

# Variation in Treatment Recommendations for Dupuytren Disease

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**Purpose** To examine agreement on Dupuytren disease (DD) treatment recommendations in an international sample of hand surgeons.

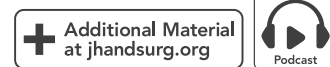
**Methods** A survey was developed to determine expertise in needle aponeurotomy, surgery, and collagenase injection to treat DD and to examine treatment recommendations for 16 case scenarios. Case scenarios were predeveloped using expert input. Each case represented a unique combination of 4 dichotomous variables including cord thickness, contracture severity, patient age, and joint involvement. Interrater reliability statistics were calculated and multinomial logistic regression modeling and analysis of variance were used to examine the impact of surgeon- and case-related variables on treatment recommendations.

**Results** A total of 36 hand surgeons from 9 countries (mean experience, 17 years) participated. Average pairwise percent agreement and Krippendorff's alpha were 26% and .012, respectively. Predictors of a recommendation for surgery over multiple options were a total contracture of greater than 70°, a thick precentral cord, involvement of the metacarpophalangeal and proximal interphalangeal joints, and greater years in practice. A greater number of years in practice predicted recommendation for collagenase injection and the presence of a thick precentral cord predicted a recommendation for needle aponeurotomy.

**Conclusions** Little agreement exists on treatment recommendations for common presentations of DD in this sample.

**Clinical relevance** Further investigation into the sources of potential widespread discrepancies in the management of DD may improve the capacity to make evidence-based recommendations. (*J Hand Surg Am.* 2017;42(12):963–970. Copyright © 2017 by the American Society for Surgery of the Hand. All rights reserved.)

**Key words** Assessment, collagenase, Dupuytren disease, needle aponeurotomy, prospective.



**D**IGITAL EXTENSION AND FUNCTIONAL improvement are the primary goals of the hand surgeon treating Dupuytren disease (DD). The management of DD is uniquely challenging for surgeons because of its heterogeneous presentation and progression.<sup>1,2</sup> Although agreement has been observed among physicians regarding diagnosis, measurements of severity, and disease extent,<sup>3</sup> additional clinical

factors, patient preferences, and tradeoffs must be considered in providing treatment recommendations. In most regions patients with DD have access to multiple treatment options, including surgery (limited fasciectomy), needle aponeurotomy (NA), and collagenase injection.<sup>4,5</sup> Other procedures such as radiotherapy, massage, placement of an orthosis, and variations of existing techniques or their adjuncts are

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reported in the literature<sup>6–9</sup>; however, further evidence is required to clarify the associated risks and benefits of these treatments.<sup>10,11</sup>

Despite the publication of several reports throughout the past decade comparing DD management modalities, an evidence-based treatment protocol for primary DD contractures has yet to be widely accepted. Evidence showing regional variations in the management of DD<sup>12–14</sup> has suggested that current recommendations may be based on variable combinations of patient preference and expertise, bias, and perception of surgeons.<sup>15</sup> A lack of evidence may introduce undesirable variations in patient care, and in turn, patient outcomes. The detrimental consequences of variable definitions of recurrence for DD have been recognized in the literature.<sup>16</sup> In addition to research studies that are unable to demonstrate the true efficacy of a procedure,<sup>15</sup> the unintended consequences of inconsistent definitions and care include the inability to standardize techniques and suboptimal resource allocation and use.<sup>17</sup> The impact of variations in practice on outcomes of DD treatment is unclear.

A collaborative effort has been made to achieve consensus and create guidelines for the management of DD in Europe,<sup>18</sup> although it is unclear whether this has been incorporated into clinical practice. Although several appropriate indications for each treatment modality were identified using a Delphi consensus strategy in 39 experts, agreement on the best treatment for cases of DD was not examined.<sup>18</sup> High agreement on DD diagnosis, severity, and factors affecting treatment choice among surgeons suggests that clinicians are aligned regarding many aspects of management.<sup>3,18</sup> However, evidence of variations in care by region and by country in Europe<sup>12,13,15,19</sup> and in the United States<sup>14</sup> indicated possible variations in surgeons' perceptions and opinions concerning treatment recommendations.

Many authors cite that there is no generic treatment for patients with DD,<sup>1,5,13,17,20</sup> but little focus has been placed on examining agreement regarding treatment recommendations, particularly in the absence of strong evidence surrounding patient preference and tradeoffs. The objective of this study was to examine current agreement about treatment recommendations given by hand surgeons for 16 clinical scenarios of common presentations of DD. Specifically, this study aimed to (1) determine expertise and agreement among respondents, and (2) examine the relationships between case- and surgeon-related variables and each treatment recommendation.

**TABLE 1. Reported Factors Used to Determine Treatment Modality During Survey Development**

Checklist Factor	Responses, n
Early onset of disease (before age 40 y)	2
Thickness of cord	2
Contracture severity	2
Ectopic disease	1
Family history	1
Number of affected digits	1
Gender	0
Radial side hand involvement	0
Diabetes	0
Little finger disease	0
Bilateral disease	0
Tenodesis effect	0
Other	
Recurrent disease after previous treatment	1
Which joints are affected	2
Distal interphalangeal joint involvement	1

## MATERIALS AND METHODS

### Survey development

To determine which factors to include in the case scenarios and the number of case scenarios needed to generate an adequate data set, 8 hand surgeons with experience in multiple treatment options for DD identified from the International Dupuytren Society Web site were invited to complete a short checklist. Respondents were asked to identify from a list the most important variables in making a treatment recommendation to a patient in their practice who had DD. A field was included for additional factors not presented in the list. [Table 1](#) shows factors and responses.

Five of the 8 surgeons completed the checklists, indicating that patient age, cord thickness, contracture severity, and the involvement of multiple joints were most important to them in recommending a treatment. Variables were defined with the goal of representing common presentations of DD in case scenarios. All case scenarios involved a single previously untreated ring finger. Contractures of the metacarpophalangeal (MCP) and proximal interphalangeal (PIP) joints were used for cases of multiple joint contractures. Variables comprising the final cases were derived from a combination of the opinions of the 5 surgeons responding to the survey development checklist and factors reported in the literature as being important in

**TABLE 2. Dichotomous Definitions of Variables Comprising Case Scenarios**

Variable	Definitions Used in Scenarios
Patient age, y	1. <50 2. >70
Joint involvement	1. MCP only 2. MCP and PIP
Joint contracture	1. $\leq 45^\circ$ 2. $> 70^\circ$
Cord thickness*	1. Thin 2. Thick

\*Figure 1 shows photos provided as definitions of a thick cord and a thin cord.

decision making for DD treatment.<sup>15,18</sup> Table 2 presents these variables and their dichotomous definitions. Photographic definitions of a thick precentral cord and a thin precentral cord (Fig. 1) were included in the final survey. Each of 16 possible combinations of the 4 variables were translated into a case scenario. The 16 case scenarios were randomly ordered. Before recruitment, the survey was piloted by a hand surgeon who was uninvolved in the study, to determine readability and estimated completion time, which was approximately 10 minutes.

The final survey consisted of a short demographics section to determine years in practice and clinical experience with surgery, needle aponeurotomy (NA), or collagenase injection to treat DD. Respondents were instructed as follows:

“Indicate which treatment you feel is most appropriate to maximize outcome and minimize impact on the patient such that the patient is satisfied with the treated hand and his/her quality of life over the next 5 years. If you feel that more than one treatment is equally appropriate, check all that apply.”

Scenarios were presented as case studies, which were constructed using a general template. An example of a case is as follows:

**Case 1:** A patient aged less than 50 years presents with a thin precentral cord and contractures at the MCP and PIP joints in the ring finger at  $15^\circ$  and  $30^\circ$ , respectively. No previous treatment has been done.

Check boxes beside “Surgery,” “Needle Aponeurotomy,” and “Xiaflex” (collagenase injection) followed each case with a line for additional comments. The survey and all case scenarios are included in this report as Appendix A (available on the *Journal's* Web site at [www.jhandsurg.org](http://www.jhandsurg.org)).

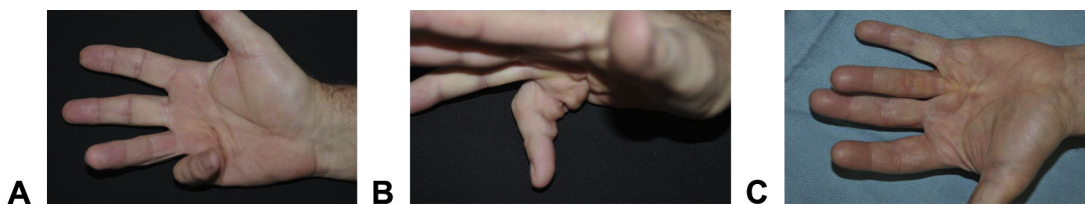
## Data collection

The Sunnybrook Health Sciences Centre Research Ethics Board approved study methods. A multidisciplinary list of registered attendees of the 2015 International Symposium on Dupuytren Disease was provided before data collection. Conference attendees were approached individually in person before or after presentations or during breaks by study personnel not previously known to participants. Those who indicated that they treated patients with DD were asked to complete a survey of case scenarios. Participants were asked to return surveys to study personnel located in a central area at the conference or to the conference organizers. Participants were given until the end of the 2-day conference to return surveys. After the conference, the list of respondents was compared with the survey participant list and nonresponders were e-mailed a request to complete an identical on-line version of the survey. One additional hand surgeon who was unable to attend the conference was asked to complete the survey. Nonresponders were e-mailed 2 requests within 5 weeks of the conference before closing data collection.

## Analysis

For each of the 16 case scenarios in the survey, pairwise agreement was calculated by observing the agreement of recommendations among all possible pairs of respondents. Once the proportion of agreeing participants was calculated for each case scenario, the mean of these proportions was calculated to provide average pairwise percent agreement. In the absence of a comparative reference point determining whether a rate of agreement was higher than chance, an agreement of 80% or higher was considered an acceptable benchmark of reliability.<sup>21</sup> Survey responses were analyzed using Krippendorff's alpha to demonstrate observed and expected disagreement among participants.<sup>22</sup> This statistic was chosen as an additional measure because it is ideal for large or small sample sizes with no minimum sample size and can be used with missing or incomplete data.<sup>23</sup> Krippendorff's alpha ranges between 0 and 1, in which 1 indicates perfect agreement and 0 indicates the absence of reliability.<sup>24</sup> Reliability is considered to be slight if Krippendorff's alpha is between 0 and .20, fair if between .21 and .40, moderate if between .41 and .60, substantial if between .61 and .80, and near perfect if between .81 and 1.<sup>25</sup>

We used multinomial logistic regression modeling to evaluate the odds of a surgeon recommending each treatment modality based on the variables presented in the case scenarios and surgeon experience. This



**FIGURE 1:** Photo definitions of cord thickness used to describe case scenarios. **A** Thick precentral cord. **B** Thick precentral cord. **C** Thin precentral cord.

test was chosen to determine predictors of categorical recommendations. Three 2-way analyses of variance were performed to examine differences in treatment recommendations between surgeons reporting more versus less experience in each modality (20 cases or less vs 21 cases or more).

## RESULTS

A total of 57 hand surgeons with experience treating DD were approached in person or via e-mail and 36 surveys were returned (63% response rate). A mean of 17 years in practice (range, 3–44 years) was reported. Figure 2 presents experience with each treatment modality.

Percent agreement for the case scenarios ranged from 0% to 100%, with an average of 26%; Krippendorff's alpha was .012. Both results indicated only slight agreement according to published benchmarks.<sup>21,24,25</sup>

Table 3 lists responses. The maximum possible number of recommendations was 576 (36 participants  $\times$  16 cases). Recommendations of multiple treatment options were combined as a single group instead of categorizing each individual combination.

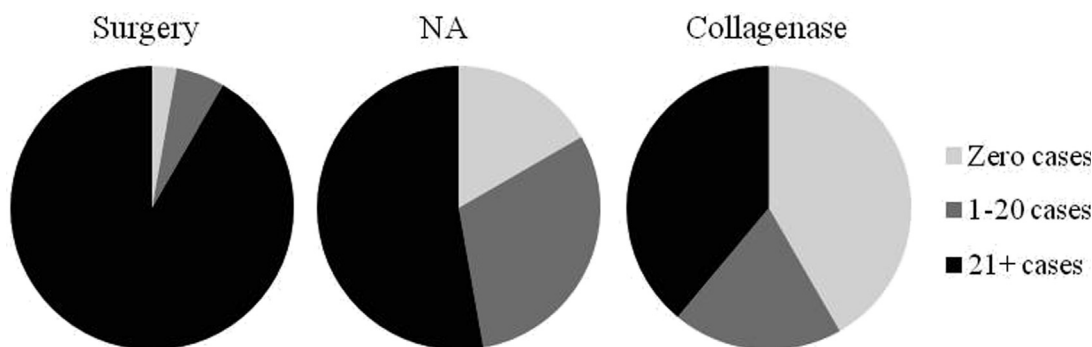
We excluded 26 observations from the regression modeling because of missing data, which resulted in an analysis of 550 recommendations. Because self-reported surgeon experience with each modality was collected as a categorical variable, inclusion in modeling was not possible, because this would have required the sample to be split into smaller subsamples and analyzed separately. Variables included in the final model were cord thickness, number of joints affected, patient age, contracture, and years in practice. A recommendation of multiple options comprised the reference category in logistic regression.

Table 4 presents odds ratios (ORs) for recommendations of a single modality versus multiple options reaching statistical significance ( $P < 0.05$ ). Patient age was the only variable that did not significantly predict a recommendation of surgery (aged less than 50 years; OR = 1.6; 95% confidence interval [CI], 0.95–2.73;  $P = .08$ ). Patient age (greater than 50 years; OR = 0.87; 95% CI, 0.56–1.36;  $P = .55$ ), joint

contracture (greater than 70°; OR = 0.76; 95% CI, 0.49–1.19;  $P = .25$ ), affected joints (MCP and PIP; OR = 0.99; 95% CI, 0.63–1.55;  $P = .97$ ), and years in practice (OR = 0.99; 95% CI, 0.97–1.0;  $P = .56$ ) did not significantly predict a recommendation of NA. Age (less than 50 years; OR = 1.40; 95% CI, 0.89–2.22;  $P = .14$ ), contracture (greater than 70°; OR = 0.76; 95% CI, 0.48–1.21;  $P = .25$ ), cord thickness (thick precentral cord; OR = 1.36; 95% CI, 0.86–2.12;  $P = .19$ ), and affected joints (MCP and PIP; OR = 1.57; 95% CI, 0.99–2.49;  $P = .05$ ) did not significantly predict a recommendation of collagenase injection.

The analysis of variance indicated that no significant difference was detected in recommendations for any modality (including a recommendation of multiple options) between surgeons with more experience in surgery ( $n = 33$ ) and those with less experience ( $n = 3$ ). Likewise, recommendations from surgeons with less experience in NA ( $n = 17$ ) versus those with more experience ( $n = 19$ ) did not differ significantly. Surgeons reporting more (21 or more cases;  $n = 22$ ) versus less (20 cases or fewer;  $n = 14$ ) experience with collagenase injection recommended collagenase significantly more frequently ( $P < .05$ ).

Of the 550 recommendations, 99 (18%) included a comment. Most comments (27%) pertained to the importance of patient preference, which indicated that several recommendations depended on the desires of patients. A total of 25% of all comments suggested that monitoring the patient without intervention may be an option. In addition, 23% of comments recommended either a procedure not offered on the survey such as segmented fasciectomy, a combination treatment of NA and collagenase, the addition of the use of an orthosis, or alternative options for the patient if recurrence took place after the initial treatment. The remaining 24% of comments was composed of a mix of explanations for the selected recommendation, comments about regional variations in funding for collagenase injection, and suggestions that more information was needed to make a definitive recommendation.



**FIGURE 2:** Respondents' expertise in each treatment modality categorized by the number of cases treated.

**TABLE 3.** Percentage of Respondents' Treatment Recommendations, by Response Category and Case Variables

Case Variables				Recommendations (% of Respondents)* (n = 36)			
Age, y	Cord	Joints	Contracture (degrees)	Surgery Only	NA Only	Collagenase Only	Multiple Options
<50	Thin	MCP + PIP	<45	14	33	22	31
<50	Thin	MCP	<45	8	31	14	39
<50	Thin	MCP	>70	14	28	8	44
<50	Thin	MCP + PIP	>70	36	19	14	31
<50	Thick	MCP + PIP	45	22	17	33	22
<50	Thick	MCP	<45	17	14	17	50
<50	Thick	MCP	>70	31	14	25	31
<50	Thick	MCP + PIP	>70	36	8	14	36
>70	Thin	MCP + PIP	45	8	36	22	31
>70	Thin	MCP	<45	8	36	8	36
>70	Thin	MCP	>70	8	42	11	39
>70	Thin	MCP + PIP	>70	25	25	14	31
>70	Thick	MCP + PIP	45	17	17	22	36
>70	Thick	MCP	<45	11	19	17	44
>70	Thick	MCP	>70	17	17	17	44
>70	Thick	MCP + PIP	>70	31	11	17	39

\*Percentage of respondents who made a recommendation. The total number of respondents differs for each case owing to cases left blank.

**DISCUSSION**

This study aimed to examine treatment recommendations for common presentations of DD. Our findings indicate a lack of consistency in treatment recommendations for the case scenarios presented. Treatment recommendations for the 16 case scenarios varied widely, such that no scenario received the same recommendation from all respondents. This variance may be due to bias resulting from a lack of experience in collagenase injection rather than disagreement among surgeons. A large proportion of participants were also from regions where patients

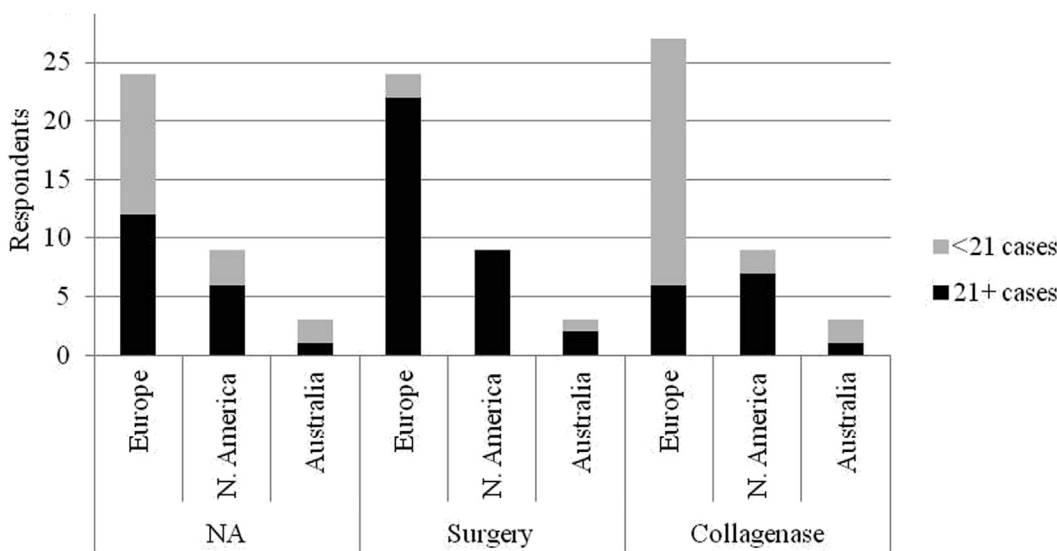
must pay for collagenase, which may have affected participants' recommendations. An ideal sample for this study would be surgeons with similar expertise in each treatment modality who are instructed to assume that all patients have equal access to all modalities. Nonetheless, our data suggested that if translated to a clinical situation, the same patient would receive a range of recommendations depending on the surgeon.

The measures of interrater reliability that were used to quantify the strength of agreement in this study indicated discrepancy among participants' recommendations. According to existing benchmarks

**TABLE 4. Predictors of Each Treatment Recommendation Identified by Multinomial Logistic Regression**

Recommendation	Variable	OR (CI)	P Value
Surgery	>70° contracture	2.18 (1.26–3.76)	< .05
	Thick precentral cord	1.74 (1.02–2.97)	< .05
	MCP + PIP joints	2.46 (1.44–4.22)	< .05
	Years in practice	0.97 (0.94–1.0)	< .05
NA	Thick precentral cord	0.44 (0.28–0.70)	< .05
Collagenase	Years in practice	1.054 (1.03–1.08)	< .05

Multiple options were used as the reference category; n = 550.



**FIGURE 3:** Number of respondents reporting expertise in each treatment modality categorized by geographical region. N.America, North America.

for reliability statistics, a Krippendorff’s alpha of .012 suggests that the strength of agreement between respondents is slight.<sup>25</sup> This finding substantiates current evidence showing considerable variation among surgeons who treat DD and their preferred modalities.<sup>12,13,15,16,26</sup>

Multiple options were recommended by respondents 36% of the time. Although this finding may represent the belief that treatments are equally suitable, it may also suggest uncertainty or insufficient case information. The considerable number of recommendations for multiple options in this study may also emphasize the importance of patient involvement in decision making,<sup>27–29</sup> which further highlights the importance of uniformity in the information and recommendations provided to patients. Kan et al<sup>27</sup> recently identified substantial heterogeneity in patient

preferences regarding treatments for DD. Some respondents in this study may have been unable to recommend a single treatment without information about patient preferences and relevant tradeoffs. Recurrence rate, the likelihood of complete correction of the contracture, and complication profiles have been cited as being critical to patients in decision making.<sup>27</sup> However, informed decision making must be based on information that is accurately presented and understood. The lack of agreement observed in this study suggests that the information provided to patients in practice may lack consistency. Whether this is a result of surgeons failing to translate available evidence is unclear. One international survey of patients found poor satisfaction in the quality of counseling on available treatment options.<sup>30</sup> Evidence has also suggested that treatment decisions are heavily

influenced by the preferences, training experience, and demographics of surgeons,<sup>31–34</sup> which may contribute to variations in care of patients with DD.

When categorized by geographical region, our data showed that fewer surgeons in Europe recommended collagenase than in North America and Australia. Fewer European surgeons also reported having expertise in collagenase injection (Fig. 3). Collagenase recommendations were made 9% of the time by European surgeons ( $n = 24$ ), whereas the whole sample recommended collagenase 18% of the time. Surgeons from regions where patients typically have access to collagenase funding, including North America ( $n = 9$ ) and Australia ( $n = 3$ ), recommended this option 39% and 25% of the time, respectively. Dias et al<sup>13</sup> demonstrated a preference of surgeons from the Nordic region in Europe for NA. This trend may further explain the absence of collagenase recommendations from European surgeons in our results. Two recent randomized controlled trials that compared collagenase with NA reported no significant difference between treatment outcomes after collagenase and NA at 2 years<sup>35</sup> and 1 year,<sup>36</sup> respectively. One of those reports also found higher complication rates in patients who received collagenase than those treated with NA.<sup>35</sup> The degree to which economic factors affected recommendations for collagenase in this study is unclear. Regional trends in training backgrounds and cultural factors also may have affected treatment recommendations.<sup>12,13</sup>

There was little difference between treatment recommendations made by those with less versus more expertise in each modality, except that those with more experience in collagenase injection recommended collagenase significantly more frequently ( $P < .05$ ). In the regression analysis, a contracture of more than 70°, a thick precentral cord, and two (MCP plus PIP) versus one (MCP) affected joint significantly predicted a recommendation of surgery rather than multiple options. A thick precentral cord was negatively associated with a recommendation of NA, which may have reflected a belief that NA is less effective for thick cords. Finally, respondents who were in practice longer were significantly less likely to recommend surgery and were significantly more likely to recommend collagenase injection rather than multiple treatments.

Although our data suggested that a general lack of agreement exists, several additional factors may have influenced our results. A substantial proportion of the sample reported having no experience with collagenase injection, which may have resulted in fewer recommendations for this modality. As suggested by respondents' comments, some surgeons may require

a live patient, or more information to make a realistic recommendation. Other possible confounders included survey fatigue, nonresponse bias, and a bias in recruitment because only those available during certain times were approached in person. Although listed attendees who were not recruited in person were e-mailed after the conference, there may have been a higher likelihood of those with strong preferences to participate.<sup>37</sup> The authors also acknowledge a potential bias in the results owing to the failure to include the option of no treatment in case scenarios. Exclusion of an option not to provide treatment may have forced participants to choose an option that did not reflect their clinical beliefs; this possibility should be considered when interpreting the results.

This study was also limited by a small sample size, which consisted entirely of surgeons at an international conference for DD. It is unknown whether these results can be generalized to all hand surgeons. A larger sample of respondents from additional regions would improve the generalizability of the results. A larger sample size could also enable the inclusion of expertise in each modality as a variable in regression modeling for a more comprehensive analysis. Finally, there is debate in the literature regarding the interpretation of reliability statistics, because they tend to be based on arbitrary benchmark scales.<sup>22,25,38</sup>

The results of this study provide evidence of high variability in treatment recommendations on an international level. Recent reports of high-quality evidence on which to base recommendations in the treatment of DD<sup>35,36</sup> may improve variations in practice suggested by the current results, although translation of knowledge into practice may require more attention.<sup>30</sup> Variability in the dissemination of available evidence and the ability of surgeons to understand and translate evidence to clinical practice may also contribute to high variability. Reported barriers to evidence-based decision making in this field include inconsistent outcome measurement, a lack of functional outcome reporting,<sup>4,39</sup> the use of variable follow-up times,<sup>11</sup> limited data on cost–benefit,<sup>34</sup> substantial conflicts of interest potentially biasing reports on collagenase, and varying definitions for recurrence.<sup>16,26,40</sup> The results of this study warrant further investigation into these barriers ultimately to improve the degree to which the provision of patient care is based on evidence. The findings also emphasize the need for a concerted effort to develop a comprehensive, consistent approach for the treatment of DD that is widely accepted to establish best clinical practice.

## REFERENCES

- Lanting R, van den Heuvel ER, Werker PMN. Clusters in short-term disease course in participants with primary Dupuytren disease. *J Hand Surg Am*. 2016;41(3):354–361.
- Becker K, Tinschert S, Lienert A, et al. The importance of genetic susceptibility in Dupuytren's disease. *Clin Genet*. 2015;87:483–487.
- Broekstra DC, Lanting R, Werker PMN, van den Heuvel ER. Intra- and inter-observer agreement on diagnosis of Dupuytren disease, measurements of severity of contracture, and disease extent. *Man Ther*. 2015;20(4):580–586.
- Crean SM, Gerber RA, Helligo Le Graverand MP. 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.
- Hovius SE, Kan HJ, Smit X, Selles RW, Cadoso E, Khouri RK. Extensive percutaneous aponeurotomy and lipografting: a new treatment for Dupuytren disease. *Plast Reconstr Surg*. 2011;128:221–228.
- Lukas B, Lukas M. Flap plasty in advanced Dupuytren's disease. *Oper Orthop Traumatol*. 2016;28:20–29.
- Betz N, Ott OJ, Adamietz B, Sauer R, Fietkau R, Keilholz L. Radiotherapy in early-stage Dupuytren's contracture: long-term results after 13 years. *Strahlenther Onkol*. 2010;186:82–90.
- Keilholz L, Seegenschmiedt MH, Sauer R. Radiotherapy for prevention of disease progression in early-stage Dupuytren's contracture: initial and long-term results. *Int J Radiat Oncol Biol Phys*. 1996;36:891–897.
- Eaton C. Evidence-based medicine: Dupuytren contracture. *Plast Reconstr Surg*. 2014;133:1241–1251.
- Becker GW, Davis TR. The outcome of surgical treatments for primary Dupuytren's disease—a systematic review. *J Hand Surg Eur Vol*. 2010;35(8):623–626.
- Dahlin LB, Bainbridge C, Szczypa PP, Cappelleri JC, Guerin D, Gerber RA. Current trends in the surgical management of Dupuytren's disease in Europe: the surgeon's perspective. *Eur Orthop Traumatol*. 2012;3(1):25–30.
- Dias J, Bainbridge C, Leclercq C, et al. Surgical management of Dupuytren's contracture in Europe: regional analysis of a surgeon survey and patient chart review. *Int J Clin Pract*. 2013;67(3):271–281.
- Dibenedetti DB, Nguyen D, Zografos L, Ziemiecki R, Zhou X. Prevalence, incidence, and treatments of Dupuytren's disease in the United States: results from a population-based study. *Hand (N Y)*. 2011;6:149–158.
- Dahlin LB, Bainbridge C, Leclercq C, et al. Dupuytren's disease presentation, referral pathways and resource utilization in Europe: regional analysis of a surgeon survey and patient chart review. *Int J Clin Pract*. 2013;67(3):261–270.
- Kan HJ, Verrijp FW, Huisstede BMA, Hovius SER, van Nieuwenhoven CA, Selles RW. The consequences of different definitions for recurrence of Dupuytren's disease. *J Plast Reconstr Aesthet Surg*. 2013;66(1):95–103.
- Baltzer H, Binhammer PA. Cost-effectiveness in the management of Dupuytren's contracture: a Canadian cost-utility analysis of current and future management strategies. *Bone Joint J*. 2013;95-B(8):1094–1100.
- Huisstede B, Hoogvliet P, Coert JH, Friden J. Dupuytren disease: European hand surgeons, hand therapists, and physical medicine and rehabilitation physicians agree on a multidisciplinary treatment guideline: results from the HANDGUIDE study. *Plast Reconstr Surg*. 2013;132(6):964e–976e.
- van Dijk D, Finigan P, Gerber RA, et al. Recognition, diagnosis and referral of patients with Dupuytren's disease: a review of current concepts for general practitioners in Europe. *Curr Med Res Opin*. 2013;29(3):269–277.
- Akhavani MA, McMurtrie A, Webb M, Muir L. A review of the classification of Dupuytren's disease. *J Hand Surg Eur Vol*. 2015;40(5):155–165.
- Neuendorf KA. *The Content Analysis Guidebook*. Thousand Oaks, CA: Sage; 2002.
- Hayes AF, Krippendorff K. Answering the call for a standard reliability measure for coding data. *Commun Methods Meas*. 2007;1(1):77–89.
- Krippendorff K. Computing Krippendorff's alpha-reliability. [http://repository.upenn.edu/asc\\_papers/43](http://repository.upenn.edu/asc_papers/43). Accessed February 24, 2016.
- Krippendorff K. Reliability in content analysis: some common misconceptions and recommendations. *Human Communication Research*. 2004;30(3):411–433.
- Landis JR, Koch GG. The measurement of observer agreement for categorical data. *Biometrics*. 1977;33(1):159–174.
- Werker PMN, Pess GM, van Rijssen AL, Denkler K. Correction of contracture and recurrence rates of Dupuytren contracture following invasive treatment: the importance of clear definitions. *J Hand Surg Am*. 2012;37(10):2095–2015.
- Kan HJ, de Bekker-Grob EW, van Marion ES, et al. Patients' preferences for treatment for Dupuytren's disease: a discrete choice experiment. *Plast Reconstr Surg*. 2016;137(1):165–173.
- Engstrand C, Kvist J, Krevers B. Patients' perspective on surgical intervention for Dupuytren's disease—experiences, expectations and appraisal of results. *Disabil Rehabil*. 2016;38(26):2538–2539.
- Zhou C, Hovius SER, Slijper HP, et al. Predictors of patient satisfaction with hand function after fasciectomy for Dupuytren's contracture. *Plast Reconstr Surg*. 2016;138(3):649–655.
- Wach W, Manley G. International patient survey (part 1: Dupuytren disease). In: Werker P, Dias J, Eaton C, Reichert B, Wach W, eds. *Dupuytren Disease and Related Diseases—The Cutting Edge*. Cham, Switzerland: Springer International Publishing; 2017:29–40.
- Aliu O, Davis MM, DeMonner S, Chung KC. The influence of evidence in the surgical treatment of thumb basilar joint arthritis. *Plast Reconstr Surg*. 2013;131(4):816–828.
- Birkmeyer JD, Reames BN, McCulloch P, Carr AJ, Campbell WB, Wennberg JE. Understanding of regional variation in the use of surgery. *Lancet*. 2013;382(9898):1121–1129.
- Hageman MGJS, Guitton TG, Ring D. How surgeons make decisions when the evidence is inconclusive. *J Hand Surg Am*. 2013;38(6):1202–1208.
- Davis TRC. Surgical treatment of primary Dupuytren's contractures of the fingers in the UK: surgeons' preferences and research priorities. *J Hand Surg Eur Vol*. 2012;38(1):83–85.
- Skov ST, Bisgaard T, Sondergaard P, Lange J. Injectable collagenase versus percutaneous needle fasciotomy for Dupuytren contracture in proximal interphalangeal joints: a randomized controlled trial. *J Hand Surg Am*. 2017;42(5):321–328.
- Stromberg J, Ibsen-Sorensen A, Friden J. Comparison of treatment outcome after collagenase and needle fasciotomy for Dupuytren contracture: a randomized, single-blinded, clinical trial with a 1-year follow-up. *J Hand Surg*. 2016;41(9):873–880.
- Pannucci CJ, Wilkins EG. Identifying and avoiding bias in research. *Plast Reconstr Surg*. 2010;126(2):619–625.
- Feinstein AR, Cicchetti DV. High agreement but low Kappa: I. The problems of two paradoxes. *J Clin Epidemiol*. 1990;43(6):543–549.
- Ball C, Pratt AL, Nanchahal J. Optimal functional outcome measures for assessing treatment for Dupuytren's disease: a systematic review and recommendations for future practice. *BMC Musculoskelet Disord*. 2013;14:131.
- Felici N, Marcoccio I, Glunta R, et al. Dupuytren contracture recurrence project: reaching consensus on a definition of recurrence. *Handchir Mikrochir Plast Chir*. 2014;46(6):350–354.



**APPENDIX A. Dupuytren Disease Case Scenario Survey**

Name: \_\_\_\_\_

E-mail: \_\_\_\_\_

Years in clinical practice: \_\_\_\_\_

**PART 1. Treatment Experience**

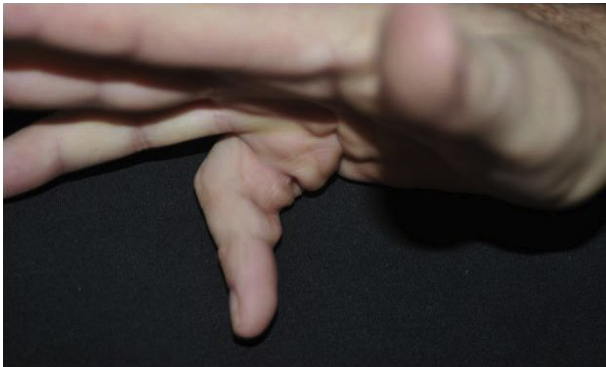
1. How many patients with Dupuytren disease have you treated with surgery?
  - A) 0
  - B) 1–5
  - C) 6–10
  - D) 11–20
  - E)  $\geq 21$
2. How many patients with Dupuytren disease have you treated with needle aponeurotomy?
  - A) 0
  - B) 1–5
  - C) 6–10
  - D) 11–20
  - E)  $\geq 21$
3. How many patients with Dupuytren disease have you treated with Xiaflex?
  - A) 0
  - B) 1–5
  - C) 6–10
  - D) 11–20
  - E)  $\geq 21$

**PART 2: Treatment Patterns****Photo Definitions:**

1. The photo below is an example of a thin cord.



**2. The photos below are examples of a thick cord.**



**Instructions: Indicate which treatment you feel is most appropriate to maximize outcome and minimize impact on the patient such that the patient is satisfied with the treated hand and his or her quality of life over the next 5 years. If you feel that more than one treatment is equally appropriate, check all that apply. Please comment if needed.**

**Case 1:** A patient aged less than 50 years presents with a thin precentral cord and contractures at the MCP and PIP joints in the ring finger at 15° and 30°, respectively. No previous treatment has been done.

Surgery	Xiaflex	Needle Aponeurotomy

Comment: \_\_\_\_\_

**Case 2:** A patient aged more than 70 years presents with a thin precentral cord and ring finger contractures at the MCP and PIP joints of 15° and 30°, respectively. The patient has not undergone previous treatment.

Surgery	Xiaflex	Needle Aponeurotomy

Comment: \_\_\_\_\_

**Case 3:** A patient aged less than 50 years presents with a thick precentral cord and a ring finger contracture of less than 45° at the MCP joint. The patient has not undergone previous treatment.

Surgery	Xiaflex	Needle Aponeurotomy

Comment: \_\_\_\_\_

**Case 4:** A patient aged less than 50 years presents with a thick precentral cord and ring finger contractures at the MCP and PIP joints of 15° and 30°, respectively. No previous treatment has been done.

Surgery	Xiaflex	Needle Aponeurotomy

Comment: \_\_\_\_\_

**Case 5:** A patient aged more than 70 years presents with a thin precentral cord and ring finger MCP joint contracture of greater than 70°. The patient has not undergone previous treatment.

Surgery	Xiaflex	Needle Aponeurotomy

Comment: \_\_\_\_\_

**Case 6:** A patient aged less than 50 years presents with a thick precentral cord and ring finger contracture at the MCP joint of greater than 70°. The patient has not undergone previous treatment.

Surgery	Xiaflex	Needle Aponeurotomy

Comment: \_\_\_\_\_

**Case 7:** A patient aged more than 70 years presents with a thin precentral cord and MCP and PIP joint contractures in the ring finger, the most severe of which is more than 70°. The patient has not undergone previous treatment.

Surgery	Xiaflex	Needle Aponeurotomy

Comment: \_\_\_\_\_

**Case 8:** A patient aged less than 50 years presents with a thin precentral cord and MCP and PIP joint contractures in the ring finger, the most severe of which is more than 70°. The patient has not undergone previous treatment.

Surgery	Xiaflex	Needle Aponeurotomy

Comment: \_\_\_\_\_

**Case 9:** A patient aged more than 70 years presents with a thick precentral cord and contractures of the MCP and PIP joints in the ring finger, the most severe of which is more than 70°. No previous treatment has been done.

Surgery	Xiaflex	Needle Aponeurotomy

Comment: \_\_\_\_\_

**Case 10:** A patient aged less than 50 years presents with a thin precentral cord and a contracture of the ring finger at the MCP joint that is greater than 70°. The patient has not undergone previous treatment.

Surgery	Xiaflex	Needle Aponeurotomy

Comment: \_\_\_\_\_

**Case 11:** A patient aged more than 70 years presents with a thick precentral cord and ring finger MCP joint contracture of less than 45°. The patient has not undergone previous treatment.

Surgery	Xiaflex	Needle Aponeurotomy

Comment: \_\_\_\_\_

**Case 12:** A patient aged more than 70 years presents with a thick precentral cord and contractures in the ring finger at the MCP and PIP joints of 15° and 30°, respectively. No previous treatment has been done.

Surgery	Xiaflex	Needle Aponeurotomy

Comment: \_\_\_\_\_

**Case 13:** A patient aged less than 50 years presents with a thin precentral cord and an MCP joint contracture of less than 45° in the ring finger. The patient has not undergone previous treatment.

Surgery	Xiaflex	Needle Aponeurotomy

Comment: \_\_\_\_\_

**Case 14:** A patient aged more than 70 years presents with a thin precentral cord and ring finger MCP joint contracture of less than 45°. The patient has not undergone previous treatment.

Surgery	Xiaflex	Needle Aponeurotomy

Comment: \_\_\_\_\_

**Case 15:** A patient aged more than 70 years presents with a thick precentral cord and ring finger MCP joint contracture of greater than 70°. The patient has not undergone previous treatment.

Surgery	Xiaflex	Needle Aponeurotomy

Comment: \_\_\_\_\_

**Case 16:** A patient aged less than 50 years presents with a thick precentral cord and contractures of the MCP and PIP joints of the ring finger, the most severe of which is more than 70°. No previous treatment has been done.

Surgery	Xiaflex	Needle Aponeurotomy

Comment: \_\_\_\_\_