years follow-up.[16] We have no explanation for the much higher recurrence rates reported by Skov et al compared with 22% in the collagenase group and 21% in the PNF group in our study. A research group headed by Strömberg et al[21] reported in a prospective, randomized study that 58 patients (76%) treated with CCH and 60 (79%) treated with PNF retained a straight MCP joint throughout the trial after 2 years. The same research group recently described that the recurrence rate in the MCP joint contracture was not different between the two treatment groups 5 years after the intervention.[19] Unfortunately, it is difficult to compare the studies as the definition of contracture recurrence varies in the cutoff point used, the timing of baseline measurement, and whether the extension deficits were measured actively or passively.[16,20,22] We suggest to use the standardized criteria of the consensus-based definition of contracture recurrence in DD: "more than 20 degrees of contracture recurrence in any treated joint at 1-year posttreatment compared to 6 weeks posttreatment."[23]

Regardless of the outcome results and the recurrence rates, the cost of treatment with CCH or PNF is an important consideration. In a retrospective review published by Leafblad and Wagner,[6] the cumulative costs of CCH treatment, including all reinterventions at 5 years, were $5592 (€5351). Without reinterventions, the costs of CCH have been estimated at $2665 (€2550) on average.[24] Therefore, exceeding in both cases, those of PNF totaling $1540 (€1473) at 5 years.[6] Similarly, Jain et al[25] argued that CCH had the highest average cost at $4453 (€4261) and was significantly higher than open fasciectomy at $3394 (€3247) and PNF at $2010 (€1923). We believe that not only the CCH price, but also the 2-day treatment contributes to higher costs in our department. In contrast, PNF is a single-session treatment, even if the intervention time lasts longer than a CCH injection.

This study has limitations imputable to its retrospective nature and small population: only 35 of the 101 patients participated in the long-term follow-up. Many patients were satisfied with their treatment outcome and preferred not to attend any further appointments. According to QuickDASH and URAM scores, patient satisfaction was high and did not differ significantly between the two groups at long-term follow-up. Similar results regarding the treatment outcomes and patient-based QuickDASH and URAM scores were reported in a recently published study by Abe.[26]

In summary, in our study, CCH and PNF showed similar long-term outcomes in terms of clinical improvement and success. Contracture recurrences were the same in the PIP joints of both groups and greater in the MCP joints in the CCH group compared to PNF. Therefore, PNF appears to be as effective and minimally invasive as CCH injection, but at significantly lower cost.

Turkhan Mehdiyev, MD
Department of Plastic, Reconstructive and Aesthetic Surgery
Medical University of Innsbruck
Anichstrasse 35
6020 Innsbruck, Austria
E-mail: turkhan.mehdiyev@gmx.at

REFERENCES

1. Lermusiaux J, Debeyre N. Le traitement médical de la maladie de Dupuytren. In: de Sèze S, Ryckewaert A, Kahn MF, eds. *L'actualité Rhumatologique*. Paris: Expansion Scientifique Française; 1980;52:338–343.
2. Foucher G, Medina J, Navarro R. Percutaneous needle aponeurotomy. Complications and results. *Chir Main*. 2001;20:206–211.
3. Lermusiaux JL, Lellouche H, Badois JF, et al. How should Dupuytren's contracture be managed in 1997? *Rev Rhum Engl Ed*. 1997;64:775–776.
4. Peimer CA, Blazar P, Coleman S, et al. Dupuytren contracture recurrence following treatment with collagenase clostridium histolyticum (CORDLESS [collagenase option for reduction of dupuytren long-term evaluation of safety study]): 5-year data. *J Hand Surg Am*. 2015;40:1597–1605.
5. van Rijssen AL, Ter Linden H, Werker PMN. Five-year results of a randomized clinical trial on treatment in Dupuytren's disease: percutaneous needle fasciotomy versus limited fasciectomy. *Plast Reconstr Surg*. 2012;129:469–477.
6. Leafblad ND, Wagner E, Wanderman NR, et al. Outcomes and direct costs of needle aponeurotomy, collagenase injection, and fasciectomy in the treatment of dupuytren contracture. *J Hand Surg Am*. 2019;44:919–927.
7. Naam NH. Functional outcome of collagenase injections compared with fasciectomy in treatment of Dupuytren's contracture. *Hand (N Y)*. 2013;8:410–416.
8. Denkler KA, Park KM, Alser O. Treatment options for dupuytren's disease: Tips and tricks. *Plast Reconstr Surg Glob Open*. 2022;10:e4046.
9. Coleman S, Gilpin D, Kaplan FT, et al. Efficacy and safety of concurrent collagenase clostridium histolyticum injections for multiple Dupuytren contractures. *J Hand Surg Am*. 2014;39:57–64.

10. Beaudreuil J, Lermusiaux JL, Teyssedou JP, et al. Multi-needle aponeurotomy for advanced Dupuytren's disease: preliminary results of safety and efficacy (MNA I study). *Joint Bone Spine.* 2011;78:625–628.
11. Foucher G, Medina J, Navarro R. Percutaneous needle aponeurotomy: complications and results. *J Hand Surg Br.* 2003;28:427–431.
12. Tang JB. Re: Levels of experience of surgeons in clinical studies. *J Hand Surg Eur Vol.* 2009;34:137–138.
13. Beaton DE, Wright JG, Katz JN; Upper Extremity Collaborative Group. Development of the QuickDASH: comparison of three item-reduction approaches. *J Bone Joint Surg Am.* 2005;87:1038–46.
14. Beaudreuil J, Allard A, Zerkak D, et al; URAM Study Group. Unité Rhumatologique des Affections de la Main (URAM) scale: development and validation of a tool to assess Dupuytren's disease-specific disability. *Arthritis Care Res (Hoboken).* 2011;63:1448–1455.
15. Sanjuan-Cervero R, Gomez-Herrero D, Vazquez-Ferreiro P, et al. Sensitivity and Specificity of the Unité Rhumatologique Des Affections De La Main (URAM) scale for Dupuytren contracture: a systematic review and meta-analyses. *Cureus.* 2022;14:e21636.
16. Skov ST, Bisgaard T, Søndergaard P, et al. Injectable collagenase versus percutaneous needle fasciotomy for Dupuytren contracture in proximal interphalangeal joints: a randomized controlled trial. *J Hand Surg Am.* 2017;42:321–328.e3.
17. Abdelrahman I, Elmasry M, Steinvall I, et al. Needle fasciotomy or collagenase injection in the treatment of dupuytren's contracture: a retrospective study. *Plast Reconstr Surg Glob Open.* 2020;8:e2606.
18. Nydick JA, Olliff BW, Garcia MJ, et al. A comparison of percutaneous needle fasciotomy and collagenase injection for Dupuytren disease. *J Hand Surg Am.* 2013;38:2377–2380.
19. Byström M, Ibsen Sörensen A, Samuelsson K, et al. Five-Year results of a randomized, controlled trial of collagenase treatment compared with needle fasciotomy for Dupuytren contracture. *J Hand Surg Am.* 2022;47:211–217.
20. Scherman P, Jenmalm P, Dahlin LB. Three-year recurrence of Dupuytren's contracture after needle fasciotomy and collagenase injection: a two-centre randomized controlled trial. *J Hand Surg Eur Vol.* 2018;43:836–840.
21. Strömberg J, Ibsen Sörensen A, Fridén J. Percutaneous needle fasciotomy versus collagenase treatment for Dupuytren contracture: A randomized controlled trial with a two-year follow-up. *J Bone Joint Surg Am.* 2018;100:1079–1086.
22. Scherman P, Jenmalm P, Dahlin LB. One-year results of needle fasciotomy and collagenase injection in treatment of Dupuytren's contracture: a two-centre prospective randomized clinical trial. *J Hand Surg Eur Vol.* 2016;41:577–582.
23. Kan HJ, Verrijp FW, Hovius SER, et al; Dupuytren Delphi Group. Recurrence of Dupuytren's contracture: a consensus-based definition. *PLoS One.* 2017;12:e0164849.
24. Mehta S, Belcher HJ. A single-centre cost comparison analysis of collagenase injection versus surgical fasciectomy for Dupuytren's contracture of the hand. *J Plast Reconstr Aesthet Surg.* 2014;67:368–372.
25. Jain A, Tarabishy S, Carter J, et al. Cost analysis and national trends in the treatment of dupuytren contracture comparing collagenase injection, needle fasciotomy, and open fasciectomy procedures. *Ann Plast Surg.* 2021;86(6S Suppl 5):S625–S627.
26. Abe Y. Comparison of treatment outcomes after collagenase injection and percutaneous needle fasciotomy for Dupuytren's contracture: objective and subjective comparisons with a 3-year follow-up. *Plast Reconstr Surg.* 2020;145:1464–1474.