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# Evaluation of Activity Limitation and Digital Extension in Dupuytren's Contracture Three Months after Fasciectomy and Hand Therapy Interventions

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Hand therapy for patients with Dupuytren's contracture focuses on enabling occupational performance and improving hand function.<sup>1</sup> Dupuytren's contracture is common in northern Europe, particularly among older men.<sup>2</sup> A Swedish study<sup>3</sup> has shown a prevalence of 6% in the population. Appreciable risk factors are diabetes mellitus,<sup>4</sup> heredity,<sup>5</sup> alcohol, and smoking.<sup>6</sup> Dupuytren's contracture starts in the palm of the hand and causes a contracture of the metacarpophalangeal (MCP) joint. Later, it involves the proximal interphalangeal (PIP) joint.<sup>7,8</sup> The latter is more difficult to correct. Moreover, the longer the joint is contracted, the more difficult Dupuytren's contracture is to correct. Surgical treatment does not cure Dupuytren's contracture,<sup>9</sup> and recurrence is

## ABSTRACT

**Study Design:** Longitudinal Case Series.

**Introduction:** Dupuytren's contracture is thought to result in digital impairments and performance disabilities. No study to date has focused on how patients with Dupuytren's contracture experience limitations in daily activities and the results after surgery.

**Purpose of the Study:** Describe which activities patients with Dupuytren's contracture defined as the most disabling, how they rated their activity limitations and determine the relationship between activity limitations and digital extension before and three months after surgery and postoperative hand therapy.

**Methods:** Self-reported rating of activity limitations, performance, and measures of total digital extension.

**Results:** The most disabling activities were with self-care (42%), though overall performance was significantly improved following surgery and postoperative hand therapy. The total digital extension was significantly improved 81 degrees and was positively related to performance.

**Conclusions:** The results provide new information about activities that patients with Dupuytren's contracture experience as being difficult to perform and describes positive changes in performance and range of motion.

**Level of Evidence:** 4

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common.<sup>10</sup> Postoperative hand therapy usually includes thermoplastic splinting, exercises, and edema and scar interventions, the objective being to maintain the range of motion gained via the surgical excision of the diseased tissue.<sup>8</sup>

Although Dupuytren's contracture makes it difficult to use the hand,<sup>11</sup> only a few studies<sup>12,13</sup> include patients' opinions about their problems with daily activities and postoperative outcome. Previous studies<sup>12,13</sup> have focused on surgical technique and the postoperative outcome. The Disability of the Arm, Shoulder, and Hand Questionnaire (DASH) was used in one of the previously performed studies as a parameter to compare two surgical techniques. The mean DASH score before surgery was 37 and decreased to 30 after surgery.<sup>12</sup> Furthermore, functional capability and overall satisfaction were investigated in a study that compared three surgical techniques. Nineteen patients were asked about difficulty with five activities (shaking hands, placing hand in pocket, applying gloves, typing, and recreational activities

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such as golf and tennis). Forty-seven percent of the patients had problems with functional capability, the most common of which was difficulty applying gloves. Eighteen of the patients were satisfied with the result after surgery, although none of them regained the full range of motion.<sup>13</sup>

Previously, two studies<sup>7,14</sup> concluded that a greater degree of deformity (in digital extension) is associated with a greater loss of hand function and that there is a significant correlation between change in total deformity and hand function. Change in deformity in the PIP joint contributes significantly more to better function than does change in the MCP joint.<sup>7</sup> The authors conclude that if the deformity is allowed to worsen, it may lead to a poorer functional outcome after surgery.<sup>14</sup> It was also seen that early surgery results in a better functional outcome.<sup>7</sup> A night splint was used for three months in both studies.<sup>7,14</sup> In one study, no additional hand therapy was given;<sup>7</sup> in the other study, hand therapy is not mentioned at all.<sup>14</sup>

Although objective measures of joint function, tendon glide, and or complications of nerve, pain, and scar quality are important to define,<sup>15</sup> the patients' assessment of the surgical result is an essential criteria in the assessment of functional outcome.<sup>16</sup> In evaluating the performance of activities, both objective and subjective aspects must be considered.<sup>17,18</sup> No study to date has focused on how patients with Dupuytren's contracture experience limitations in daily activities and the results after surgery. The aim of the present study was to describe the most disabling activities as defined by the patient, uncover how they rated activity limitations, and measure digital extension before and after interventions. An additional aim was to investigate the relationship between activity limitations and digital extension.

## METHODS

### Patients

Data on a convenient sample of 103 consecutive patients were collected during 2006 after they were informed about the study and invited to participate in this study. The inclusion criteria for the study were patients with Dupuytren's contracture in digit II–V who had had surgery and postoperative hand therapy treatment according to the standard protocol at the clinic. Twenty-two patients declined the invitation to participate in the study. Four patients were excluded because they had other conditions and had not followed the standard protocol: one had carpal tunnel syndrome and was operated on a couple of weeks after the surgery for Dupuytren's contracture, one had psoriatic arthritis, and two developed Complex Regional Pain Syndrome. Five patients did not attend to their training sessions at the occupational therapy department. Further, 11 patients had incomplete

DASH questionnaires, and one patient had an incomplete measurement of digital extension before surgery. No statistical differences were found between the study group and the drop outs with respect to age, sex, duration of symptoms, incidence of diabetes, recurrence, heredity, or unilateral or bilateral disease.

Altogether, 60 patients were included, 55 men and five women with a mean age of 66.5 years (range, 43–87). The mean duration of symptoms for the patients was 12.5 years (range, 2–33). Twenty-nine patients gave heredity as the cause of the disease, eight had diabetes and 12 had recurrent Dupuytren's contracture. Forty-six of the patients had Dupuytren's contracture in both hands.

Most of the patients, 41, had had surgery in one digit. Seventeen patients had surgery in two digits, and two in three digits. The total number of digits in the study was 81. The small and ring fingers were the most commonly involved, with 43 and 28 digits, respectively. The other digits were less common; nine middle fingers and one index finger. No thumbs were included in the study as they are not treated according to the standard protocol used in this study. The majority of the digits, 55, involved the MCP and PIP joints. Ten digits involved only the MCP joint, ten only the PIP and DIP joints, and six digits involved all three joints.

The Research Ethics Committee, Faculty of Health Science, Linköpings University, Sweden, approved the protocol.

### Measures

All measurements used in this study were conducted before and three months after surgery.

### Identification of Activities Difficult to Perform

The patients were asked to define the most disabling activity they had experienced during the previous week as a consequence of the poor hand function caused by the Dupuytren's contracture. The performance of that specific activity was rated on a ten-point scale ranging from "unable to do" to "do extremely well." At the follow-up three months later, the patients again rated the performance of the same activity on the ten-point scale. At that point, the patients were not given the previous rating of their performance. This method was developed by the authors and evolved from a client-centered point of view, which involves focusing on occupational performance goals that are meaningful to the client.<sup>19</sup>

### Self-reported Activity Limitations as Reported by DASH

Further, the ratings of activity limitations were measured by the Swedish version of the DASH, a self-administered questionnaire with a region-specific outcome that was developed to measure

disability of the upper extremity and symptoms.<sup>20</sup> The Swedish version of the DASH has been tested for both reliability and validity.<sup>21,22</sup> It is considered as a valuable instrument in clinical research into disorders of the upper extremity<sup>21</sup> and for detecting and differentiating between changes in disability over time.<sup>22</sup> The DASH consists of a 30-item disability/symptoms scale, a four-item work scale, and a four-item sport/music scale. The latter two scales are optional, depending on their relevance for the patient. Each item can be scored on a five-point scale ranging from “no difficulty” to “unable to perform.” The sum of all items is used to calculate the total DASH score, which ranges between 0 and 100, from “no disability” to “severest disability.”<sup>20</sup>

## Digital Extension

A goniometer was used to measure digital extension. Only the operated hand was assessed. The extension of the MCP, PIP, and DIP joints in each affected finger was measured. The total digital extension for each finger was calculated by adding together the individual extension of the MCP, PIP, and DIP joints. This method of calculating total digital extension has been described as part of the Tubiana grade.<sup>23</sup> Goniometry is a valid and reliable method,<sup>24</sup> and standards for measurements have been published.<sup>25,26</sup> Five experienced occupational therapists following guidelines based on standards from literature conducted measurements, and were also responsible for the interventions after surgery.

## Intervention

Fifty-seven patients underwent fasciectomy with local flap Z-plasty, and three patients underwent fasciectomy with full thickness skin graft. One patient had a digital nerve repair. Five patients were given antibiotic treatment five to seven days after surgery. All patients were treated according to a standard protocol (Figure 1) for treating Dupuytren's contracture. Before starting exercises, information was gathered from the surgeon about the extension gained at surgery, status of the volar plate, release of the PIP joint, and nerve injuries. The exercise programme is adapted to each patient's individual needs and is based on the patients' impairment, physical status, and competency. The programme includes isolated active flexion and extension of the PIP and DIP joints, and full composite flexion. The splint in the standard protocol is a volar splint, and the angles are as follow: the wrist in 10–20° extension, the MCP joint in 10–20° flexion, and the IP joints in maximum extension without applying tension to the wounds. The splint is used at night for as long as the digital extension is worse in the evening than in the morning. Fifteen patients needed more splinting than in the

standard treatment: These included dynamic extension splints, dynamic flexion splints, exercise splints, and wrist splints. The mean number of days before starting active exercise was 7 (range, 5–14), the mean number of visits to the occupational therapist was 6 (range, 2–13), and the mean number of visits to the physician was 3 (range, 1–7).

## Data Analysis/Statistical Analysis

The activities defined by the patients as the most disabling were categorized into three activity areas according to The Canadian Model of Occupational Performance: self-care, productivity, and leisure, depending on the purpose of the activity. Self-care includes personal care, personal responsibilities, functional mobility, and organization of personal space and time. Productivity includes schoolwork, employment, homemaking, and parenting. Leisure includes socializing, creative expressions, outdoor activities, game, and sport.<sup>19</sup>

Student's t-test was used to compare the study group and the drop outs in respect of age, sex, and duration of symptoms. A contingency table (chi-square test) was used to analyze the incidence of diabetes, recurrence, heredity, and whether the disease was unilateral or bilateral.

The Wilcoxon signed-rank test was used to analyze the DASH scores and the performance of the most disabling activities defined by the patients because these data were on an ordinal level. A parametric test (paired t-test) was used to analyze differences in total digital extension. Spearman rho correlation coefficient was calculated to estimate the relationship between the DASH score on the disability/symptoms scale and total digital extension.

## RESULTS

### Identification of Activities Difficult to Perform

The most disabling activity limitation was defined by 52 of the 60 patients, whereas eight patients could not define what activity caused the most limitations. Within self-care, 22 patients (42%) reported problems, with 17 (33%) reporting problems at work, and 13 (25%) reporting problems during leisure time. Twelve patients had problems putting on a glove, ten with washing and grooming, eight with doing carpentry, and five with shaking hands.

Individual patients defined a wide range of activities that caused limitations, for example using a computer, baking, playing the piano or the trumpet, gardening, doing gymnastics, gripping a bicycle handlebar, or any activity that demanded manipulating objects with both hands. The performance of

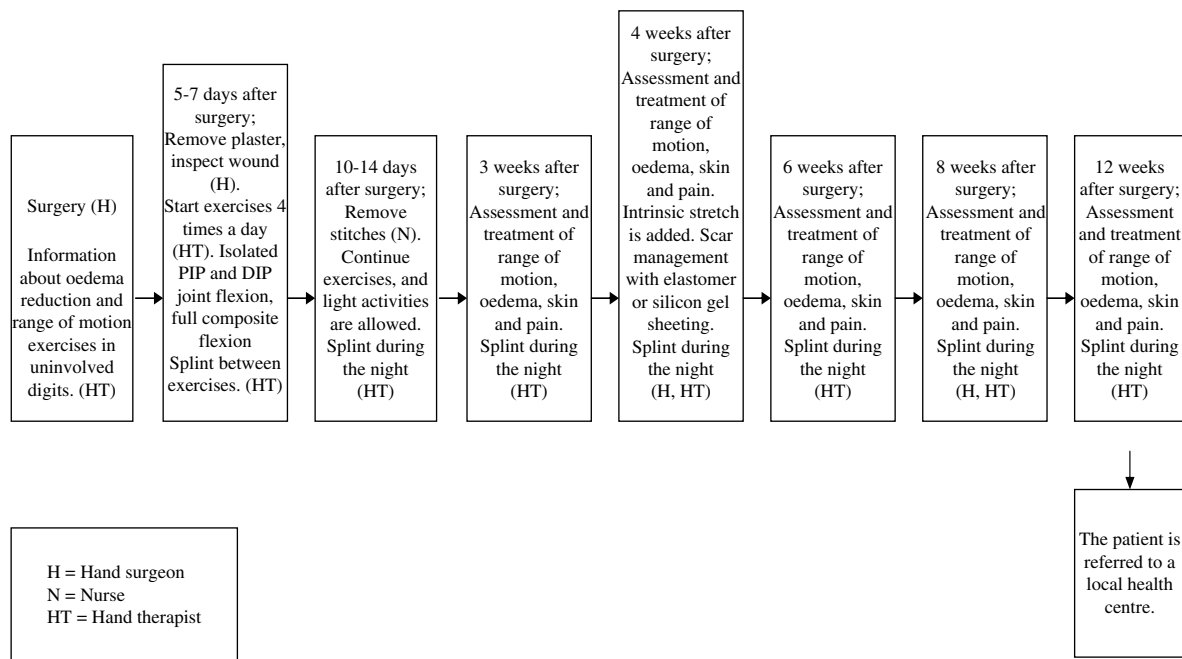


FIGURE 1. Standard protocol for patients with Dupuytren's contracture.

the activities was statistically improved ( $p < 0.001$ ) from a median of four to nine after three months.

### Self-reported Activity Limitations as Reported by DASH

The disability/symptoms scale was filled in by all 60 patients, with 16 of the patients also completing the work scale, and 14 the sport/music scale, Table 1. After interventions, 47 had a significantly lower DASH score on the disability/symptoms scale, which meant that they had fewer symptoms or limitations to their daily activities. Thirteen had a higher DASH score after interventions, and three of these were recurrent Dupuytren's contracture.

Eleven of 16 patients had a lower DASH score on the work scale, and four patients' scores were unchanged.

Ten of 14 had a lower DASH score on the sport/music scale, and four were unchanged.

TABLE 1. Self-reported Activity Limitations by Disabilities of the Arm, Shoulder, and Hand Questionnaire (DASH)

DASH	n	Before Interventions, Md (Iqr)	After Interventions, Md (Iqr)	p
Disability/symptoms	60	17 (7–28)	7 (3–12)	<0.001
Work	16	16 (6–47)	0 (0–6)	0.008
Sport/music	14	22 (0–75)	0 (0–3)	0.005

Scores reported by patients before and after interventions. Data analyzed by Wilcoxon signed-rank test, and presented as median (Md) and interquartiles (Iqr).

### Digital Extension

Seventeen patients had surgery in two digits each. Six of the digits had a total digital extension of less than 50 degrees. In five of the six digits only the MCP joint was involved, and one finger displayed only PIP joint involvement.

Eighty of the 81 digits had better total digital extension after interventions, and in one digit it was unchanged. The total mean digital extension before interventions was 105 degrees ( $SD \pm 37$ ), ranging from 20 to 170. After interventions, the mean was 24 degrees ( $SD \pm 22$ ), with a range from 21 to 108. Overall, the changes were significant,  $p < 0.001$ .

### Relation between Activity Limitations and Digital Extension

The analysis showed no significant correlation before interventions. However, after interventions a significant correlation appeared between the DASH score on the disability/symptoms scale and total digital extension ( $\rho = 0.28$ ,  $p = 0.011$ ).

### DISCUSSION

The results show that patients experienced fewer activity limitations reported by DASH after interventions and that the total digital extension was improved. The present study includes three different aspects of outcome after interventions for Dupuytren's contracture: identification of activities difficult to perform, self-reported activity limitations

as reported by DASH, and total digital extension. The study shows that patients with Dupuytren's contracture have limitations in many different types of activities, including activities that have not previously been described, such as washing and grooming. A study performed by Roush and Stern<sup>13</sup> described activities such as shaking hands, placing hand in pocket, putting on gloves, typing, and recreational activities such as golf or tennis as difficult to perform. Difficulties putting on gloves and shaking hands were also reported in the present study. Unlike the previous study, which provided five predetermined activities to choose from, the present study allowed patients to choose and define the most disabling activity limitations by themselves. When given that opportunity, many of the patients reported activity limitations that are not usually described in connection with Dupuytren's contracture, such as doing carpentry, gardening, gymnastics, and activities that require objects to be held with both hands. These results emphasize the importance of documenting patients' perceptions of what they consider meaningful. Activity limitation scores as defined by the patients were improved and reflect the importance of relevant and meaningful activities in measuring outcomes.

The scores on the DASH disability/symptoms scale were improved for 47 of 60 patients in this study, and the DASH score decreased from 17 to 7. This is a better result than that obtained by Skoff,<sup>12</sup> in whose study the DASH score decreased from 37 to 30. Although the surgical techniques differ in the studies, the interventions after surgery, with a night splint and range of motion exercises, are similar. However, the scores in themselves may be the result of more disability in the Skoff study, and therefore they are difficult to compare. Furthermore, the time for follow-up differs. In the present study, the outcome was measured after three months. In Skoff's study, the follow-ups for the two groups were performed after 2.7 and 3.5 years. The advantage of using the DASH is confirmed in both studies, as it can measure changes in daily activities over time.

Only a few patients answered the two optional scales, work and sport/music. This may be because the patients had retired, which people do at the age of 65 years in Sweden, or were still on sick leave three months after surgery. Another explanation can be that the patients do not engage in sport or music.

In an earlier study with 42 patients, the mean total deformity decreased from 81 to 32 degrees after surgery.<sup>14</sup> A night splint was used for three months, but hand therapy is not mentioned at all in that study. The authors conclude that if the deformity is allowed to worsen, it may lead to a poorer functional outcome. The patients in our study had severe deformities before surgery, and for most of them both the MCP and the PIP joints were involved. The PIP

flexion contractures represent the more complex cases. Nevertheless, the results in this study show an improvement in total digital extension from 105 to 24 degrees when the standard protocol was followed, which may be a result of the combined structured treatment. More research is needed to confirm these results, in particular studies including controls.

The follow-up was performed at three months after surgery as this is the standard treatment for Dupuytren's contracture at the clinic. After that, the patient is referred to a local health center. Loss of digital extension is central to Dupuytren's contracture, and the main goal of correction was to improve this aspect of range of motion. During the first months after surgery hard, thick scars can be a part of the problem affecting range of motion. It is of importance to emphasize the care of applying extension splints to grafted tissue, nerve repair, and fragile corner flaps because hypertrophic scar may be a result of aggressive tension applied too early in wound healing. As the follow-up in the present study was made after three months, total digital extension was chosen as an objective measurement to reflect impaired body function. It is too early to follow up other aspects such as finger flexion or grip strength after three months because improvement is still possible. Further, loss of flexion after surgery is common among patients with Dupuytren's contracture. A study by Roush and Stern<sup>13</sup> showed that no patient in their study achieved restoration of full range of motion, yet the patients were satisfied with the result.

Only the operated hand was measured. Because 46 patients (75%) had Dupuytren's contracture in both hands, it would not have been useful to measure the other hand as a control. Measurements of digital extension were made by five different occupational therapists. To increase the reliability, the same type of goniometer was used and the measurements were done according to the guidelines at the clinic. It has previously been shown that when experienced therapists make measurements according to standard guidelines, there is hardly any difference between them.<sup>27</sup>

There was a weak significant correlation between the DASH score on the disability/symptoms scale and total digital extension after intervention, but there was no significant correlation between these variables before interventions. Lack of correlation between digital extension and the DASH in patients with Dupuytren's contracture has been shown by Zyluk and Jagielski.<sup>28</sup> The weak correlation may reflect the fact that the ability to perform activities is affected by other factors as well. Digital extension in the finger joints constitutes one part of the physical components of the person. According to Townsend<sup>19</sup> the abilities of the individual, the specific activity, and the environment interact in performing activities. In the present study, the correlation after

interventions was weak, although the joint angles improved significantly. One explanation may be that the patients learned to adjust to these gradual deteriorations in hand function and found alternative ways to manage to be active, and still experience satisfaction with their activities.

Most patients in the present study were men (92%), which confirm results from other studies showing that the disease is more common in men.<sup>2,3</sup> The sample in this study is also comparable to other previously performed studies concerning age,<sup>2</sup> heredity,<sup>29</sup> and diabetes.<sup>4,30</sup> Further, the drop outs did not differ from the participants with respect to age, sex, duration of symptoms, heredity, diabetes, or unilateral or bilateral disease.

Twenty-two patients declined the invitation to participate, which may be an expression of weariness at being asked to fill in questionnaires by the clinic and generally in health care.

## CONCLUSIONS

The results of this study have shown that surgery combined with postoperative hand therapy affects outcome to a significant degree. Our results reflect the patients' view, as they were asked to define activity limitations that they considered relevant. Including the patients' own views has revealed information that has not been reported previously about activities experienced as difficult for patients with Dupuytren's contracture.

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# JHT Read for Credit

## Quiz: Article # 112

**Record your answers on the Return Answer Form found on the tear-out coupon at the back of this issue. There is only one best answer for each question.**

- #1. The purpose(s) of the investigation was to evaluate \_\_\_\_\_ following palmar fasciotomy
- digital extension
  - functional ability
  - digital motion and functional abilities
  - grip and pinch strength
- #2. Activity limitation was assessed by the
- DASH
  - SF 36
  - Moberg pick up test
  - Sollerman
- #3. The authors identify the following as an additional source of information compared to other studies
- the investigators' observations of the patients' use of their hands during follow up clinical visits

- the surgeons' description of the pathological tissue excised at the time of surgery
  - the operational description of the post op dressings
  - the self reporting of their functional difficulties by the patients
- #4. The correlation between digital extension and the DASH was a
- strong significant correlation after intervention
  - strong significant correlation before intervention
  - weak significant correlation after intervention
  - weak significant correlation before intervention
- #5. Active ROM was initiated approximately \_\_\_\_\_ post op
- 2 weeks
  - 1 week
  - 2 days
  - 1 day

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