Comparative Outcomes of Dupuytren Disease Treatment

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KEYWORDS

• Dupuytren • Classification • Assessment • Patient-reported outcome • Fasciectomy • Collagenase • Needle aponeurotomy

KEY POINTS

- Although staging systems have been historically important, current outcomes focus more on angular correction and patient-reported outcomes.
- Recurrence is defined as a more than 2° increase in the passive extension deficit with a palpable cord compared with that at 3 months after treatment.
- The most frequent comparative outcome studies are between collagenase *Clostridium histolyticum* and needle aponeurotomy. These suggest there is no significant difference in outcomes between these techniques at 1 year to 2 years.

INTRODUCTION

With growing interest in alternatives to surgical excision for Dupuytren disease, and multiple methods available for treatment, a consensus as to definitions and outcomes was essential to compare the available treatment options.

DEFINITIONS

Dupuytren Staging

Dupuytren staging can be conceptualized in 3 terms:

1. Assessment: an aspect that might be measured, for example, degree of contracture or type of disease
2. Scoring system: a system that attempts to quantify the disease by producing a series of numbers or discrete variables
3. Classification: subdivisions into types that are not ordinal[1]

Many methods of assessment have been used in the study of Dupuytren disease, including:

1. Degree of contracture or range of motion (ROM)
2. Disease type based on the localization of pathologic fascia[2]
3. Histology[3]
4. Dupuytren diathesis: bilateral disease, family history of Dupuytren, ectopic lesions, and young age at onset of disease[4]
5. Hand function or disability: Unité Rhumatologique des Affections de la Main (URAM); Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire; and the Michigan Hand Questionnaire (MHQ)[1,5]
6. Rate of recovery/time to return to work[1]
7. Recurrence and progression[6–9]
8. Complications[6]

Scoring systems fall into 5 proposed categories:

1. Severity according to degree of contracture
2. Detailed scoring of every digit
3. Systems that score the severity of the condition or results of surgery into arbitrary categories of excellent/good/fair/poor

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4. Attempts to predict surgical difficulty
5. Questionnaires based on functional assessment scores[1]

Several investigators have reported arbitrary categorization for their postoperative results, which have failed to become established standards in published literature for Dupuytren disease.[10–15] The British Society for Surgery of the Hand Audit Committee conducted a multicenter study to assess the outcomes of surgery.[16] They used a newly created patient questionnaire with graphics to assess the finger contracture and a classification into mild, moderate and severe to determine a patient's preoperative status. The postoperative status was a patient-reported Likert scale and patient-reported outcome questionnaire.[16]

A well-known scoring system is the Tubiana staging system (TSS). This system uses an algebraic sum of the degree of contracture of the metacarpophalangeal (MP) joint, proximal interphalangeal (PIP) joint, and distal interphalangeal (DIP) joint of a specific affected finger ray. Flexion deformity is measured using a goniometer at the joints. There are 4 stages of increasing severity: 0° to 45°, 45° to 90°, 90° to 135°, and greater than 135° (**Table 1**).[9] Tubiana and colleagues[17] subsequently revised the original staging to include the thumb.[17] Other investigators have proposed additions to TSS to address relevant risk factors with disease severity, including diathesis.[18]

Endpoints or Outcomes

Range of motion

ROM is the most commonly used physical outcome measure in Dupuytren literature. A goniometer is used reliably as a tool to assess active and passive ROM.[19] Inconsistencies in terminology and measurement protocol, however, prevent high-quality evidence for future comparative studies.[19]

ROM for Dupuytren studies can be used in several ways, including:

1. The severity of the initial contracture, reported in degrees
2. The residual contracture postintervention at a particular time period, reported in degrees
3. The amount of contracture correction, determining the difference between preintervention and postintervention at a particular time period. This can be reported in degrees or as a percentage of correction of the deficit.

ROM can be reported for a single joint or for a whole digit incorporating the values of the MCP, PIP, and DIP joints. The extension deficit can be determined actively or passively. The amount of contracture can be reported to give either total passive extension deficit (TPED) or total active extension deficit (TAED) for an individual digit.

Correction of contracture

Correction of contracture can be reported using ROM as indicated by the various measures above. In most studies, however, the results are qualified, with no consistency across the literature, preventing comparisons between studies.[20]

An example of a quantitative definition of correction of contracture is used in the Food and Drug Administration phase 3 studies of *Clostridium histolyticum* (CCH) for the treatment of Dupuytren contracture. In these studies, correction of contracture was defined as "clinically successful" if a reduction in primary joint contracture to 0° to 5° of full extension was achieved 30 days after the last injection[21,22]; however, other investigators have used 15° and some have used 90% to 100% correction.

The value of reporting clear methodology of measurement and results in a comparative fashion is clearly required going forward.[19,20]

Patient-reported outcomes

Patient-reported outcome (PRO) measures involve patients being asked a series of questions, and a score is calculated based on patient response. There are various PROs assessing different outcome measures, which are described.

Disabilities of the arm, shoulder and hand The DASH questionnaire is a validated instrument used to score disabilities of the upper extremities during daily activities.[23–25] The DASH score

Table 1
Original staging of Dupuytren disease by Tubiana

Stage	Deformity
0	No lesion
N	Palmar nodule without presence of contracture
1	TFD between 0° and 45°
2	TFD between 45° and 90°
3	TFD between 90° and 135°
4	TFD >135°

Total Flexion Deformity (TFT) is measured with goniometer at the MP, proximal, and DIP joints.[18]

From Tubiana R. Dupuytren's disease of the radial side of the hand. Hand Clin 1999;15(1):149–59; with permission.

examines a patient's ability to perform multiple dexterous tasks, interference with social and working activities, and sleep disturbance, providing an overall assessment of upper extremity function in the context of disease.[26] The 30-item disability/symptom scale is the main part of the DASH questionnaire concerning patient's health status during the week before. Each item is scaled from 0 to 5; henceforth, the scores are added and transformed into a 100-point scale. The lower the score, the less disability experienced by the patient. The QuickDASH is a shortened 11-item version of the DASH, which is more feasible to complete. It is important to recognize that the DASH does not measure individual hand function. A Rasch modeling analysis (a statistical model transforming PRO to a linear scale) concluded that DASH is still acceptable for use with patients affected by Dupuytren contracture.[27]

Michigan hand questionnaire The MHQ is a 37-item hand-specific outcome questionnaire consisting of 6 domains: overall hand function, activities of daily life, pain, work performance, aesthetics, and patient satisfaction. The MHQ has been validated for a variety of hand conditions, inclusive of Dupuytren disease.[5] Patients are asked to answer each question from 1 to 5. Each domain is based on a score of 0 to 100, with 0 the worst score and 100 the best.[5]

Unité rhumatologique des affections de la main URAM is an outcome assessment tool specifically for patients with Dupuytren disease. The URAM scale is a 9-item patient-reported questionnaire with total scores for Dupuytren disease–associated disability ranging from 0 (best) to 45 (worst). Higher scores indicate poorer functional outcome.[28] The URAM scale has been evaluated for reliability and responsiveness with several studies.[29–31]

Pain visual analog scale Patients are asked to rate the severity of the pain they experienced during a particular event, for example, an injection, on a visual analog scale (VAS). This is a line on a paper with the scale rated from 0 (indicative of no pain) to 10 (indicative of worst pain). Patients mark on the line their response and an exact measure of distance is made and recorded.[32] VAS can be used to assess other issues where the endpoints of the line are defined for that issue.

Recurrence

Recurrence has been used in many different ways, including, but not limited to, failure of surgical joint contracture release, disease recurrence within the surgical area (with or without joint contracture), and disease anywhere within the same ray postsurgery.[16]

A recent study looking at rates of contracture correction and recurrence reviewed 218 studies, of which 21 met their study inclusion criteria. Most studies reviewed reported results in a qualitative fashion preventing comparison. The investigators concluded that clear definitions of correction of contracture and recurrence are required.[20]

To this end, an international conference was held in 2013 after initial online questionnaires using Delphi methodology. The consensus was that:

1. The presence of disease alone without contracture did not constitute recurrence.
2. Recurrence was associated with an individual joint and not a total ray.
3. Time 0 is between 6 weeks and 3 months.
4. Recurrence is a PED of more than 20° for at least 1 treated joint, in the presence of a palpable cord, compared with the result obtained at time 0.[33]

At this same conference, it was determined that the TSS was considered inappropriate for reporting recurrence. The long-term value of staging Dupuytren disease in clinical studies seems to be diminishing, although not gone.[34]

PUBLISHED COMPARATIVE OUTCOMES STUDIES

Surgery Versus Needle Aponeurotomy

Two studies, a randomized controlled study (RCT) and an observational study, have compared the effectiveness of limited fasciectomy (LF) and percutaneous (NA) for Dupuytren contracture.[25,35]

In the RCT study, there were 166 rays: 88 rays in the NA group and 78 rays in the LF group. The inclusion criteria were a PED of at least 30° in a finger and a clearly defined pathologic cord in the palmar fascia.[25] Patients who were enrolled were followed-up 1 week and 6 weeks posttreatment. From weeks 1 to 5, patients were asked to fill out the DASH questionnaire, followed by a satisfaction questionnaire and complication checks at week 6. Study outcomes show that patients treated with NA reported less discomfort after treatment. DASH scores were also significantly lower in the NA group in the first 5 weeks posttreatment.

In a follow-up publication to this RCT, the investigators presented the 5-year recurrence rates, defined as an increase in extension deficit greater or equal to 30° compared with the results at 6 weeks.[36] The recurrence rate in the NA group

was significantly greater than in the LF group, and recurrence occurred significantly sooner in the NA group. Recurrence was not associated with any features of Dupuytren diathesis. Older age at the time of treatment significantly decreased the recurrence rate. Patients receiving LF were significantly more satisfied at 5 years with their treatment than those with NA, and this was significantly associated with recurrence. There were 45 recurrences in the NA group. Twelve chose no treatment, 7 chose LF, and 26 chose to repeat NA. In the LF group, there were 9 recurrences: 4 chose to have NA and 5 declined further treatment. None of the LF patients chose to have retreatment with LF.

In the weighted observational study, among the total eligible patients (n = 293), 78 were in the NA group whereas 215 were in the LF group.[35] On average, patients had a follow-up duration of 10 weeks (range 6–12 weeks). The impact of NA and LF on patient-reported hand function was assessed using the MHQ. This study found that among mild to moderate affected digits, NA reduced contractures as effectively as LF in clinical practice. NA had greater MHQ subscores and shorter recovery times and showed significantly lower rate of mild complications.

Surgery Versus Collagenase

There is 1 study that compared clinical results of collagenase CCH and LF. This observational multicenter study used a propensity score to minimize confounding by indication bias[34]; 104 patients were treated with CCH, and 114 were treated with LF. Primary outcome was the degree of TAED at follow-up visits between 6 weeks and 12 weeks postintervention. Secondary outcomes included whether affected joints achieved clinical improvement (defined as >50% reduction from baseline contracture), adverse events, and MHQ. The degree of residual contracture in the 2 treatment arms was not significantly different at the MP joint level, whereas the affected PIP joints were worse in the CCH group compared with the LF group. Patients in the CCH group reported larger and quicker functional improvements as demonstrated by greater MHQ scores. The patients in the CCH group were more satisfied with their finger mobility and hand function than patients in the LF group. The CCH group had significantly better work performance and greater satisfaction at follow-up than the LF group.

Collagenase Clostridium histolyticum versus needle aponeurotomy

There are 3 studies comparing CCH and NA.[37–39] The first was a single-blinded RCT comparing the efficacy of CCH and NA for contracture of the MP joint.[37] The inclusion criteria was a contracture of 20° or more. A cycle of treatment included 1 visit in the NA group, 2 visits in the CCH group, a 7-day follow-up, and a blinded follow-up after 1 year. The primary outcome was a straight finger, defined as reduction in extension deficit in the affected MP joint to 5°. Secondary outcomes were PROs and the presence of complications. CCH patients were found to have significantly greater procedural pain than NA. Final 1-year follow-up results showed significant improvement from baseline in both treatment arms; however, no significant differences were found between treatment after 1 year in terms of reduction in MP contracture or URAM score.

In a second RCT comparing CCH and NA, patients were included with primary Dupuytren contracture, excluding the thumb, with a palpable cord and a total extension deficit from 30° to 135° with less than 60° in the PIP joint.[38] There were 45 patients treated with NA and 38 with collagenase injections. Patients were seen before treatment, and 3 months and 1 year post-treatment. The primary outcome was the degree of total extension deficit. Secondary outcomes were QuickDASH, URAM, recurrence (defined as $\geq$20° of extension loss between the 3-month and 12-month time points), complications, and pain VAS scores. Reduction of contracture by NA and CCH were similar at 3-month and 12-month follow-ups. Analysis showed that QuickDASH and URAM scores did not differ significantly between the groups before the treatment or at 3 months or 12 months. VAS treatment pain scores at the time of treatment were greater for the CCH group than the NA group at 3 months but not subsequently. Correction of MP joints was maintained at 1 year; however, PIP joint contracture corrections were not maintained in either group.

A third RCT study compared CCH and NA treatment of PIP contractures with a 2-year follow-up. Inclusion criteria were a 20° or more PIP joint PED and a well-defined cord[39]; 50 patients were recruited. There were 29 patients in the CCH group and 21 patients in the NA group. Patients were seen at day 30, at 1 year, and at 2 years. The primary outcome was clinical improvement defined as a reduction in contracture of greater than or equal to 50% from baseline. Secondary outcomes included changes in PIP joint contracture, pulp-to-palm distance, tabletop test, DASH score, clinical success defined as 5° or less PIP joint PED, recurrence defined as 20° or greater PIP joint PED, adverse events, and complications. After 30 days, all NA patients and 89% of CCH patients had clinical improvement. At 2 years, 6 of 19 NA

patients and 2 of 24 CCH patients maintained clinical improvement without statistical difference. Transient complications were significantly higher after CCH than NA. Other secondary outcomes remained the same with both groups.

Limited fasciectomy versus dermofasciectomy

In this RCT study of 79 patients, LF with Z-plasty closure was compared with dermofasciectomy with full-thickness skin grafting.[40] Patients with a 30° or greater contracture of the PIP joint were randomized, after full correction and confirmation that the skin over the proximal phalanx could be easily closed, to have either a firebreak skin graft or Z-plasty closure. The primary outcomes of this study were recurrence, ROM, and complications. Patients were assessed at 3 months, 6 months, 12 months, 24 months, and 36 months. There was no clear definition of recurrence in this study, but it was reported that over 3 years there was recurrence at the PIP joint in 5 Z-plasty and 6 skin graft patients, without significant statistical difference. All MCP contractures were corrected fully, whereas PIP deformities were corrected to a mean of 6° with no difference between groups. Groups were comparable in terms of grip strength, ROM, and disability at follow-up.

Modified Bruner Versus Z-plasty

This pseudo-RCT study looked at whether the design of the skin incision affects recurrence rates comparing longitudinal incision with Z-plasty closure with a modified Bruner incision closed by Y-V plasties.[41] Recurrences were defined as any new nodule in the operative field under the flaps. Patients were eligible for entry if they had Dupuytren disease in 1 ray only and any degree of resultant contracture. At 2-year follow-up there were 46 modified Bruner incision and 33 Z-plasties available for evaluation. Secondary outcomes included extension, any complications, algodystrophy, and digital nerve injury. Recurrence rates were not significantly different, 15 in the modified Bruner group compared with 6 in the Z-plasty group. There were no significant differences in any of the secondary outcomes.

Direct Closure Versus Z-plasty

A prospective trial was conducted to test the hypothesis that recurrence rates were reduced if tension is reduced in the skin after fasciotomy.[42] The inclusion criteria were a single cord contracture of a single ray confined to the palm and affecting only the MCP joint; 27 patients were enrolled and were assigned in strict alternation. Patients either had excision through a transverse palmar incision with direct closure, or a longitudinal incision with closure using a Z-plasty. The primary outcome was recurrence defined as the reappearance of Dupuytren tissue in the operative field. At 2 years, 7 of 14 direct closure and 2 of 13 Z-plasty patients had recurrence. The investigators reported statistical significance at follow-up, but it should be noted they set a significance level at $P<.1$, rather than the traditional $P<.05$.

Open Palm Technique Versus Full-Thickness Skin Graft

A prospective study of 30 patients undergoing LF split the patients into 2 groups.[43] The first 10 patients had an open palm technique in which diseased tissue was excised through a transverse palmar incision left to heal secondarily. The second 20 patients had the open palm covered with a full-thickness hypothenar skin graft. Primary outcome was not defined. Patients were compared for ROM, function, appearance, patient satisfaction, joint contractures, recurrence, time to healing, quality of soft tissue, and DASH. The average follow-up was 3.5 years for the open palm group and 2.7 years for the skin graft group. Time to healing and soft tissue outcome were significantly better for the skin graft group. Recurrence was not defined in the study, and it is not clear if there was a significant difference between the groups.

Needle aponeurotomy plus steroid versus needle aponeurotomy alone

A 2014 RCT study, 44 participants were randomized to either NA group (n = 21) or NA combined with triamcinolone acetonide injection (NATI) (n = 23).[44] Inclusion criteria consisted of at least 1 joint contracture of 20° or more. Primary outcome measure was TAED, which was compared on various time scales (months) after treatment. Analysis of the results showed NATI was associated with lower TAED for up to 2 years.

Limited fasciectomy versus percutaneous aponeurotomy and lipofilling

This RCT study compared LF to percutaneous aponeurotomy and lipofilling (PALF) in 80 patients.[45] Dupuytren contracture patients were included if they met the inclusion criteria of having a flexion contracture of at least 20° at the MP joint, at least 30° at the PIP joint, or both. Patients were measured at baseline and at 2 weeks, 3 weeks, 6 months, and 1 year postoperatively. The primary outcomes were contracture correction and convalescence time. Analysis of their results showed no significant differences in contracture correction, with both groups having full MP joint extension at

Table 2
Study comparatives, endpoints or outcomes, study type, study duration, total sample size, and key points of results

Comparative Study	Endpoints or Outcomes Used	Study Type	Study Duration	Total (N)	Results Key Points
Surgery vs NA[25]	1. Total PED 2. Patient satisfaction 3. DASH 4. Complication rate	RCT	6-wk	166 rays: 88 NA,78 LF	NA has less pain and better DASH scores.
Surgery vs NA[36]	1. Recurrence (increase of TPED >30°) 2. Patient satisfaction 3. Flexion 4. Sensibility	RCT	5 y	93 patients: LF: 41, NA: 52	1. Recurrence rates after 5 y higher in the NA group than LF. 2. Older age at treatment decreases recurrence rate.
Surgery vs NA[35]	1. Total residual extension deficit 2. MHQ 3. Complications	Observational study	6–12 wk post-treatment	293 patients: 78 NA, 215	1. No difference in correction mild to moderate 2. NA report better MHQ
Surgery vs CCH[34]	1. Degree of residual contracture 2. Clinical improvement with affected joints (>50% reduction from baseline contracture) 3. Adverse events 4. PROs a. MHQ	Comparative study	6–12 wk post-treatment	218 subjects: 104 CCH, 114 LF	1. PIP joints clinical improvement worse for CCH 2. No difference in clinical improvement for MP 3. CCH group better MHQ values
CCH vs NA[37]	1. Reduction in extension deficit in the affected MCP joint to 5° 2. PROs a. VAS pain scale b. URAM 3. Complications	RCT	1 y	140 patients: 69 CCH, 71 NA	1. No difference CCH vs NA in correction of contractures 2. No difference in URAM 3. CCH VAS pain was greater
CCH vs NA[38]	1. Degree of total extension deficit 2. PROs a. URAM b. VAS pain scale c. QuickDASH 3. Recurrence 4. Complications	RCT	1 y	83 patients: 45 NA, 38 CCH	1. No difference in reduction of contracture 2. No difference in QuickDASH and URAM 3. Treatment pain was greater in CCH 4. PIP joint corrections not maintained in either group

CCH vs NA[39]	1. Clinical improvement (reduction in contracture ≥50% from baseline) 2. PIP joint contracture 3. Pulp-to-palm distance 4. Tabletop test 5. Clinical success (≤5° PIP joint PED) 6. Recurrence (≥20° PIP joint PED) 7. Adverse events 8. Complications 9. DASH	RCT	2 y	50 patients	1. No difference in clinical improvement 2. CCH led to higher transient complications
Modified Bruner vs Z-plasty[41]	1. Recurrence 2. Extension 3. Complications 4. Algodystrophy 5. Digital Nerve Injury	RCT	2 y	46 patients in modified Bruner 33 patients in Z-plasty	No difference in recurrence rate
Direct closure vs Z-plasty[42]	1. Recurrence 2. Complications	Prospective trial	1–2 y	27 patients: 14 direct closure, 13 Z-plasty	No difference at $P<.05$
Open palm technique vs skin graft[43]	1. ROM 2. Function 3. Appearance 4. Patient satisfaction 5. Joint contractures 6. Recurrence 7. Time to healing 8. Quality of soft tissue skin 9. DASH	Prospective trial	Average follow-up: Synthesis: 2.7 y, Open palm: 3.5 y	30 patients: 10 in open palm technique, 20 in synthesis of surgical technique	1. Open palm technique takes longer to heal. 2. Skin graft leads to better soft tissue quality. 3. Not clear if there was a difference in recurrence
LF vs DF[40]	1. Recurrence 2. Correction of contractures 3. Complications 4. ROM	RCT	3 y	79 patients: 39 DF, 40 LF	1. No significant difference in recurrence rates 2. No difference in correction of contractures
NA steroid vs NA (no steroid)[44]	1. TAED 2. Length of time from initial procedure to retreatment	RCT	6–53 mo from initial procedure	44 participants: 21 NA, 23 NATI	Triamcinolone injections combined with NA associated with lower TAED for up to 2 y
LF vs PALF[45]	1. Correction of contractures 2. Convalescence time 3. PROs a. QuickDASH 4. Recurrence rates a. Complication	RCT	1 y	80 patients: 40 LF, 40 PALF	No significant differences in contracture correction

1-year follow-up. PALF-treated hands experienced quicker healing and quicker return to their daily activities and were able to make a full fist earlier than the LF-treated hand group. Recurrence was also not significant at 1 year between groups. QuickDASH improved significantly in both groups.

SUMMARY

Staging systems for Dupuytren disease have played an important role in studies in the past. Although many investigators have created their own staging systems, few have survived the test of time. TSS has been retained in the literature and some investigators have sought to modify it.

Contemporary studies have largely moved away from staging systems, looking at changes in extension deficit and PROs. There is a need for investigators, however, to be clear about how the extension deficit has been calculated. Recent efforts at reaching consensus about the term recurrence have been successful in defining this as 20° greater than the deficit at time 0 with evidence of a Dupuytren cord.

Outcome studies for isolated MCP joint contractures indicate there is no significant improved outcome with CCH compared with NA. At the PIP joint, there is a suggestion that NA is better than CCH; however, this was only evaluated in 1 study.

Comparing NA and LF, 2 studies have shown that NA has a quicker recovery. The 1 long-term RCT comparing LF and NA demonstrates a higher recurrence rate for NA, but this effect decreases for older patients. It is suggested that NA is more preferred intervention in older patients.

A comprehensive, evidence-based treatment algorithm for the management of Dupuytren disease is yet to be determined, but from the few comparative outcomes studies available (**Table 2**), it might be suggested that:

1. Surgery should be used in younger patients to decrease recurrence rates.
2. Surgery has lower recurrence rates.
3. Recurrence rates are lower for older patients.
4. NA recurrence rates are lower in older patients.
5. Patients experience less pain and quicker recovery with NA compared with CCH compared with surgery.
6. Advantages of CCH over NA have not been definitively demonstrated.

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