

# A review of scales used to assess the severity and outcome of surgery for Dupuytren's disease

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## ABSTRACT

The number and variety of different classifications that have been proposed for assessing the severity of Dupuytren's disease (DD) and for evaluating the results of surgery for DD indicate that there is no single perfect tool for assessing this disease. Despite the multiplicity of these scales, there is no consensus on the best method of grading the severity of this disease and on the most accurate outcome measure after treatment. This review article presents scales for assessing the severity and outcomes of surgery for DD based on the current literature. Several different classifications are presented, such as assessment of the degree of contracture, assessment of hand function, histologic

evaluation, and so-called "complex scales". Each of these classifications has its advantages, but each also has weaknesses. This article provides a comprehensive and critical review of these instruments. Of all the scales and outcome measures reviewed in this article, these so-called "patient-oriented outcome measures" probably best reflect patients' perceptions of their outcomes after treatment. Therefore, these instruments seem to be more accurate and effective than other outcome measures in assessing the severity of DD and evaluating the results of treatment. However, the selection of the ideal outcome measure remains a task for future research.

**Keywords:** Dupuytren's disease; classification; outcome measure.

## INTRODUCTION

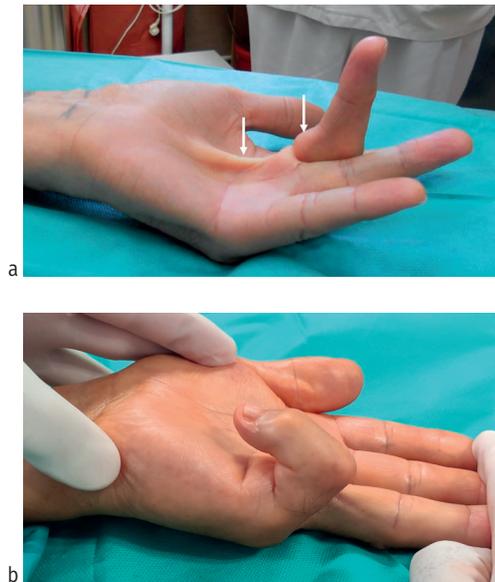
Dupuytren's disease (Dupuytren's contracture; DD) is a pathologic condition of the palmar aponeurosis (also called "palmar fascia") consisting of proliferation of pathologic myofibroblasts forming nodules due to deposition of collagen in this structure. The nature (etiology) of the disease is not clearly determined. The first and early sign of DD is the formation of a small, hard nodule under the skin of the palm. This nodule slowly grows and extends longitudinally, forming a fibrous cord that gradually invades the fibrous sheath of the flexor tendon corresponding to an adjacent finger. As the disease progresses, the collagen fibers that make up the fibrous cord shrink, causing a slow, gradual contracture of the corresponding finger. The cause of the formation of nodes and cords in the structure of normal palmar aponeurosis is the excessive proliferation of fibroblasts and myofibroblasts, which produce a specific type III collagen. It is not clear why myofibroblasts and fibroblasts become hyperactive in individuals with DD. Fibrous transformation of the palmar fascia occurs predominantly on the "ulnar" side of the palm, and subsequent contracture most commonly involves the ring and little fingers, followed by the middle finger (Fig. 1a, b). The "radial" digits (thumb and index finger) are rarely affected [1, 2, 3, 4, 5].

Dupuytren's disease is characterized by several specific features:

- it occurs more frequently in men than in women (rate 4:1) and the prevalence increases with age [3, 5];

- it is bilateral in approx. 70% of patients, with the timing of onset and severity of changes usually different in each hand [4, 5];
- it occurs in about 30% of close relatives of patients, both female and male, indicating that genetic predisposition is an important predisposing factor [6, 7, 8];
- tendency to recur and appearance of new nodules beyond the operated site (new manifestation or extension of the disease) [1, 9];
- occurrence and incidence vary geographically and racially, with the highest incidence in northern Europe (Scandinavia, Great Britain) and much higher in the white race compared to African and Asian populations [3, 4]. Interestingly, the clinical course of DD is milder in Asian patients: finger contractures are less severe and disease progression is slower [10].

When the disease occurs, it is usually progressive, leading to severe contractures of the fingers, but the rate of deterioration varies between patients; even in the same patient with bilateral disease, the progression may be different in each hand. Some data from the literature show that a progressive course is observed in only 70% of patients, and in the remaining 30% the disease stabilizes at the level of a nodule or single cord in the palm [4, 5, 11].

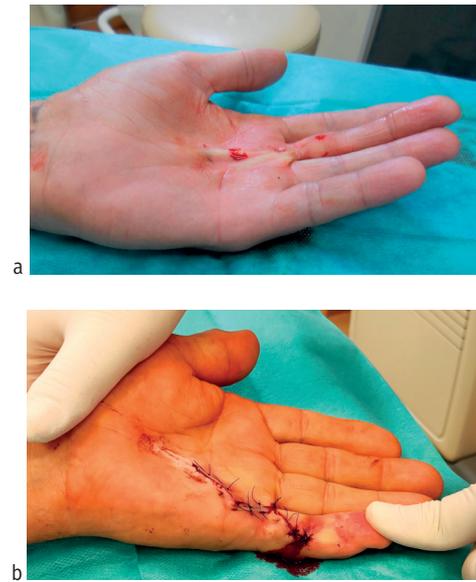


**FIGURE 1.** Dupuytren's disease involving: (a) only the metacarpo-phalangeal joint of the annular finger (Tubiana's stage 2). Arrows mark bite sites for "needle fasciotomy"; (b) metacarpo-phalangeal and proximal interphalangeal joints of the little finger (Tubiana's stage 4)

There are several methods of assessing clinical severity and improvement after surgery for DD in the literature, although few are used in daily clinical practice [1, 3]. It seems desirable to present some of them to readers interested in the management of this disease. The aim of this review was to present scales for assessing the severity and results of surgery for DD based on the current literature.

### WHY WE NEED TO USE SCALES AND OUTCOME MEASURES IN DUPUYTREN'S DISEASE

Patients present at different stages and clinical forms of DD. For example, one patient may have mild or moderate contracture of 1 finger at the metacarpo-phalangeal (MCP) joint (Fig. 1a), another may have severe contracture of the little finger at the MCP and proximal interphalangeal (PIP) joints (Fig. 1b), still another may have severe contracture of 2 fingers (i.e., the ring finger and the little finger). For research but also practical purposes, each of these forms should be classified differently in descriptive or scoring form. This is because the results of treatment (usually surgical) and the risk of recurrence are different in each of the above examples. In the first case, a simple mini-invasive procedure such as a needle fasciotomy or a single injection of collagenase may result in complete extension of the finger [12]. In 2 other cases, even "open fasciotomy" (Fig. 2b) does not guarantee complete correction of the contracture. This case is also associated with a relatively high risk of recurrence. Therefore, preoperative classification of the degree of progression (severity) of the individual case of DD is desirable. Obviously, for research purposes, it is necessary to avoid bias in the assessment of the true effectiveness of a given method of treatment (i.e. various surgical techniques or collagenase injections).



**FIGURE 2.** Immediate release of finger's contracture following: (a) "needle fasciotomy"; (b) "open fasciotomy"

### METHODS OF ASSESSMENT OF THE SEVERITY (GRADE OF ADVANCEMENT) OF DUPUYTREN'S DISEASE

#### Assessment of the degree of contracture

Direct measurement of angles in the affected joints is the simplest and most commonly used method of assessing the severity of contracture. The degree of contracture of the affected joints in a single finger can be measured with a goniometer. Measurement with a goniometer is simple and the device is widely available. The angle in each joint is measured in degrees, and then the sum of the angles in the MCP and PIP joints is calculated and reported as "the degree of contracture" (i.e., MCP flexion = 30°, PIP flexion = 45°, degree of contracture = 75°). This value is then usually converted to a variable called loss of extension (LoE), which means subtracting the sum of the angles from 180° (i.e., 180° - 75° = 105°). Loss of extension is usually assigned to a single finger, but may be added when multiple fingers are involved in a hand. These measurements can be made with a computerized goniometer, but the benefit is not clear and the results are somewhat different from standard goniometry [1].

#### Assessment of hand function: URAM, DASH, and PEM questionnaires

Assessment of hand function is considered to be a better and more accurate measure of patients' problems associated with DD than simple measurement of LoE fingers. Therefore, "patient-oriented outcome measures" (PROMs) are now more desirable tools in both research and practice. Patient-oriented outcome measures may be particularly useful in hand surgery because the functional needs of patients with hand disorders are different, as are their expectations of treatment effect and definition of satisfactory outcome. Various methods of assessing hand function have been proposed, such as the disability of arm, shoulder and hand

(DASH), the patient evaluation measure (PEM), the Sollerman questionnaire, and most recently the Unite Rhumatologique des Affections de la Main (French, URAM) [13, 14, 15, 16]. The first 3 questionnaires are generic and have been widely used to assess the degree of hand impairment caused by various diseases and injuries. The URAM has been validated for the assessment of DD and can therefore be called a “disease-oriented” instrument [16]. It is a patient-oriented questionnaire, relatively short and easy to use in clinical practice and scientific studies (Tab. 1). The URAM scale consists of 9 items, each of which is scored 0–5, depending on the difficulty in performing that particular function (Tab. 1). It has an associated disability range from 0 (no disability) to 5 (worst disability), which means that higher scores indicate a higher level of disability. This instrument has not been used in clinical trials. Rodrigues et al. performed their critical evaluation based on a cohort of 110 patients with DD who listed the problems from their disease that led them to request surgery and their relative priorities of the results of surgery. These patients reported a total of 278 problems. As many as 94 different combinations of problems were reported by patients, and 55% of these were not captured by items on the URAM scale. The authors conclude that the validity of the URAM scale needs to be re-evaluated and possibly modified for general use [17].

Alternative PROMs to the URAM are the DASH and the PEM:

- the DASH questionnaire is the most commonly used outcome measure in various diseases and injuries of the upper limb [13]. It is a generic instrument that mainly assesses the performance of specific, defined tasks and therefore may not capture many problems experienced by patients with DD;
- the PEM questionnaire assesses symptoms and generalized rather than specific task performance [14]. Therefore, the PEM may (presumably) better capture the wide range of specific problems experienced by patients;
- the Sollerman test consists of 20 items, each scored 0–4. Total Sollerman scores range from 0 (total disability) to 80 (normal function) [15].

These instruments have been used in several studies published in the literature. The most recent study from the author's institution investigated the effect of baseline LoE of the fingers in 74 patients with DD on postoperative hand strength and function as assessed by the DASH questionnaire. At presentation, the median LoE of the patients was 80°, grip strength was 41 kg, and DASH score was 54. Twelve months after surgery, the median LoE decreased to 10° and the DASH score to 32 (statistically significant improvement), while grip strength decreased slightly to 40 kg. These results show that the initial severity of the contracture had no significant effect on function, but had a significant negative effect on hand strength. Improvement in finger extension after surgery had a significant positive effect on function but no effect on strength [18].

The DASH form was also used by Skoff, who reported the results of treating 30 patients with 2 different methods: the open palm technique and the “synthesis” technique. This method consisted of selective fasciectomy followed by closure of the wound in the finger with the distally advanced, radially based full-thickness skin flap. The degree of deformity was assessed for each joint, and hand function was assessed using the DASH questionnaire. A significant reduction in the mean contracture of the metacarpophalangeal joints from 50°/57° (method 1/ method 2) preoperatively to 0° at 3.5 years and in PIP joints from 40°/58° (method 1/ method 2) preoperatively to 6°/10° at 3.5 years was noted. This correction of finger deformity correlated with improvement in hand function as measured by DASH scores, which decreased from a mean of 37 preoperatively to a mean of 30 at the final follow-up [19].

Sinha et al. reported the results of surgical treatment of 42 patients with DD. The overall degree of deformity was assessed using the LoE and hand function was assessed using the Sollerman test. These authors found a significant correlation between preoperative deformity and hand function impairment. They also found a statistically significant reduction in

TABLE 1. The URAM questionnaire items

No.	Are you able to...? score	With no problems 0	With very little difficulty 1	With some difficulty 2	With much difficulty 3	Almost impossible 4	Impossible 5
1	wash yourself with a flannel keeping your hand flat						
2	wash your face						
3	hold a bottle in 1 hand						
4	shake someone's hand						
5	stroke something or caress someone						
6	clap your hands						
7	spread out your fingers						
8	lean on your hand						
9	pick up small objects with your thumb and index finger						

total deformity from 81° preoperatively to 32° at 6 months. This correlated with a statistically significant improvement in overall hand function as measured by the Sollerman score, which changed from 71 points preoperatively to 77 points at the 6-month follow-up [20].

Although none of the above PROMs (except the URAM) are specific to DD, they are recommended for measuring baseline disability and outcomes of surgery for DD, as they better reflect patients' perceptions of their outcome [21].

### Histological assessment

It is a widely accepted staging of DD based on findings from histologic examination of samples taken from diseased palmar fascia. It was introduced by Luck [22]. This staging classifies the disease into 3 progressive stages:

- proliferative stage is characterized by intense cellularity randomly arranged in separate whorls;
- involutinal stage in which cells appear to align along lines of tension;
- residual stage in which the tissue forming the cords is predominantly fibrous and acellular.

This staging system relied on simple histologic techniques and standard staining, making it relatively easy to use, inexpensive, and reproducible. Further findings by other investigators using more advanced techniques revealed that the predominant cell type in the involutinal stage is myofibroblast (electron microscopy) and that different proportions of collagen III and collagen I in diseased palmar fascia correlate highly with the staging system proposed by Luck [22, 23, 24]. A strong correlation was found between the presence of myofibroblasts or prominent microtubules in palmar fascia specimens and the risk of recurrence after surgical treatment. The original staging system introduced by Luck has been the subject of several modifications. Rombouts et al. proposed 3 different histologic types of DD based on the examination of samples taken from diseased palmar fascia [25]. They distinguished:

- proliferative disease with high cellularity and mitoses;
- fibrocellular disease with the presence of a reticular network;
- fibrous disease with predominant acellular cords.

Each biopsied sample of diseased palmar fascia showed a mixture of these 3 histologic types, and these authors graded individual cases according to the lowest grade they found. These authors used their scale to predict recurrence after surgery: they believed that recurrence was more likely in fibrous disease than in the proliferative stage [25].

Another modification was proposed by McGrouther, who reduced the number of stages from the original 3 to 2: an initial proliferative process and a later mechanical process [26]. None of these modified staging systems gained wider popularity and none was used in many clinical trials.

### Complex scoring systems and scales

Many authors have attempted to classify (score) the clinical severity of DD and subsequently the outcomes of surgery. Some of these classifications have been relatively simple, while others have been more complex. Many of the scoring systems were based on 4 grades (categories) depending on the subjective assessment of the results as excellent, good, fair, and poor (bad). This grading was based on the range of motion of the involved fingers, overall hand function, the presence of complications, the presence of recurrence or extension, and the extent of the impact of this recurrence on the patient's use of the hand in daily activities. Honner et al. presented the results of surgery for DD in the 4-grade scale mentioned above. Assignment to a particular grade was based on the degree of LoE fingers, functional impairment, and presence of recurrence (if there was a recurrence) [27]. Twenty years later, Makela et al. modified the scale proposed by Honner et al. by including a measurement of the sum of the vertical distance by which the fingertip falls below the plane of full extension and the gap between the tip of the flexed finger and the distal palmar crease [27, 28]. This 4-grade scoring system has been used in many studies, but unfortunately, in most of them, the authors used completely different criteria to select certain grades. This fact led to obvious difficulties in comparing the results presented between studies, i.e. a score of "good" in one study did not necessarily mean the same in the other study. This lack of standardization of outcome data led some researchers to conclude that a critical comparison of surgical techniques and their efficacy is almost impossible due to large inconsistencies in outcome reporting [21].

Tubiana et al. proposed one of the most popular scoring systems that has been widely accepted and used in the XX century. This classification classifies the contracture into 1 of 4 grades (stages) based on the combined angles of contracture of the MCP and PIP joints (Fig. 3, Tab. 2). This scale was based on the measurement of the degree of LoE: less LoE was assigned to a lower stage, whereas more LoE was assigned to a higher stage. Stage 0 was assigned to an early form of DD, with nodules present in the palm but no LoE (Tab. 2) [29]. The revised version of this system was published in 2000 with some modifications [30]. The basic scale remained unchanged, but some new elements were added, including measurement of the first web contracture (in cases of thumb involvement). An additional letter designation was proposed as follows: depending on the location of the nodules in the palm or digits, the basic stage was assigned the letter "P" or "D", consecutively. The PIP joint contracture greater than 70° was designated "D+", and fixed hyperextension in the DIP joint was designated with the letter "H". The total score was calculated by assigning points for each of the features described in the scale [30]. The original Tubiana's scale was widely used in research and practice, but its revised version did not gain the same popularity. Although it was more comprehensive than the primary version, it was considered cumbersome for daily clinical use [1, 21].

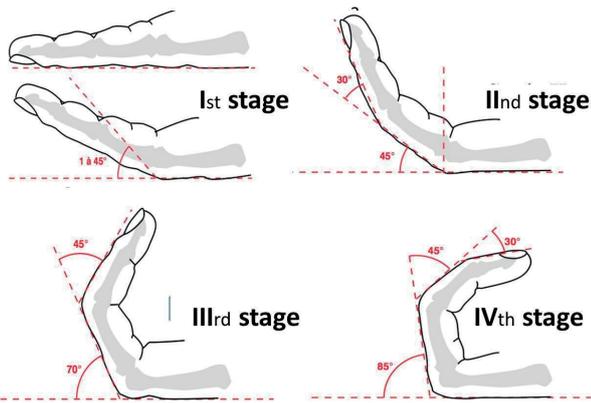


FIGURE 3. Stages of Tubiana's classification of the severity of Dupuytren's disease

TABLE 2. Tubiana's classification of the severity of contracture in Dupuytren's disease

Stage	Extension deficit
0	no extension deficit (only nodules in the palm)
1	<45°
2	46–90°
3	91–135°
4	>135°

Hindocha et al. presented another modification of the original Tubiana scale. The modification consisted in including some selected risk factors of poor outcome or recurrence of DD after surgery, i.e. presence of diathesis. The authors believed that their modified Tubiana's scale is more objective, accurate, and precise than the original instrument, and therefore can better predict the results of surgery [31]. Contrary to the authors' expectations, this scale was not widely used in clinical practice because it was even more complicated than the modified Tubiana's instrument and thus too difficult for routine clinical use.

Some other authors prepared modifications of the original Tubiana's scale that included additional variables related to the severity of the contracture (range of LoE), presence of predisposing factors (i.e. positive family history, exposure to vibration, diabetes), involvement of more digits (i.e. 2 or 3 vs. 2), hyperextension of the DIP joint, or involvement of 2 "radial" digits (the index and the thumb). All of these variables could (hypothetically) more accurately predict an unfavorable outcome after surgery or be associated with a higher risk of recurrence [32].

Another interesting and original scoring system was presented by Abe et al. These authors used a 4-point scale depending on the involvement of the MCP joint, the PIP joint, and the range of LoE. This scale was used for preoperative evaluation of disease severity and for follow-up evaluation of outcomes. Based on the treatment results, Abe et al. found no effect of baseline (preoperative) severity of MCP contracture on postoperative improvement: patients with mild and severe MCP contracture benefited similarly from surgery. In contrast, PIP contracture severity had a statistically significant negative

effect on outcomes: patients with severe PIP contracture benefited less from surgery than those with mild PIP contracture. The authors suggested that subjects with severe PIP contracture may require additional procedures during surgery, more than just subtotal fasciectomy alone [33].

## FINAL REMARKS

The number and variety of different classifications that have been proposed to assess the severity of DD and to evaluate the results of surgery for DD show that there is no one perfect instrument for assessing this disease. A variety of scales, questionnaires, and outcome measures used by researchers in different centers makes it difficult to compare the treatment results reported in the studies. However, of all the scales and outcome measures presented in this article, the so-called PROMs probably best reflect patients' perceptions of their outcomes. This is because most patients decide to have hand surgery in the hope of improving hand function or preventing deterioration of function due to disease progression. Therefore, PROMs seem to be better instruments than other outcome measures used in studies of DD. The selection of the ideal outcome measure remains a task for future research.

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