Visual Estimation of Dupuytren's Flexion Contractures—A Prospective Comparative Trial

L'évaluation visuelle des contractures de Dupuytren—un essai comparatif et prospectif

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Abstract

Purpose: Surgeons and resident physicians in a clinic setting often visually estimate Dupuytren flexion contractures of the hand to follow disease progression and decide on management. No previous study has compared visual estimates with a standardized instrument to ensure measurement reliability. **Methods:** Consecutive patients consulted for Dupuytren flexion contractures of the hand had individual joint contractures estimated in degrees (°) by both a resident physician and staff surgeon. Estimates were compared with goniometer measurements to generate intraclass correlation coefficients (ICCs), and residents and surgeons were compared based on their accuracy. **Results:** Twenty-eight patients enrolled in this study, which provided a total of 80 hand joints for analysis. Resident physicians achieved an ICC of 0.42, which indicates poor reliability. The hand surgeon achieved an ICC of 0.86, which indicates high reliability. The surgeon also had better accuracy than the residents. **Conclusion:** Hand surgeons should be mindful of the limitations of visual estimates of Dupuytren flexion contractures, particularly when conducted by trainees. Joint angle measurements taken for the purposes of research should be done with a goniometer at minimum.

Résumé

Objectifs : Les chirurgiens et les résidents en milieu clinique font souvent une évaluation visuelle des contractures de Dupuytren pour suivre l'évolution de la maladie et prendre des décisions thérapeutiques. Aucune étude n'a comparé les évaluations visuelles à un instrument standardisé pour garantir la fiabilité de la mesure. **Méthodologie :** Des patients consécutifs qui avaient consulté en raison de contractures de Dupuytren avaient des contractures articulaires individuelles qu'un résident et un plasticien ont évaluées en degrés. Les auteurs ont ensuite comparé les résultats à des mesures goniométriques pour produire des coefficients de corrélation intraclass (CCI), puis ont comparé la précision des résidents à celle des plasticiens. **Résultats :** Vingt-huit patients ont participé à l'étude, pour un total de 80 articulations de la main pouvant être analysées. Les résidents ont obtenu un CCI de 0,42, ce qui fait foi d'une faible fiabilité. Le plasticien de la main a obtenu un CCI de 0,86, ce qui est indicateur d'une fiabilité élevée. Les résultats du plasticien étaient également plus précis que ceux des résidents. **Conclusion :** Les plasticiens de la main devraient être conscients des limites des évaluations visuelles des contractures de Dupuytren, particulièrement lorsqu'elles sont effectuées par des stagiaires. À tout le moins, il faudrait utiliser un goniomètre pour effectuer les mesures d'angle des articulations obtenues aux fins de la recherche.

Keywords

Dupuytren, goniometer, contracture

Introduction

Dupuytren disease in the hand causes fibrotic cords under the glabrous skin of the hand that progressively form digital joint flexion contractures. Management ranges from observation to more increasingly invasive measures such as needle fasciotomy,

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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 greater than 135°

Figure 1. Tubiana's staging of Dupuytren's disease. TFD indicates total flexion deformity.²

enzymatic fasciotomy with collagenase injections, and surgical fasciectomy.¹ Treatment decisions are based on patient functional deficits, patient preferences, and the degree of joint contracture, which can be classified according to Tubiana's staging (Figure 1).² A patient's outcome is directly related to the preoperative degree of contracture and knowing this parameter helps with patient education, prognosis, and management of expectations.³

The technical indications for surgical management are related to the degree of flexion contracture, and thus, it is important to accurately identify this measurement. However, there are limitations of physician assessment of Dupuytren disease contracture. Caution against using visual inspection alone in the assessment of Dupuytren flexion contractures has previously been opined.⁴ The reasoning was 2-fold; first, the elastic nature of digits leads to significant variance in assessments depending on degree of passive stretch, and second, the high density of joints in the area compromises the measurement of individual joints. Accuracy of visual inspection of Dupuytren flexion contractures has not been studied previously in the hand surgery literature.

It has previously been proposed that in order for an instrument to be acceptable clinically, it should be within 5° of the true flexion contracture.⁵ This is in addition to other characteristics of a useful measurement device; namely appropriateness, acceptability, feasibility, interpretability, precision, reliability, validity, and responsiveness.⁶ Precise forms of measurement exist for assessing the degree of contracture, such as photography, goniometers, and computer programs.⁷ Goniometer measurement of Dupuytren flexion contracture of hand joints has been studied previously and has been found to be reliable and extremely accurate (Figure 2).⁸

There are no prior studies comparing visual inspection with another method for the assessment of the degree of flexion contracture of hand joints. If visual inspection performs comparably with a goniometer, then it would be a measurement tool suitable for informing clinical decisions. We conducted a trial to compare physician visual assessment with goniometer measurements in Dupuytren flexion contractures of the hand.

Materials and Methods

Participants

A single-center prospective comparative trial of consecutive patients was conducted to address this research question.

Figure 2. Example of a goniometer.

Approval for this study was granted by the institutional research ethics board.

Consecutive patients consulted to the senior author for Dupuytren contracture of the hand were enrolled. The inclusion criterion was a visible joint contracture of one or more joints of the hand. Thumb flexion contractures and previously treated joint contractures (with needle fasciotomy, collagenase injections, or surgery) were excluded from this study.

Joint Measurements

Patients had all involved digital joints considered for treatment assessed for the purposes of this study. Both a staff surgeon and a plastic surgery resident (post-graduate years 1-5) independently visually inspected the same joints to estimate the contracture in degrees. Estimates were made in reference to the long axis of the digit. Each joints' flexion contracture was then evaluated with a goniometer device by an occupational therapist with advanced training in hand therapy. Goniometer measurements were done by aligning the instrument laterally or dorsally along the digits' long axis and recording the number indicated in degrees. Estimates were each made separately to minimize bias of the estimator. Additionally, all estimates were kept blinded during the course of the study to prevent correction over time. All recorded data points were recorded into an Excel database (Microsoft Corporation, 2010, Redmond, WA, USA) along with the associated joint and finger being measured.

Sample Size Calculation

The sample size was determined based on the previous literature.⁹ Using an interclass correlation coefficient (ICC) of at least 0.8, and a half width at 0.1 with an assurance probability of 0.9, it was estimated 77 total observations were required. This was further inflated to 80 observations for the purposes of this study.

Statistical Analysis

Descriptive statistics of the joints assessed were recorded as categorical data. The estimated contractures were compared

Figure 3. Bland-Altman plot showing resident performance.

with the goniometer measurements to assess ICC. Intraclass correlation coefficients were categorized according to Munro.¹⁰ A graphical representation of this was constructed according to Bland.¹¹ As 5° has previously been established as a threshold for accuracy,⁵ a comparison between staff physician and resident estimates was also done with a χ^2 test. Statistical significance was based on an α value of .05. Statistical analysis was carried out using the SAS software package (SAS Institute Inc, Cary, North Carolina). Graphics were created in Microsoft Excel (Microsoft Corporation, 2010).

Results

A total of 28 patients participated in this study, which provided 80 hand joints with Dupuytren flexion contracture. In terms of contracture location, 42 were of the right hand and 38 were of the left hand. Among the digits, 42 (52.5%) were in the small, 25 (31.3%) were in the ring, 8 (10.0%) were in the middle, and 5 (6.3%) were in the index. The metacarpophalangeal (MCP) joint was involved in 47 (58.8%) observations, the proximal interphalangeal (PIP) joint was involved in 31 (38.8%) observations, and the distal interphalangeal (DIP) joint was involved in 2 (2.5%) observations. Dupuytren flexion contractures ranged from 1° to 85° based on goniometer measurements. The mean contracture was 38.0° and the median was 35.5°. The mean contractures for the MCP, PIP, and DIP joints were 36.9°, 40.6°, and 32°, respectively.

Interclass correlation coefficients for resident assessments with goniometer measurements was 0.42, which indicates low reliability. Staff surgeon estimates and goniometer measurements had an ICC of 0.86, which indicates high reliability. Staff estimates were within 5° of the goniometer estimate more frequently than resident estimates (66 vs 47, $P < .001$). A plot is provided as Figures 3 and 4 as per Bland and Altman.¹¹

Discussion

The degree of Dupuytren flexion contracture in the hand is often estimated by visual inspection. Multiple factors play a role in making this the de facto measurement device of choice

Figure 4. Bland-Altman plot demonstrating surgeon performance.

including limited accessibility to an advanced measuring device, time constraints of a busy hand clinic, and the high number of joints potentially involved. However, the primary reason visual inspection is relied on so heavily is the presumption that it adequately approximates more precise instruments and is sufficient to inform clinical decision-making. Of course, patient function and preferences play the primary role in selecting a treatment option, but if degree of flexion contractures is routinely reported in Dupuytren disease consultations, then it seems prudent to determine the veracity of these estimates. This is the first study to compare visual estimates with a device that is known to be accurate; in this case a goniometer.

The results of this study showed that a single fellowship-trained hand surgeon performed reasonably well when compared with a goniometer. The ICC level of the physician corresponded with high reliability. However, even in this case, an estimate was inaccurate in one observation by 40°. Thus, while visual inspection is reliable when completed by a specialist, significant errors are still not avoided, which may lead to misinformed clinical decision-making. Resident estimations, in contrast, were rated as poor in terms of the ICC. Also, residents were outside of 5° from the goniometer measurement significantly more frequently than the staff surgeon. This indicates that resident estimates are dubious and likely should not be relied upon for clinical documentation. Although previous studies have shown that clinical skills improve with increasing postgraduate year, this effect, if it exists, was not analyzed in this study.¹² Resident physicians often are integral to the hand surgery service in major academic centers. Thus, it may be important that they continue to refine these estimates throughout their residency; however, the estimates should not be relied upon for clinical decision-making.

A number of instruments for determining the degree of flexion contracture in Dupuytren exist. Smith et al previously investigated the use of photography and computer software⁷ and found reasonable reliability when compared with goniometer measurements. The advanced instruments however are time-consuming and require significantly more resources than a visual estimate or goniometer assessment.

The methods for measuring Dupuytren flexion contractures have not been standardized. In the literature, various procedures have been used such as active extension loss,¹³ total extension deficit,¹⁴ composite flexion contractures,¹⁵ and total passive extension deficit.¹⁶ In some studies, the methods are not reported.¹⁷ In this trial, occupation therapists with advanced training in hand therapy took all measurements using a similar procedure, only differing by whether the angle was measured dorsally or laterally. This has been shown previously to not affect overall accuracy.¹⁸

There are a number of limitations of this study. The first limitation, and likely foremost, is the limited representation of staff physicians. Only the senior author contributed to this group. As a fellowship trained hand surgeon, he likely provided a higher degree of accuracy than most clinicians, which limits external validity. However, the results may be generalizable to fellowship-trained hand surgeons. Also, a previous study has shown that the degree of accuracy is lower when assessing DIP joints,⁵ and in our study only 2 were assessed. This may have inflated the ICC values because of a higher representation of joints that are more easily studied. Lastly, no patient characteristics were considered in the analysis. Therefore, if a certain demographic of patients allows for superior or inferior estimates, then this was not captured in the trial.

In conclusion, this study was the first trial to compare staff and resident physician visual estimates of Dupuytren flexion contracture with goniometer measurements. The calculated ICC demonstrated poor correlation between residents and the goniometer, and high correlation for the fellowship-trained hand surgeon. Therefore, hand surgeons should be circumspect when documenting resident physician estimates of Dupuytren flexion contracture and mindful of their own fallibility. For accuracy, a goniometer should be considered standard of care for all clinical measurements of flexion contracture in Dupuytren disease. Furthermore, any research conducted in this area should not rely on visual estimation of joint flexion contractures alone and instead incorporate a goniometer or more advanced measurement device.

Declaration of Conflicting Interests

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