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Original Research

## Acute Pain Intensity After Collagenase *Clostridium histolyticum* Injection in Patients With Dupuytren Contracture



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**Purpose:** To investigate multidimensional pain intensity and quality after collagenase *Clostridium histolyticum* (CCH) injection in patients with Dupuytren contracture using a pain visual analog scale (VAS) and the revised version of the Short-Form McGill Pain Questionnaire (SF-MPQ-2).

**Methods:** This prospective observational study was carried out from 2015 to 2017. As a primary end point, patients completed the pain VAS (range, 0 [no pain] to 100) and SF-MPQ-2 before and after CCH injection; 3, 9, and 24 hours after CCH injection; after the extension procedure; and 3 and 7 days after CCH injection. In addition, they reported the dose and duration of supplementary analgesic use during this period.

**Results:** A total of 41 patients were enrolled in this study (51 joints). Mean pain VAS score (mean  $\pm$  SD, 34  $\pm$  21) was maximal 9 hours after CCH injection and decreased within the following 7 days. The total score of the SF-MPQ-2 significantly increased after CCH treatment and decreased in the 7 days after the injection. Among the SF-MPQ-2 subscales, the highest and lowest scores after CCH injection were recorded for continuous pain and affected descriptors, respectively. Nonsteroidal anti-inflammatory drugs were most frequently self-administered during 7 days after the extension procedure compared with any other study period.

**Conclusions:** The pain VAS and SF-MPQ-2 revealed acute pain after CCH injection. However, all examined pain aspects dramatically improved within 7 days after injection. Pain after CCH injection is characterized by low scores in the Affective Descriptors subscale of the SF-MPQ-2.

**Type of study/level of evidence:** Prognostic IV.

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Dupuytren contracture (DC) is a fibroproliferative disease that affects mainly the palmar hand and causes a progressive flexion contracture of the fingers. This flexion contracture limits hand function and interferes with daily activities.<sup>1</sup> Surgical treatments such as fasciotomy or fasciectomy have been the standard options for this disease.<sup>2,3</sup> However, since Hurst et al<sup>4</sup> reported the effectiveness of collagenase *Clostridium histolyticum* (CCH) injection for patients with DC in 2009, this nonsurgical treatment has become

an alternative in North American, European, and Asian countries.<sup>5–7</sup>

*Clostridium histolyticum* is an enzyme that lyses collagen, leading to a disruption of contracted cords.<sup>8</sup> Several side effects are reported, such as peripheral edema, contusion, and injection site hemorrhage. Although injection site or upper-arm pain is frequently observed in more than 30% to 70% of DC patients and even complex regional pain syndromes can occur, the pain prevalence and the efficacy of antinociceptive remedies have not been sufficiently analyzed.<sup>4,5</sup> Pain sensations during infiltration and manipulation have been reported<sup>9</sup>; however, the quantity and quality of the pain response over time after CCH injection have not been elucidated. Understanding the progression of pain is useful in patient care to take suitable preventative measures.

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**Table 1**  
Background Characteristics, Risk Factors, and Disease Characteristics of Patients Who Received CCH Injections

Background Characteristics	Primary MCP Joints (n = 41)	Primary PIP Joints (n = 10)	Total (n = 51)
Age, y			
Mean (SD)	69 (9.7)	69 (9.5)	69 (9.6)
Range	46–89	48–82	46–89
Sex, n (%) (reference = male)	38 (93)	8 (80)	46 (90)
Family history of DC, n (%) (reference = yes)	0	0	0
Medical history related to DC, n (%)			
Knuckle pads	0	0	0
Peyronie disease	0	0	0
Ledderhose disease	3 (7.3)	1 (10.0)	4 (7.8)
Diabetes mellitus	12 (29.0)	5 (50.0)	17 (33.0)
Malignant tumor*	6 (15.0)	1 (10.0)	7 (14.0)
Epilepsy	1 (2.4)	0	1 (2.0)
Duration of DC, y (mean [SD])	6.2 (5.0)	3.7 (4.2)	5.6 (4.9)
Treatment history related to DC, n (%)			
None	24 (59)	8 (80)	32 (63)
Surgical procedure	7 (17)	2 (20)	9 (18)
Physical therapy	0	0	0
Injection	0	0	0
Contracture of primary joint (degrees) (mean [SD])	37 (20)	55 (15)	39 (20)

\* This category included 2 with lung cancer, 2 with gastric cancer, 1 with esophageal cancer, 1 with bladder cancer, and 1 with lip cancer.

There are several approaches to assess pain quality and intensity.<sup>10</sup> The revised version of the Short-Form McGill Pain Questionnaire (SF-MPQ-2) was developed to measure neuropathic and non-neuropathic pain in treatment-response studies.<sup>11</sup> The SF-MPQ-2 consists of 4 subscales: Continuous Pain, Intermittent Pain, Neuropathic Pain, and Affective Descriptors. By determining SF-MPQ-2 scores before and after CCH injection and extension procedures, we were able to evaluate the multidimensional pain qualities in DC patients after CCH injection.

We hypothesized that the pain visual analog scale (VAS) and the total scores of the SF-MPQ-2 would be highest immediately after injection and that the scores on the SF-MPQ-2 subscales would show the pain-related characteristics of DC patients.

## Materials and Methods

### Study design

This prospective observational study was carried out from 2015 to 2017. Inclusion criteria were age 20 years or more, a diagnosis of DC, and flexion contractures in one or more fingers as a result of palpable cords at the metacarpophalangeal (MCP) joint, proximal interphalangeal (PIP) joint, or both.

Patients who were excluded had additional chronic diseases of the hand that might have affected the assessment; those who had received treatment for DC in a primary joint within 90 days before the first injection; those who had recently experienced a stroke, hemorrhage, or other disease affecting the hand; those allergic to collagenase; and those who were pregnant.

### Visual analogue scale (VAS) for pain severity measurement



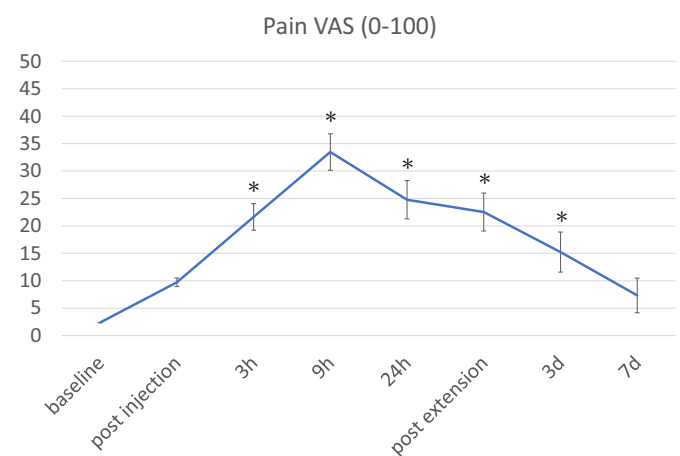
**Figure 1.** Visual analog scale for pain severity measurement. The scale for pain is an unmarked horizontal line of precisely 100 mm on which the patient marks the pain level ranging from no pain to worst pain. Subsequently, the score is determined using a ruler to measure the distance from the end of the line (No pain) to the patient's mark.

### Patients

In this study, 41 patients were enrolled (51 joints). **Table 1** describes the baseline characteristics of the study population. Mean age of patients was 69 years; approximately 90% were men, 41% had a history of diabetes mellitus, and 17% had been previously treated for a malignant tumor (**Table 1**). Mean disease duration before CCH injection was 5.6 years; 22% had a prior surgical procedure for DC. Mean values for primary contractures were 37° for the MCP joint and 55° for the PIP joint.

### Treatment

*Clostridium histolyticum* (0.58 mg) was directly injected into the Dupuytren cord in the MCP and PIP joints by hand surgery specialists. The volume of the CCH solution per injection was 0.25 mL for MCP joints and 0.20 mL for PIP joints. In patients with contractures in both MCP and PIP joints, CCH was first injected into the cord on the MCP joints.



**Figure 2.** Time course of pain scores before and after CCH injection. Mean values  $\pm$  standard error are shown. Patients rated pain intensity on the pain VAS before and after (within 5–10 minutes) the CCH injection; 3 and 9 hours after the CCH injection; before (24 hours after CCH injection) and after (within 5–10 minutes) the extension procedure; and 3 and 7 days after the CCH injection.

**Table 2**  
Time Course of Pain VAS (Scale of 0 to 100) Before and After CCH Injection\*

Time Course of Pain	Baseline	After Injection	3 h	9 h	24 h	After Extension	3 d	7 d
Mean $\pm$ SD	2.4 $\pm$ 4.7	9.7 $\pm$ 14.4	21.6 $\pm$ 19.7 <sup>†</sup>	33.5 $\pm$ 20.7 <sup>†</sup>	24.8 $\pm$ 20.4 <sup>†</sup>	22.5 $\pm$ 2 1.6 <sup>†</sup>	15.2 $\pm$ 18.9 <sup>†</sup>	7.3 $\pm$ 10.5
Difference from baseline (95% confidence interval)		7.3 (2.9–11.8)	19.3 (12.6–25.9)	31.1 (24.6–37.6)	22.4 (15.6–29.1)	20.1 (12.8–27.5)	12.8 (6.9–18.8)	4.9 (1.5–8.4)

\* Patients rated pain intensity on the VAS before CCH injection, after the injection (within 5–10 minutes), at 3 and 9 hours after the injection, before (24 hours after CCH injection) and after the extension procedure (within 5–10 minutes), and at 3 and 7 days after the CCH injection. A lower score indicates better with regard to pain. Compared with the baseline value, Pain VAS was significantly higher at 3 and 9 hours after the CCH injection, before (24 hours after CCH injection) and immediately after the extension procedure, and 3 days after the CCH injection.

<sup>†</sup>  $P < .05$ .

An investigator carried out passive extension of the injected finger approximately 24 hours after CCH administration. This extension procedure was preceded by local anesthesia or a wrist block. We used 10 mL of 1% lidocaine for local anesthesia or a wrist block. Patients were instructed to exercise the hands in the daytime and to wear an orthosis at night for 3 months after the extension procedure. Up to 3 injections per joint were allowed at 30-day intervals.

Nonsteroidal anti-inflammatory drugs (NSAIDs) such as loxoprofen or celecoxib were used for pain as needed.

#### Assessment of pain VAS and SF-MPQ-2

Patients were asked to complete the pain VAS and SF-MPQ-2 to evaluate the acute pain quality and intensity as a primary end point. We used the VAS scale for pain, which is an unmarked horizontal line of precisely 100 mm on which the patient marks the pain level ranging from no pain to worst pain (Fig. 1). Subsequently, the VAS score was determined using a ruler to measure the distance from the end of the line (no pain) to the patient's mark.

The SF-MPQ-2 consists of 22 descriptors with a numerical rating scale of 0 to 10 in which 0 = none and 10 = worst possible. The 22 descriptors were divided into 4 subscales: (1) Continuous Pain (6 items): throbbing pain, cramping pain, gnawing pain, aching pain, heavy pain, and tender; (2) Intermittent Pain (6 items): shooting pain, stabbing pain, sharp pain, splitting pain, electric-shock pain, and piercing; (3) Neuropathic Pain (6 items): hot-burning pain, cold-freezing pain, pain caused by light touch, itching, tingling or pins and needles, and numbness; and (4) Affective Descriptors (4 items): tiring-exhausting, sickening, fearful, and punishing-cruel.<sup>11</sup> The Japanese version of the SF-MPQ-2 has been validated.<sup>12</sup> Pain intensity and quality were assessed by comparing the values of each subscale.

#### Timing of assessment

Patients graded symptoms with the pain VAS and SF-MPQ-2 before and after (within 5–10 minutes) the CCH injection; at 3, 9, and 24 hours after the injection (before receiving anesthesia); after the extension procedure (within 5–10 minutes); and 3 and 7 days after the injection. In addition, they reported the dose and duration of supplementary analgesic use at these intervals. Patients were handed the questionnaire regarding the pain VAS, SF-MPQ-2, and analgesic use; it was collected at the outpatient clinic 1 week after the CCH injection. Patients rated pain when they answered the questions, not during the injection or extension procedure.

#### Statistical analysis

We used Tukey's test to compare the mean values of the pain VAS and the SF-MPQ-2 scores at each time point with the baseline

score. All differences were considered statistically significant at  $P < .05$ .

## Results

### Pain VAS

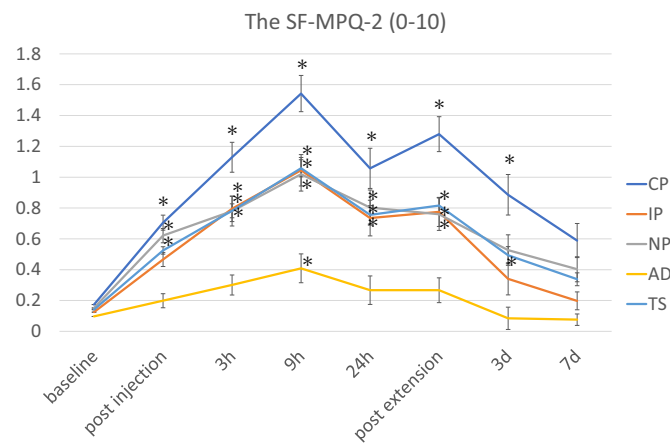
The mean value on the pain VAS was maximal 9 hours after injection. Afterward, it consistently decreased and showed no statistically significant difference on day 7 after CCH injection compared with the baseline value (Fig. 2, Table 2).

### Short-Form McGill Pain Questionnaire

Among the SF-MPQ-2 subscales, the highest and lowest scores after CCH injection were recorded for Continuous Pain and Affective Descriptors, respectively. Similar to the results for the pain VAS, each subscale showed the highest score 9 hours after CCH injection. Within the following 7 days, each subscale score decreased and was not significantly different from its baseline value on day 7 (Fig. 3, Table 3).

### Supplementary analgesic use

Enrolled patients used only 2 types of NSAIDs (ie, loxoprofen and celecoxib). Because 27 of 41 patients used no NSAIDs during the 7 days, mean NSAID use per patient was less than 1. The NSAIDs



**Figure 3.** Time course of revised version of the SF-MPQ-2 scores before and after CCH injection. Mean values  $\pm$  standard error are shown. Patients completed the SF-MPQ-2 before and after (within 5–10 minutes) the CCH injection; 3 and 9 hours after the CCH injection; before (24 hours after the CCH injection) and after (within 5–10 minutes) the extension procedure; and 3 and 7 days after the CCH injection. AD, affective descriptors; CP, continuous pain; IP, intermittent pain; NP, neuropathic pain; TS, total score.

**Table 3**

Time Course of Mean Scores of Revised Version of SF-MPQ-2 and 95% Confidence Intervals (CIs) Before and After CCH Injection\*

McGill Subscales	Baseline	After Injection	3 h	9 h	24 h	After Extension	3 d	7 d
Continuous Pain ± SD	0.17 ± 0.8	0.7 ± 1.6 <sup>†</sup>	1.13 ± 1.9 <sup>†</sup>	1.54 ± 2.1 <sup>†</sup>	1.06 ± 1.84 <sup>†</sup>	1.28 ± 2.1 <sup>†</sup>	0.89 ± 1.8 <sup>†</sup>	0.59 ± 1.3
Difference from baseline (95% CI)		0.53 (0.36–0.71)	0.95 (0.74–1.17)	1.37 (1.12–1.61)	0.88 (0.67–1.09)	1.1 (0.83–1.38)	0.71 (0.49–0.93)	0.41 (0.24–0.6)
Intermittent Pain ± SD	0.13 ± 0.7	0.47 ± 1.3 <sup>†</sup>	0.8 ± 1.6 <sup>†</sup>	1.05 ± 1.9 <sup>†</sup>	0.74 ± 1.5 <sup>†</sup>	0.78 ± 1.7 <sup>†</sup>	0.34 ± 0.9	0.2 ± 0.7
Difference from baseline (95% CI)		0.34 (0.18–0.5)	0.67 (0.47–0.87)	0.92 (0.69–1.15)	0.61 (0.43–0.79)	0.65 (0.43–0.87)	0.22 (0.1–0.33)	0.07 (0.05–0.2)
Neuropathic Pain ± SD	0.15 ± 0.8	0.62 ± 1.6 <sup>†</sup>	0.78 ± 1.8 <sup>†</sup>	1.02 ± 1.8 <sup>†</sup>	0.8 ± 1.7 <sup>†</sup>	0.76 ± 1.6 <sup>†</sup>	0.53 ± 1.3	0.4 ± 1.1
Difference from baseline (95% CI)		0.47 (0.29–0.65)	0.63 (0.42–0.84)	0.87 (0.65–1.09)	0.65 (0.45–0.85)	0.61 (0.4–0.82)	0.38 (0.22–0.53)	0.25 (0.09–0.41)
Affective Descriptors ± SD	0.1 ± 0.6	0.2 ± 0.9	0.3 ± 1.2	0.41 ± 1.2 <sup>†</sup>	0.27 ± 1.1	0.27 ± 0.9	0.09 ± 0.5	0.08 ± 0.4
Difference from baseline (95% CI)		0.1 (0–0.2)	0.2 (0.03–0.38)	0.31 (0.14–0.49)	0.17 (0.03–0.31)	0.17 (0–0.34)	0.01 (–0.09 to 0.07)	0.02 (–0.13 to 0.1)
Total score ± SD	0.14 ± 0.7	0.52 ± 1.4 <sup>†</sup>	0.79 ± 1.7 <sup>†</sup>	1.06 ± 1.9 <sup>†</sup>	0.76 ± 1.6 <sup>†</sup>	0.82 ± 1.7 <sup>†</sup>	0.49 ± 1.3 <sup>†</sup>	0.34 ± 1
Difference from baseline (95% CI)		0.38 (0.3–0.47)	0.65 (0.55–0.76)	0.92 (0.8–1.03)	0.62 (0.52–0.71)	0.68 (0.56–0.79)	0.35 (0.27–0.44)	0.2 (0.12–0.28)

\* Patients completed the SF-MPQ-2 before CCH injection; after the CCH injection (within 5–10 minutes); at 3, 9, and 24 hours after the CCH injection; after the extension procedure (within 5–10 minutes); and at 3 and 7 days after the CCH injection. The score ranges from 0 to 10. A lower score indicates better with regard to pain. The SF-MPQ-2 subscales Continuous Pain, Intermittent Pain, and Neuropathic Pain, and total score were significantly higher at 3, 9 and 24 hours after the CCH injection, and after the extension procedure, 3 days after the CCH injection compared with the baseline value. The subscale Affective Descriptors showed the lowest scores among subscales and was significantly higher only at 9 hours after the CCH injection.

<sup>†</sup>  $P < .05$ .

were most frequently self-administered during 7 days after the extension procedure (Fig. 4).

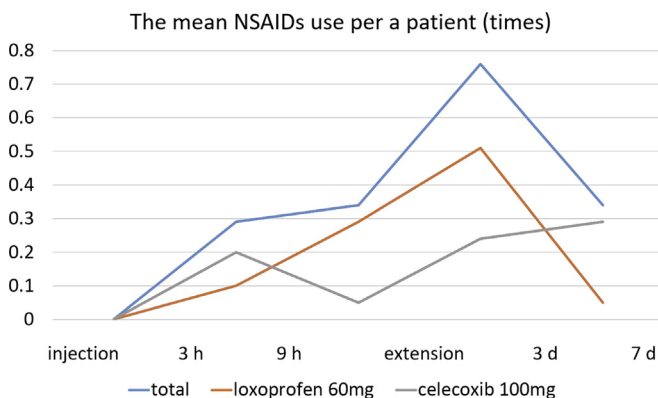
## Discussion

This study investigated in detail the development of pain intensity and quality in DC patients treated with CCH. Both the mean pain VAS and the total SF-MPQ-2 score reached maximal values 9 hours after the drug injection. We observed a time lag in all subscales before the pain intensities peaked. Among the SF-MPQ-2 subscales, the Continuous Pain subscale displayed the highest scores, whereas the Affective Descriptors subscale showed the lowest scores.

Pain is widely recognized as an adverse event in CCH treatment. A previous prospective study used a numerical rating scale to measure pain associated with CCH treatment.<sup>9</sup> The researchers demonstrated that CCH injection can be a painful process, and pain sensation during manipulation was clearly correlated with the pain level experienced during CCH infiltration. In contrast, Nordenskjöld et al.<sup>13</sup> reported that local anesthesia before CCH injection

significantly reduced the overall pain experience for DC patients. Thus, local anesthesia before CCH would be an option for relieving pain during injection. Although we examined the pain VAS and SF-MPQ-2 after CCH injection (within 5–10 minutes) or the extension procedure (within 5–10 minutes) and not during injection or extension in this study, these procedures were well-tolerated by patients. The delay in peak pain rated by the VAS and SF-MPQ-2 subscales may have resulted from dorsal and volar edema, hematoma, and ecchymosis in the hand, which occur over time after CCH injection. Clinicians should be aware that there is a peak in pain perception 9 hours after the injection. In our study, manipulation-induced pain was controlled with anesthesia and analgesics such as NSAIDs. There was a discrepancy between the peak of pain and the use of NSAIDs. Although patients reported the most pain 9 hours after CCH injection, most did not use NSAIDs at that time. However, NSAIDs may have been used after the extension procedure to avoid pain after the anesthesia had expired.

Pain is a multidimensional experience including sensory-discriminative, affective-motivational, and cognitive components.<sup>14</sup> This conceptualization of pain was summarized by Melzack,<sup>15</sup> and the MPQ was developed to evaluate pain qualities. It has been used to assess multiple types of acute and chronic pain for more than 4 decades. The SF-MPQ-2 was established in 2009 to provide increased responsiveness by adding 7 symptoms relevant to neuropathic pain, replacing the previous 4-point rating scale with a numerical rating scale of 0 to 10 for all 22 items.<sup>11</sup> The reliability of the SF-MPQ-2 was assessed in patients with painful diabetic peripheral neuropathy (DPN) in a clinical trial for a topical combination of amitriptyline and ketamine. Mean subscale scores of patients with DPN ranged from 2.9 to 3.8 at baseline. At the end of the trial, mean subscale scores were decreased, ranging from 1.8 to 2.3. In patients with DPN, the subscale for intermittent pain and for neuropathic pain showed the lowest and highest mean scores, respectively. In DC patients treated with CCH injection, the Continuous Pain SF-MPQ-2 subscale showed the highest score whereas the Affective Descriptors showed the lowest scores. We interpret low affective descriptors to mean that patients were less afraid during the series of treatments by CCH injection. Furthermore, the mean subscale score in DC patients for neuropathic pain was not high. If neuropathic pain or affected descriptors were high,



**Figure 4.** Time course of NSAID use after injection with CCH. Patients reported the type and dose of self-administered NSAIDs for the injection to 3 hours, 3 to 9 hours, 9 hours to the extension procedure, the extension procedure to 3 days, and 3 to 7 days after the CCH injection.

pregabalin or tricyclic antidepressants might have been useful in addition to NSAIDs. These findings show a characteristic subscale pattern of treatments by CCH injection for DC patients.

Our study had several limitations. First, we did not standardize the use of analgesics. This may have affected pain evaluation. However, pain after CCH injection was controlled by minimal NSAID use and few patients required analgesics. Second, local anesthesia or wrist block was used before the extension procedure. Different anesthesia protocols might have influenced pain perception after the extension procedure. The expected duration of anesthesia was more than 1 hour for both local anesthesia and wrist block. Finally, we did not compare pain scores between patients with primarily affected PIP and MCP joints because the number of patients with flexion contracture of a PIP joint was too small. Although pain is multifactorial, we did not analyze confounding factors that might have influenced outcomes because of the complex cause of pain. Despite these limitations, we were able to evaluate pain after CCH injection on a multidimensional scale. These findings will help patients to manage pain properly.

The pain VAS and SF-MPQ-2 scores demonstrated the presence of acute pain in CCH-treated patients. After the CCH injection, all investigated pain dimensions dramatically decreased within 7 days. Low values on the affective descriptors subscale of the SF-MPQ-2 are characteristic for pain in patients with DC.

## References

- Shih B, Bayat A. Scientific understanding and clinical management of Dupuytren disease. *Nat Rev Rheumatol*. 2010;6(12):715–726.
- Denkler KA, Vaughn CJ, Dolan EL, Hansen SL. Evidence-based medicine: options for Dupuytren's contracture: incise, excise, and dissolve. *Plast Reconstr Surg*. 2017;139(1):240e–255e.
- Crean SM, Gerber RA, Le Graverand MP, Boyd DM, Cappelleri JC. The efficacy and safety of fasciectomy and fasciotomy for Dupuytren's contracture in European patients: a structured review of published studies. *J Hand Surg Eur Vol*. 2011;36(5):396–407.
- Hurst LC, Badalamente MA, Hentz VR, et al. Injectable collagenase clostridium histolyticum for Dupuytren's contracture. *N Engl J Med*. 2009;361(10):968–979.
- Hirata H, Tanaka K, Sakai A, Kakinoki R, Ikegami H, Tateishi N. Efficacy and safety of collagenase *Clostridium histolyticum* injection for Dupuytren's contracture in non-Caucasian Japanese patients (CORD-J Study): the first clinical trial in a non-Caucasian population. *J Hand Surg Eur Vol*. 2017;42(1):30–38.
- Lauritzson A, Atroshi I. Collagenase injections for Dupuytren's disease: prospective cohort study assessing 2-year treatment effect durability. *BMJ Open*. 2017;7(3):e012943.
- Peimer CA, Skodny P, Mackowiak JI. Collagenase clostridium histolyticum for dupuytren contracture: patterns of use and effectiveness in clinical practice. *J Hand Surg Am*. 2013;38(12):2370–2376.
- Badalamente MA, Hurst LC, Hentz VR. Collagen as a clinical target: nonoperative treatment of Dupuytren's disease. *J Hand Surg Am*. 2002;27(5):788–798.
- Sanjuan-Cerveró R, Carrera-Hueso FJ, Vazquez-Ferreiro P, Fikri-Benbrahim N, Franco-Ferrando N, Peimer CA. Pain associated with treatment of Dupuytren contracture with collagenase *Clostridium histolyticum*. *J Hand Surg Am*. 2017;42(2):e109–e114.
- Bennett MI, Attal N, Backonja MM, et al. Using screening tools to identify neuropathic pain. *Pain*. 2007;127(3):199–203.
- Dworkin RH, Turk DC, Revicki DA, et al. Development and initial validation of an expanded and revised version of the Short-form McGill Pain Questionnaire (SF-MPQ-2). *Pain*. 2009;144(1-2):35–42.
- Maruo T, Nakae A, Maeda L, et al. Validity, reliability, and assessment sensitivity of the Japanese version of the short-form McGill pain questionnaire 2 in Japanese patients with neuropathic and non-neuropathic pain. *Pain Med*. 2014;15(11):1930–1937.
- Nordenskjöld J, Waldén M, Kjellin A, Franzen H, Atroshi I. Benefit of local anesthesia in reducing pain during collagenase injection for Dupuytren's contracture. *Plast Reconstr Surg*. 2017;140(3):565–569.
- Bouhassira D, Attal N. All in one: is it possible to assess all dimensions of any pain with a simple questionnaire? *Pain*. 2009;144(1-2):7–8.
- Melzack R. The McGill Pain Questionnaire: major properties and scoring methods. *Pain*. 1975;1(3):277–299.