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Outcomes of Management of Recurrent Dupuytren Contracture: A Systematic Review and Meta-analysis

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Abstract

Background: With numerous treatment modalities available, it is unclear whether the treatment of recurrent Dupuytren disease is as effective as its initial treatment. We aimed to investigate the outcomes of management of recurrent Dupuytren contracture. **Methods:** Adhering to Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines, MEDLINE, Embase, PubMed, CINAHL, and Cochrane Central Register of Controlled Trials were searched from their inception to April 2020. Studies of patients aged above 18 years undergoing treatment for recurrent Dupuytren contractures were included. The Risk Of Bias In Non-randomized Studies-of Interventions tool was used for quality assessment. The study was registered with Open Science Foundation. **Results:** A systematic review identified 12 studies: 311 patients with 224 affected digits—index (n = 5; 2.2%), long (n = 17; 7.6%), ring (n = 57; 25.4%), small (n = 112; 50%), and unspecified (n = 33; 14.7%); of these, there were 76 metacarpophalangeal joints (MCPJ; 45.5%), 90 proximal phalangeal joints (PIPJ; 53.9%), and 1 distal interphalangeal joint (0.6%). Previous treatment included the following: percutaneous needle aponeurotomy (n = 103 of 311 patients; 33.1%), collagenase clostridium histolyticum-injection (CCH; n = 75 of 311; 24.1%), limited fasciectomy (LF) ± skin graft (n = 83 of 311; 26.7%), fasciotomy (n = 1 of 311; 0.3%), and unspecified (n = 64 of 311; 20.6%). Recurrence was treated by percutaneous needle aponeurotomy (n = 68 of 311 patients; 21.9%); CCH injection (n = 53 of 311; 17.0%); aponeurotomy or dermofasciectomy or LF (n = 176 of 311; 56.6%); ray/digit amputation (n = 8 of 311; 2.6%); and PIPJ arthrodesis (n = 6 of 293; 2.0%). Range of motion was improved by 23.31° (95% confidence interval [CI] = 13.13°-33.50°; I^2 = 67%; P = .05) and 15.49° (95% CI = 2.67°-28.31°; I^2 = 76%; P = .01) for MCPJ and PIPJ, respectively. **Conclusions:** There is low level of evidence that both surgical and nonsurgical treatments provide clinically important improvements for recurrent Dupuytren contracture.

Keywords: Dupuytren contracture, surgical procedures, conservative treatment, treatment outcome, patient outcome

Introduction

Dupuytren disease is an inherited, benign, chronic fibroproliferative disorder of palmar fascia, digital fascia, and adjacent soft tissue that impairs digit extension.[1] Given that existing treatment options address Dupuytren contracture rather than Dupuytren disease, both recurrence and extension of the disease are common.[1] The risk factors for recurrence include the following: plantar fibromatosis, Garrod nodules, radial side involvement, early onset (<50 years of age), and male sex.[2,3]

Treatment for recurrent disease is complicated by the lack of a universally agreed-upon definition of recurrence. The only consensus-based definition via the Delphi method defines recurrence as greater than 20° of contracture at a joint 1 year after treatment compared with 6 weeks after treatment.[4] Recurrence rates of 12% to 39%, 50% to 58%, and 10% to 31% have been reported for open partial fasciectomy, needle aponeurotomy, and collagenase clostridium histolyticum (CCH) injection, respectively.[5] The most common treatment modality for recurrent Dupuytren contracture is open partial fasciectomy considering the significant scarring, altered anatomy, and poor definition of diseased tissue.[6] Open fasciectomy for Dupuytren contracture appears to afford greater initial correction and better visualization of

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nerves, arteries, and flexor tendons, whereas CCH and needle aponeurotomy have a more benign complication profile and faster recovery.[6,7] For the purpose of this review, CCH and needle aponeurotomy are referred to as nonsurgical treatment modalities for Dupuytren disease.

A consensus on the efficacy of treatment for recurrent Dupuytren disease is not yet available. It is unclear whether the treatment of recurrence produces similar results as the initial treatment. Moreover, with the numerous treatment modalities now available in a surgeon's armamentarium, patients may receive both nonsurgical and surgical treatments. Synthesizing the current literature to understand the outcomes of recurrent Dupuytren disease poses numerous benefits to both patients and their surgeons, including, but not limited to, improved preoperative counseling with evidence-based information, estimate of contracture degrees regarding specific treatments, and whether the success of repeated treatment is affected by initial treatment.[8] The aim of this systematic review of the literature is to investigate the outcomes of management of recurrent Dupuytren contracture.

Methods

Search Strategy and Study Selection

The review was reported in concordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines (shown in Supplemental Figure 1). A literature search (Supplemental Material) was performed using PubMed (from inception to April 19, 2020), Ovid MEDLINE (from inception to April 29, 2020), EMBASE (from inception to April 19, 2020), CINAHL (from inception to April 19, 2020), and Cochrane Central Register of Controlled Trials (CENTRAL) (from inception to April 19, 2020) databases by 2 independent reviewers (C.W. and R.F.).

Included full-text articles featured any randomized controlled trial, prospective cohort, or retrospective cohort study for patients aged above 18 years undergoing treatment for recurrent Dupuytren contractures. Articles were excluded if they demonstrated any of the following: not primary research articles (ie, abstracts, conference proceedings, etc), if the data could not be extracted, or were case report studies.

The main objective of the study was to determine the outcomes of various surgical and nonsurgical management of recurrent Dupuytren contracture. Primary outcomes of interest were the following: range of motion (ROM) at the joints, severity of joint contractures, extension deficits, patient-reported outcome measures (ie, Disabilities of the Arm, Shoulder, and Hand [DASH] scores), and efficacy of treatment for recurrent Dupuytren contracture. Secondary outcomes were the following: surgical complications (ie, digital nerve injury, etc), wound healing complications (ie, infection, dehiscence, sensitivity), quality-affected life-years scores, cost-effectiveness analyses, and patient satisfaction. The language of publication was restricted to English. This review has been registered with the Open Science Foundation.[9]

Data Extraction and Quality Assessment

Data from the included articles were independently extracted in duplicate by 2 reviewers (C.W. and R.F.) using a predefined, standardized data collection instrument.[10] Any disagreements were resolved by discussion to reach a consensus. If a consensus could not be obtained, any conflicts were resolved by the third author (M.H.). The extracted data included demographic information (age, sex, comorbidities, smoking status, previous treatments, baseline severity of disease, etc), type of study, management of recurrent Dupuytren contracture, objective outcome measures (ie, improvement in range of motion), patient-reported outcomes, rates of complication, and follow-up time.

Two reviewers (C.W. and M.H.) independently assessed the studies for risk of bias and applicability of the study methodology. For each article, the risk of bias assessment was performed using the ROBINS-I tool (Risk Of Bias In Non-randomized Studies-of Interventions)[11] for nonrandomized studies.

The ROBINS-I tool was used to assess the risk of bias and quality of nonrandomized studies in 7 key domains: (1) bias due to confounding; (2) bias in selection of participants into the study; (3) bias in classification of interventions; (4) bias due to deviations from intended interventions; (5) bias due to missing outcome data; (6) bias in measurement of the outcome; and (7) bias in selection of the reported result. Risk of bias could be scored as no information, low, moderate, serious, or critical. Disagreements between reviewers (C.W. and R.F.) were resolved through consensus. If a consensus could not be obtained, any conflicts were resolved by the third author (M.H.). Interrater reliability was calculated using Cohen's κ score.

Statistical Analysis

Descriptive statistics were reported for patient demographic information, study characteristics, previous treatments, and patient outcomes. The improvement in ROM was synthesized via meta-analytic pooling of proportions from the included studies using a DerSimonian-Laird random effects model. Only ROM was included in the quantitative analysis as the remaining outcome variables had high rates of missing data and limited number of studies. Heterogeneity was quantified using I^2 statistics. No transformation of data was required. Due to the inconsistency of outcome reporting and missing data, a regression analysis could not be performed.

All data analyses were performed in R statistical software (version 3.6.1).[12]

Results

Search Strategy and Study Selection

A systematic review of the literature identified 849 unique titles, 33 of which underwent full-text review (Supplemental Material). Of these, 12 articles met inclusion criteria and were included in the review (shown in Supplemental Figure 1). Interreliability κ scores were 0.93 for title and abstract screening and 0.55 for full-text screening. Of the articles included, 3 were prospective studies and 9 were retrospective chart reviews representing a total of 311 patients (225 men [72.3%], 65 women [20.9%], 21 unspecified [6.8%]); patient characteristics can be found in Table 1). In total, 224 digits were affected by recurrent Dupuytren contracture, specifically 5 index fingers (2.2%), 17 long fingers (7.6%), 57 ring fingers (25.4%), 112 small fingers (50%), and 33 unspecified (14.7%). Of these, there were 76 metacarpophalangeal joints (MCPJ; 45.5%), 90 proximal phalangeal joints (PIPJs; 53.9%), and 1 distal interphalangeal joint (0.6%). The mean age at onset ranged from 39 to 58 years. The follow-up time ranged from 3 months to 4.4 years. Previous treatment included the following: percutaneous needle aponeurotomy (n = 103 of 311 patients; 33.1%), CCH injection (n = 75 of 311; 24.1%), limited fasciectomy ± skin graft (n = 83 of 311; 26.7%), fasciotomy (n = 1 of 311; 0.3%), and unspecified (n = 64 of 311; 20.6%). The mean time since previous treatment ranged from 1 to 5 years. Treatment for recurrent Dupuytren contracture included the following: percutaneous needle fasciotomy (n = 68 of 311 patients; 21.9%); CCH injection (n = 53 of 311; 17.0%); aponeurotomy or dermofasciectomy or limited fasciectomy (n = 176 of 311; 56.6%); ray/digit amputation (n = 8 of 311; 2.6%); and PIPJ arthrodesis (n = 6 of 293; 2.0%). Of those who underwent an aponeurotomy or dermofasciectomy or limited fasciectomy, additional procedures were also completed: a supplementary interphalangeal arthrodesis (n = 6 of 176 patients; 3.4%), PIPJ release (n = 26 of 176; 14.8%), or skin flap/local graft (n = 34 of 176; 19.3%). Further details are found in Tables 1 to 3 and Supplemental Table 1.

Qualitative Outcomes

There were 2 studies[15,20] that documented mean pain via the Visual Analogue Scale (VAS), which ranged from 1.8 to 2.6, on a 10-point scale, postoperatively. Satisfaction was recorded in 2 studies[15,17] using VAS and in 4 studies[18,20-22] qualitatively. Using VAS, the mean and median satisfaction scores reported were 6.3 and 8, respectively.[15,17] Qualitatively, the rate of satisfaction ranged from 56% to 100%.[18,20-22] A mean QuickDASH score of 16.5 was reported in 1 study.[15] Other studies reported DASH scores where a score of 0 shows no disability and a score of 100 complete disability, as median[17] (33) or mean[18,20,22] (range from 15 to <35.04). Qualitative outcomes are listed in Table 3.

Range of Motion

The meta-analysis included 3 studies, representing 74 patients undergoing CCH injection (n = 51 of 74; 68.9%); limited fasciectomy ± interphalangeal arthrodesis and dermofasciectomy ± PIPJ release (n = 4 of 74; 5.4%); and skin graft or local flap (n = 19 of 74; 25.7%). This included 84 digits, specifically 3 index fingers (3.6%), 9 long fingers (10.7%), 29 ring fingers (34.5%), and 43 small fingers (51.2%). Treatment for recurrence improved ROM by 23.31° (95% confidence interval [CI] = 13.13°-33.50°; I^2 = 67%; P = .05; Figure 1) and 15.49° (95% CI = 2.67°-28.31°; I^2 = 76%; P = .01; Figure 1) for MCPJ and PIPJ, respectively. Refer to Table 3 for further details.

Complications

There were no reported cases of complex regional pain syndrome, infection, neurovascular injury, adhesions, or scarring. Wound dehiscence was reported in 17 digits. Of the 5 studies[13,14,17,22,23] that commented on recurrence, it was documented in 20.7% (n = 24 of 116) of patients. See Supplemental Table 2 for further details.

Quality of the Studies

The overall quality of the included studies varied from low to serious using the ROBINS-I tool (Figure 2) due to lack of controlling for baseline confounding factors such as severity of disease, lack of a standardized definition for recurrence to determine indication for treatment, variability in treatment protocols, and missing outcome reporting. The interreliability κ score was 0.24 for ROBINS-I.

Discussion

Reported rates of extension or recurrence of Dupuytren disease vary from 2% to 76% in the literature, owing to inconsistency in both the definition of recurrence and length of follow-up.[5,24-26] With recurrence of contracture over time, patients suffer from impaired hand function and thus eventually require new treatment.[27] The aim of this systematic review was to investigate outcomes of management of recurrent disease.

Recurrent Treatment

Our meta-analysis of 3 studies demonstrated clinically significant improvement in both MCPJ and PIPJ ROM following

Table 1. Summary of Study Characteristics and Demographic Information.

Study	Type	No. of patients	Sex	Mean age, y	Joint	Digit (n = number of digits)	Mean follow-up (months unless otherwise specified)
Abe et al[13]	Retrospective	4	4M	67	—	D5 (5)	32.2
Bear et al[14]	Prospective	51	50M, 1F	66.5 (SD, 9.5)	MCPJ (31), PIPJ (20)	D2 (2), D3 (4), D4 (24), D5 (21)	30 ± 5 d and 365 ± 30 d after each injection
Degreef and De Smet[15]	Retrospective	8	6M, 2F	62	MCPJ (5), PIPJ (2), DIPJ (1)	D4 (1), D5 (7)	—
Eberlin et al[16]	Retrospective	11	6M, 5F	69 (range, 52-76)	MCPJ (7), PIPJ (12)	—	16 (range, 2-29)
Hohendorff et al[17]	Retrospective	13	10M, 3F	70 (median; range, 46-78)	PIPJ (15)	D2(1), D4(3), D5(11)	22 (range, 6-35)
Könneker et al[18]	Retrospective	16	13M, 3F	65 (SD, 9)	MCPJ (3), PIPJ (13)	D2 (1), D3 (3), D4 (3), D5 (9)	40 (SD, 26)
Mendelaar et al[8]	Prospective	114	77M, 37F	62 (SD, 12)	—	—	3
Molenkamp et al[19]	Retrospective	21	—	—	—	—	—
Novoa-Parra et al[20]	Retrospective	6	6M	60 (range 48-78)	PIPJ (6)	D4 (2), D5 (4)	19.6
Roush and Stern[21]	Retrospective	19	16M, 3F	—	—	D2 (1), D3 (5), D4 (5), D5 (17)	4 y (median; range, 1-15 y)
Spies et al[22]	Retrospective	18	15M, 3F	70 (range, 47-80)	—	D3 (1), D4 (4), D5 (17)	94 (range, 70-114)
van Rijssen and Werker[23]	Retrospective	30	22M, 8F	59	MCPJ (21), PIPJ (13), MCPJ and PIPJ (9)	D3 (4), D4 (15), D5 (21), unspecified (12)	4.4 y (range, 2-7 y)

Note. MCPJ = metacarpophalangeal joint; PIPJ = proximal interphalangeal joint; DIPJ = distal interphalangeal joint.

Table 2. Preoperative Characteristics of Patients Undergoing Treatment for Recurrent Dupuytren Contracture.

Study	Baseline	Previous treatment	Mean time since previous treatment
Abe et al[13]	Mean ROM: MCPJ (79°), PIPJ ROM (30°)	Not specified; mean number of recurrences was 1.4 (per digit)	—
Bear et al[14]	Mean fixed flexion contracture: MCPJ (40° [SD, 15]), PIPJ (46° [SD, 21]), total (42° [SD, 18]) Mean ROM: MCPJ (54° [SD, 15]), PIPJ (60° [SD, 21])	CCH (51 patients; mean number of previous CCH injections: 3.4 [SD, 1.9; range, 1-8]), fasciectomy (9), needle aponeurotomy (4), fasciotomy (1), other (1)	50.2 mo (median; range 3.6-58.8 mo)
Degreef and De Smet[15]	—	Mean number of interventions: 2.75 (range, 2-4)	18 mo (range, 1-60 mo)
Eberlin et al[16]	Mean fixed flexion contracture: MCPJ (42°), PIPJ (60°) Mean ROM: MCPJ (48°), PIPJ (40°)	CCH injection (mean number of previous injections: 1.5; range, 1-3)	12 mo (range, 6-24 mo)
Hohendorff et al[17]	Median flexion contracture: PIPJ (73° [range, 45°-100°])	Partial fasciectomy	—
Könneker et al[18]	Mean extension deficit: MCPJ (35°), PIPJ (74.5°), total (65°)	Fasciectomy 3 times (8 patients), surgery and/or minimally invasive treatment between 4 and 8 times (8 patients)	—
Mendelaar et al[8,a]	Mean extension deficit: MCPJ (22.1° [SD, 21]), PIPJ (34.9° [SD, 24.6]), total (60.3° [SD, 28.2])	Needle fasciotomy (46%), collagenase (11%), limited fasciectomy (41%), limited fasciectomy and skin graft (2%)	114 wk (SD, 57)
Molenkamp et al[19]	Mean TPED: 44° (SD, 27)	Percutaneous needle fasciotomy	—
Novoa-Parra et al[20]	Mean extension deficit: PIPJ (88.3° [range, 80°-100°])	Operated on at least twice beforehand (range, 2-3)	—
Roush and Stern[21]	Mean ROM: MCPJ (68.0°), PIPJ (46.6°)	Previous procedures: 2 (13 patients), 3 (5 patients), and 4 (1 patient)	5 y (range, 1-19 y)
Spies et al[22,b]	—	Surgery	—
van Rijssen and Werker[23]	Mean TPED: 50° (SD, 21)	Percutaneous needle fasciotomy (26 patients), limited fasciectomy (4 patients)	—

Note. No study reported complications from previous treatment. ROM = range of motion; MCPJ = metacarpophalangeal joint; PIPJ = proximal interphalangeal joint; CCH = collagenase clostridium histolyticum; TPED = total passive extension deficit.

[a]Mendelaar et al[8]: Unable to interpret data for previous complications.

[b]Spies et al[22]: Unable to interpret data for baseline.

Table 3. Treatment and Outcomes for Recurrent Dupuytren Contracture.

Study	Treatment	Postoperative outcome (mean ± SD; unless otherwise specified)	Postoperative improvement (mean ± SD; unless otherwise specified)	Pain	Satisfaction	DASH
Abe et al[13]	Dermofasciectomy ± PIPJ release	ROM: MCPJ (96°), PIPJ (37°)	ROM: MCPJ (17° ± 17.5°), PIPJ (7° ± 19.1°)	—	—	—
Bear et al[14]	Up to 3 CCH injections, 0.58 mg per injection; 69% (35 of 51) received 1 injection, 24% (12 of 51) received 2 injections, and 8% (4 of 51) received 3 injections)	Fixed flexion contracture: MCPJ (7° ± 12°), PIPJ (15° ± 16°) ROM: MCPJ (85° ± 16°), PIPJ (86° ± 16°)	Fixed flexion contracture: MCPJ (33° ± 16°), PIPJ (31° ± 19°) ROM: MCPJ (31° ± 18°), PIPJ (26° ± 17°)	Pain in extremity (16 patients), injection site pain (10 patients)	—	—
Degreef and De Smet[15]	Ray amputation (5 patients) or finger amputation (3 patients)	—[a]	—[a]	Mean VAS: 1.8 (range, 0-5)	Mean VAS: 6.3 (range, 5-8)	QuickDASH 16.5 (range, 2.3-40.9)
Eberlin et al[16]	Salvage palmar fasciectomy	Fixed flexion contracture: MCPJ (0°), PIPJ (21°) ROM: MCPJ (90°), PIPJ (79°)	Fixed flexion contracture: MCPJ (42°), PIPJ (39°) ROM: MCPJ (42°), PIPJ (39°)	—		—
Hohendorff et al[17]	Partial fasciectomy and supplementary arthrolysis of the PIPJ	Median flexion contracture: PIPJ (35° [range, 0°-90°])	Median flexion contracture: PIPJ (38°)	—	Median VAS: 8 (range, 1-10)	Median DASH: 33 (range, 24-53)
Könneker et al[18]	Limited fasciectomy	Extension deficit: MCPJ (5°), PIPJ (10°), total (8.57°)	Extension deficit: MCPJ (30° ± 20°), PIPJ (64.5° ± 22°), total (59.2° ± 26.8°)	—	76.9% of patients were satisfied with the results. 83.3% would have another surgical procedure performed if needed	Mean DASH: 15.6 (SD, 20.1) in the disability and symptom section
Mendelaar et al[8]	Collagenase (2%), limited fasciectomy (80%), needle fasciotomy (15%), limited fasciectomy and skin graft (4%)	Extension deficit: MCPJ (4.5° ± 8.1°), PIPJ (19.0° ± 16.5°), total (24.8° ±18.7°)	Extension deficit improvement: MCPJ (17.6°), PIPJ (15.9°)	—	—	—
Molenkamp et al[19]	Percutaneous needle fasciotomy	TPED: 8° ± 13°	TPED: 36° ± 23°	—	—	—
Novoa-Parra et al[20]	PIPJ arthrodesis (3 [30°], 3 [45°])	—	Extension deficit: PIPJ (32.5° [range, 20°-45°])	Initial VAS 4.16 (SD, 2.10), postoperative VAS: 2.6 (SD, 2.09)	All patients were satisfied with the surgery and would accept it again	Initial DASH: 37.73 (SD, 26.41), postoperative DASH: 35.04 (SD, 27.29)
Roush and Stern[21]	Limited fasciectomy and interphalangeal arthrodesis (7 digits), fasciectomy with full-thickness skin graft (8 digits), and fasciectomy with local flap (Z-plasty or V-Y plasty; 13 digits)	ROM: MCPJ (86.1°), PIPJ (56.6°)	ROM: MCPJ (18° ± 27°), PIPJ (10° ± 27°)	—	18 of 19 patients were unconditionally satisfied with their experience and would undergo the procedure again	—
Spies et al[22]	Open partial aponeurotomy (22 digits); transposition flap D5 (6); VY plasty D3 (1), D4 (3), D5 (7); Z plasty D4 (1), D5 (4); arthrolysis PIPJ D3 (1), D4 (2), D5 (9)	—	—	VAS: 10 patients (56%) had no pain at all. Pain reduction was "excellent" for 5 patients (28%). One patient (6%) endorsed slightly increased pain at the time of examination	Ten patients (56%) had an improved overall outcome. Eight patients (44%) were not satisfied	Fifteen patients (83%) had a DASH score of 15 or lower (range, 0-47)
van Rijssen and Werker[23]	Percutaneous needle fasciotomy	—	Contracture: 76% ± 34%	—	—	—

Note. DASH = Disabilities of the Arm, Shoulder, and Hand; PIPJ = proximal interphalangeal joint; ROM = range of motion; MCPJ = metacarpophalangeal joint; CCH = collagenase clostridium histolyticum; VAS = Visual Analogue Scale; TPED = total passive extension deficit.
[a]Unable to extract data.

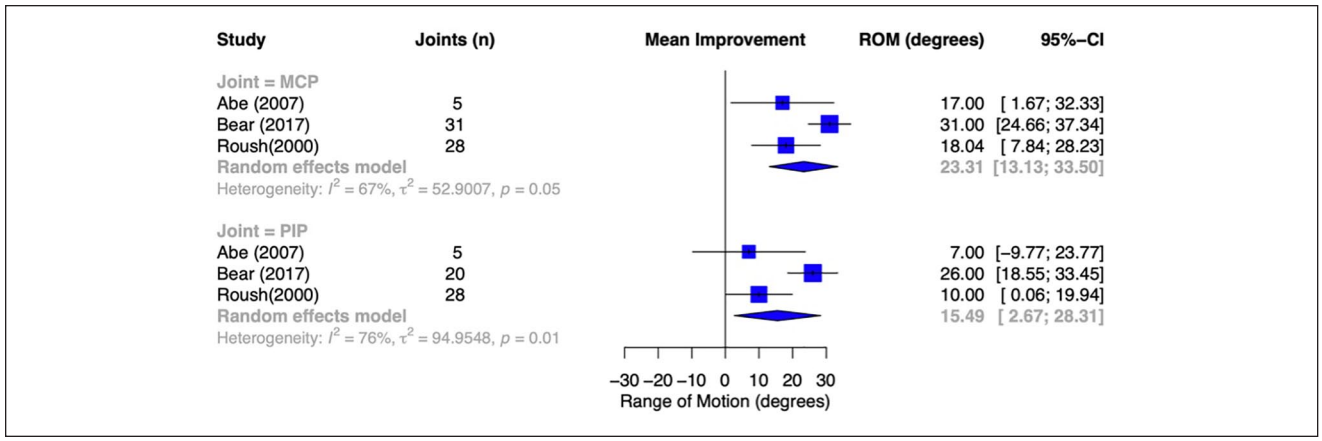

Figure 1. Meta-analysis of improvement in ROM (degrees).
Note. MCP = metacarpophalangeal; ROM = range of motion; CI = confidence interval; PIP = proximal interphalangeal.

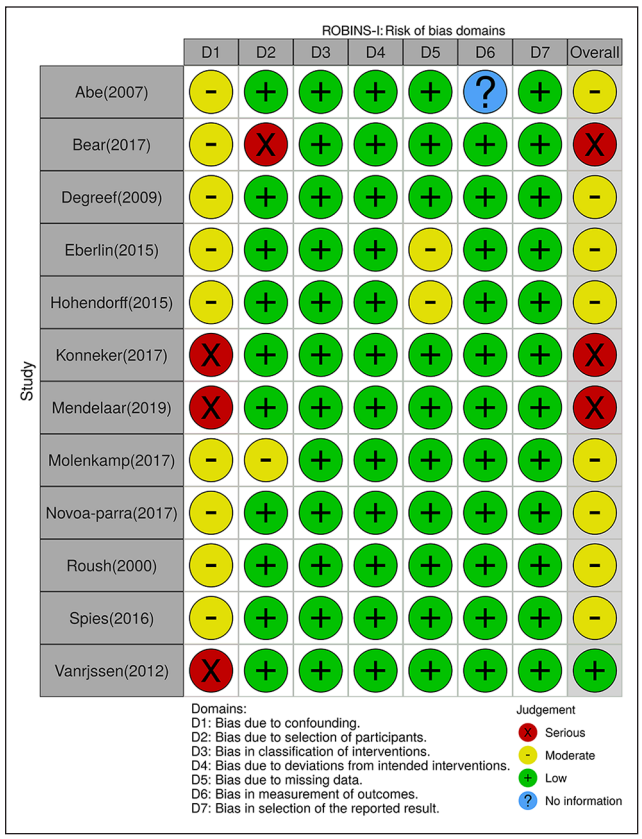

Figure 2. Quality assessment of studies using the Risk of Bias in Non-randomized Studies-of Interventions tool (ROBINS-I).

surgical and nonsurgical modalities. Secondary analysis of the collagenase option for the reduction of dupuytren's (CORD) I trial suggested the minimum clinically important difference (MCID) to be 13.5° (95% CI = 11.9°-15.1°).[28] Therefore, treatment for recurrent disease, at both PIPJ and MCPJ, continues to provide meaningful improvement for patients. Generally, more extensive procedures may result in greater correction of contractures.[7] As such, traditionally, palmar fasciectomy is considered the criterion standard for treatment of Dupuytren contracture.[29] However, it is accompanied by significant postoperative rehabilitation.[16] In contrast, percutaneous needle fasciotomy and CCH injections are minimally invasive and have a shorter recovery period.[23,30] Recurrence is common for all procedures, reported as 50% to 58%, 10% to 31%, and 12% to 39% for needle aponeurotomy, CCH injection, and open partial fasciectomy, respectively.[5] Although the expectations for recurrence are an important aspect to address when offering patients various treatment modalities, our study also provides evidence that treatment for recurrence remains effective.

Proximal Phalangeal Joints

It is well known that outcomes following surgery for PIPJ contractures are highly variable.[31] Most often, residual PIPJ contracture results from shrinkage, shortening, and/or adhesion of the surrounding structures or joint deformity; scarring from previous surgeries; and/or contracture of intrinsic muscles.[17,32] In fact, residual flexion contracture has been found to be a predictor of worse recurrent PIPJ contracture.[31] However, despite incomplete correction, the literature reports that surgery for PIPJ contractures often yields improved hand function.[33] Similarly, we found that treatment for recurrent PIPJ Dupuytren contracture is both effective and represents a clinically important difference (CID), as seen with a 15.49° improvement in ROM, although surgical management may provide poorer outcomes based on our limited outcome data. In the study by Abe et al,[13] 2 cases of poor clinical results were reported and attributed to tendon sheath injuries, which explains the large CI for the study's point estimate. Meanwhile, Roush and Stern[21] demonstrated less improvement than the MCID. Conversely, Bear et al[14]

showed a mean improvement of 26°. Therefore, the overall pooled summary estimate demonstrated that treatment of recurrent disease at the PIPJ yields meaningful improvement; however, it remains unclear whether recurrent disease should be managed with nonsurgical or surgical modalities. With limitations in outcome data reporting and low number of studies, no further analysis was possible to conclude whether nonsurgical modalities were significantly superior, or noninferior, to surgical interventions at the PIPJ. Despite uncertainty in the efficacy of recurrent treatment for PIPJ contracture, a CID in ROM can be achieved with surgical or nonsurgical treatment.

Qualitative Outcome Measures

Few studies commented on qualitative outcomes, including pain, satisfaction, and DASH scores. Only 1 study included measurements for pain and DASH scores preoperatively and postoperatively. Per Novoa-Parra et al,[20] VAS scores decreased from 4.16 (SD, 2.10) to 2.6 (SD, 2.09), whereas DASH scores decreased from 37.73 (SD, 26.41) to 35.04 (SD, 27.29) postoperatively. For context, previous work has identified the MCID as a range between 8 and 40 mm (per the standard 100 mm scale) for VAS scores and 10.83 points for DASH scores.[34,35] Overall, most patients were satisfied with the results following their procedure.

Previous Treatment

The effect of previous treatment on the success of treatment for recurrence remains largely unknown.[8] In cases of previous surgical treatment, the risk of digital neurovascular injury is increased by both its anterior displacement by pathological spiral bands and challenges in dissection due to the embedding of neurovascular bundles in scar tissue.[36] The risks of perfusion disorders are further increased if only a single residual digital artery remains due to previous damage to other vascular structures.[15,18] Similarly, cases of previous CCH injections have been compared with that of a digit with Dupuytren disease having undergone multiple surgeries.[16] Microscopically, there have been no histological differences found in patients presenting with recurrent disease who have been previously treated with CCH or fasciectomy.[37] Macroscopically, in addition to disruption of the normal architecture of the palm, fine areolar tissue planes used to identify and preserve important structures are obliterated by these injections.[16] Others have reported that although the surrounding neurovascular structures are unaffected by collagenase injections, palmar fasciectomy for recurrence is technically more challenging in these patients.[16] Despite these risks, in our review of the literature we found that of the 4 studies that commented on neurovascular injuries, no complications were reported despite variations in both initial and recurrent treatments (Supplemental Table 2).

Salvage Procedures

Prior to amputation, local flaps, skin grafts, arthroplasty, osteotomy, and arthrodesis may be attempted.[20] However, in severe cases, such as patients with severe functional impairments or numbness and cold intolerance from neurovascular injury, amputation may be the treatment of choice.[15,36] Following fasciectomy, the incidence of neuropathic pain ranges from 0% to 7.7% and 4.2% to 27% in primary and recurrent treatment, respectively.[38] In these cases, repeat surgery may be contraindicated and amputation may be taken into consideration.[39] In our review of the literature, 1 study on amputation was identified. All 8 patients included in the study reported satisfaction and significant improvement with a VAS of 1.8 (range, 0-5) for pain, VAS of 6.3 (range, 5-8) for satisfaction, and DASH score of 16.5 (range, 2.3-40.9).[15] With the possibility of eventual amputation for therapeutic benefit, it is imperative to discuss this risk with patients upon consent of initial treatment for Dupuytren contracture.[15]

Limitations

There are several limitations to this study. First, the methodological quality of included studies ranged from low to moderate, indicating a moderate risk of bias in the results. Second, the generalizability of the outcomes is inherently limited given the lack of universal definition for recurrence. Without a clinical definition, it is difficult to determine the effect of baseline differences in patients, which are an important factor in surgeons' discretion for treatment. Third, there is inconsistency in outcomes reported across studies. This posed as a barrier when results were pooled for meta-analysis. Fourth, length of follow-up is variable across studies. With insufficient follow-up, secondary recurrences, ROM, and contracture cannot be accurately documented. Finally, the meta-analysis combined outcomes of both surgical and conservative modalities without subgroup analysis within each group. The heterogeneous nature of this analysis makes it difficult to compare whether specific modalities of treatments within each group were superior or noninferior. For instance, despite surgery being efficacious for improving ROM for patients with Dupuytren disease, it is not possible to comment whether limited fasciectomy or fasciotomy would provide better results. As such, only a general impression of outcomes of treating recurrent Dupuytren contracture can be made.

Conclusion

The results of this study represent low-level evidence that both surgical and nonsurgical treatment modalities are effective in treating recurrent Dupuytren contracture. Both MCPJ and PIPJ contractures result in clinically meaningful

improvement, albeit the latter demonstrated more variable results. Currently, the choice of treatment for recurrent disease remains a balance between both patient and physician preference.[8] Future steps should focus on: consensus of a universal definition for recurrent Dupuytren contracture to allow standardized comparison of treatments, complete outcome data reporting, and conducting higher level evidence studies to investigate treatment efficacy for recurrent Dupuytren contracture.

Ethical Approval

This study was approved by our institutional review board.

Statement of Human and Animal Rights

This article does not contain any studies with human or animal subjects.

Statement of Informed Consent

Informed consent was obtained from all individual participants included in the study.

Declaration of Conflicting Interests

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