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ARTICLE

Needle fasciotomy for Dupuytren's contracture- a prospective cohort study of 58 fingers with a median follow-up of 6.5 years

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ABSTRACT

Needle fasciotomy (NF) is a minimally invasive treatment option for Dupuytren contractures, but long-term results have indicated a high recurrence rate. This prospective study was initiated to monitor the introduction of NF in a context where limited fasciectomy had been the only treatment option, and to investigate the long-term results. The inclusion criterion was a palpable cord with a Metacarpophalangeal (MCP) and/or Proximal interphalangeal (PIP) contracture in one or more fingers. Fifty-eight fingers in 42 patients (40 male and 2 female with a median age of 68 years) were treated by needle fasciotomy between November 2010 and March 2012, and were followed for a median of 6.5 years. The median total passive extension deficit (TPED) was 52° at baseline, but decreased significantly to 20° postoperatively. No severe adverse events such as nerve or tendon injuries were reported. At final-follow up of 48 fingers the median TPED was still significantly reduced to 23° for all fingers ($p < 0.0001$). Twenty-nine fingers retained full correction of the contracture, and in patients with recurrent contractures NF was preferred in 13 out of 17 patients. This study showed that needle fasciotomy is a safe procedure for Dupuytren's contracture, with excellent immediate reduction of the joint contracture and with a recurrence rate comparable to treatment by collagenase clostridium histolyticum (CCH).

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Introduction

Dupuytren's disease (DD) is a condition in which myofibroblasts in the aponeurosis of the hand proliferate, contract and form a rigid cord that causes an extension deficit in the affected finger, a Dupuytren cord [1,2] (DC, Figure 1(A)). While limited fasciectomy (LF) with excision of the cord has become the mainstay treatment in some European countries [3], French rheumatologists have developed a minimally invasive procedure in which the cord is divided percutaneously by a thin needle, needle fasciotomy (NF) [4,5]. Although this method is simple for the patient and requires considerably less resources than open surgery [6], a high degree of recurrence compared to LF [7] has been reported and there are few studies with a follow-up that exceeds five years. Pess *et al*, for instance, found a total recurrence rate of 48% in a study with a median follow-up time of three years. However, a randomized controlled study between limited fasciectomy and NF reported that 53% of patients with recurrence after NF preferred the same treatment again [7]. Complications after NF, such as skin ruptures and injury to the flexor tendons and digital nerves are rare, especially compared to limited fasciectomy which has a high rate of complications [8]. At our department, limited fasciectomy was the only treatment option for Dupuytren's contracture until 2010. The indication for this procedure was a contracture of 30–40 degrees or more, and patients generally had to wait for the contracture to develop even though they had well-developed cords. In order to offer an earlier treatment option we introduced NF, and this study was designed to monitor the short and long-term effects of this treatment regarding reduction of the contracture, adverse events, recurrence and need for further treatment.

Materials and methods

This study is a prospective cohort study of all patients with Dupuytren's contracture treated by NF at the Department of Hand Surgery between November 2010 and March 2012. The main inclusion criteria were the presence of a Dupuytren cord suitable for NF (i.e. readily palpable and clearly defined from surrounding tissue), and a flexion contracture which limited the hand function of the patient. Reasons for exclusion were an anticipated need for arthrolysis of the affected joints, or that the patients did not wish to attend continuous annual follow-up. Both metacarpophalangeal (MCP) and proximal interphalangeal (PIP) joint contractures with well-defined Dupuytren cords were included. No specific flexion contracture was defined and multiple fingers in the same hand were included, as well as recurrences after previous limited fasciotomy, if the inclusion criteria applied.

All patients were included and treated by two senior hand surgeons well acquainted with the method, and the final follow-up was completed by a resident in orthopedic surgery between November 2017 and January 2018. The study was approved by the regional Ethical Committee (EPN 805-11).

Patients and outcome measures

All patients with Dupuytren disease referred to the department were assessed for the study, and all participants were included consecutively. After the patients had received information and signed a letter of consent, they were scheduled for needle fasciotomy. The primary outcome measure was the total passive extension deficit of the MCP and PIP joints (TPED). At inclusion, all

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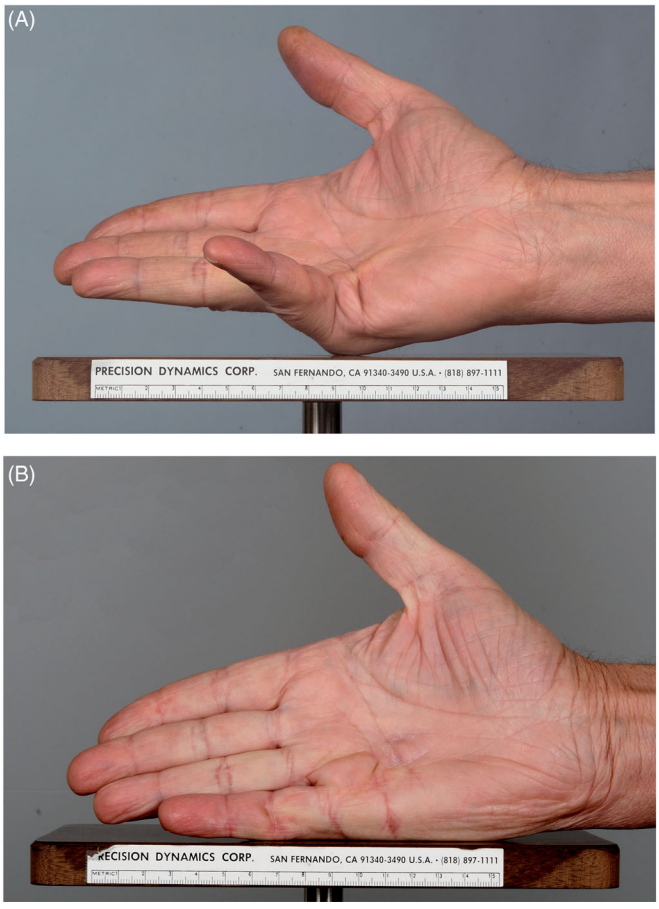

Figure 1. A Dupuytren contracture with a cord in the little finger before treatment with NF (A) and at the one-year follow-up (B). Note that the well-defined pretendineous cord before treatment had disappeared completely after one year.

patients were evaluated regarding the degree of the contracture/s, grip strength and presence of a Dupuytren cord by the surgeons, and they also completed the DASH and Quick-DASH questionnaires [9]. The hand to be treated was also photographed.

Needle fasciotomy

The procedure was performed in a minor operating room in the outpatient clinic. The hand to be treated was prepared and draped with an arm cover by an operation nurse. NF was performed with a 25 gauge needle fitted on a 2.5 ml syringe with 1 ml of methylprednisolone [10] (Depomedrol®, Pfizer, 40 mg/ml) and 1.5 ml of mepivacaine (Carbocain®, AstraZeneca, 20 mg/ml). The primary site of treatment was chosen at the thinnest part of the cord of the most contracted joint, avoiding flexion creases to minimize the risk of skin rupture. A small volume was injected above the cord for local anesthesia and the finger was gently extended passively during the whole of the remaining procedure. The needle was used to perforate the cord until disruption with subsequent extension of the joint. In patients with more than one affected joint, or multiple cords at the same joint, the procedure was repeated until all cords had been ruptured. In treatment of PIP joints, a smaller volume was administered than for the MCP joints and distal sensibility was also assessed frequently in order to avoid damage to the neurovascular bundle. Any skin ruptures were recorded and the injection site was covered with a bandage. If there was a difference of ten degrees or more between active and passive extension of the joint, the patients were referred to an occupational therapist for a night splint with full extension of the finger to be used for three months. The patients were allowed to use their hands normally immediately after the procedure.

Follow-up

The immediate results were assessed directly after the procedure and after two weeks by either of the two senior hand surgeons. The presence of skin ruptures as well as the size of these was recorded, and the treated hand was examined for signs of infection, hematoma and nerve injury (as measured by a 2-point discrimination test). Passive extension of the treated joint/s was measured, grip strength was recorded and the treated hand was photographed. Hyperextension of the MCP joint was recorded by negative measurements, e.g. −20 degrees. In case of sick-leave after two weeks, the duration of this leave was recorded.

The intermediate and long-term results were assessed after three and six months and after one year, with subsequent annual follow-up by either of the two senior hand surgeons. The patients completed the DASH and Quick-DASH questionnaires, and the treated finger was assessed regarding passive extension of the treated joint/s, TPED, the presence of a Dupuytren cord and recurrence of any contracture with need for secondary treatment. Recurrence was defined as the need for a secondary procedure in a finger that had been straightened. Patients who were scheduled for secondary treatment were excluded from further follow-up.

Statistical methods

Shapiro-Wilks test for normality failed to show normal distribution of any data, hence non-parametric tests were applied throughout the study. Repeated individual measurements (e.g. TPED) were analyzed with Wilcoxon's signed-rank test. Categorical data (e.g. prevalence of cords) were analyzed with McNemar's test. A significance level of 5% ($\alpha = 0.05$) was used for all statistical tests of the outcome, so that a p-value of <0.05 was considered significant. SPSS software version 22–24 and Excel: Mac 2011 were used for the statistical analysis.

Results

Forty-two patients, 40 male and 2 female, with 58 fingers were included and treated in this study. The characteristics of the included patients and fingers are described in Table 1. The median age of the patients was 68 years (range 43–83), and the majority had contractures of the little and ring fingers. Four of the fingers had been opererated with a limited fasciectomy prior to the study, and had developed recurrent contractures.

Immediate results

The median total passive extension deficit (TPED) decreased significantly from 52° (range 15–166°) at baseline to 20° (range −10°−142°) postoperatively, and was 15° (range −5°–122°) at two weeks ($p < 0.0001$). The median MCP contracture was 45° (range −30°–92°), and the median PIP contracture for 29 patients with PIP involvement (defined as extension deficit >5°) was 34° (range 6°–94°) at baseline, but was reduced significantly to 10° (range −15°–57°) and 20 (0°–72°) at two weeks, respectively.

The most severe adverse event was a reported transient hemidigital paresthesia that later resolved after three months in a patient treated for a PIP contracture. No cases of flexor tendon injuries or infections were registered at two weeks. Superficial

Table 1. Patient characteristics at baseline.

Patients, n = 42	
Age (yrs)	
Median (range)	68 (43–83)
Gender, *n* (%)	
Male	40 (95)
Female	2 (5)
Hand with contracture (*n*)	
Right	25
Left	14
Bilateral	3
Duration since first symptoms (yrs)	
Median (range)	7 (1–30)
Grip strength affected hand (kgs)	
Median (range)	43 (16–70)
Quick-DASH score	
Median (range)	9 (0–50)
DASH-score	
Median(range)	6 (0–53)
Fingers, n = 58	
Finger involved (*n*)	
Little	30
Ring	22
Middle	5
Index	0
Thumb*	1
TPED# (°)	
Median (range)	52 (15-166)
MCP (°)	
Median (range)	45 (-30-92)
PIP (°)	
Median (range)	48 (24-92)
Affected joints, *n*	
MCP (>5°)	55
PIP (>5°)	29

*All measurements for the thumb are reported separately and are not included in calculations of TPED.
#MCP + PIP.

skin ruptures were seen in 16 fingers (28%) with a median length of 2 mm (0.5–10 mm). After two weeks, ten of these were completely healed and six were not healed. These remaining skin ruptures all healed uneventfully. Grip strength was measured at two weeks, and there was no significant difference between the treated and the contralateral hand ($p = 0.942$). One single patient had a sick leave for one week due to manual labor.

Long-term results

The number of patients who attended annual follow-up declined throughout the study, with 53 fingers assessed at one year and 42 at two years even though all patients were sent a letter with an appointment. The three-year follow-up included only 34 fingers. In order to collect data for all participating patients, a follow-up was performed by a resident in orthopedic surgery between November 2017 and January 2018.

At this follow-up, 35 fingers were assessed. Four patients (8 treated fingers) were deceased, and two patients (two treated fingers) declined follow-up, and these 10 fingers were excluded in the final follow-up. Data regarding the remaining 13 fingers, such as recurrence and further treatment, were obtained from medical records and measurements from the last assessment were used as final follow-up. The median follow-up time of all patients was 6.5 years (IQR 4.6 years). The results are shown in Figure 2 and Table 2. The primary outcome, TPED, decreased significantly between baseline and all subsequent measurements ($p < 0.0001$).

The prevalence of Dupuytren cords varied throughout the study, with a significant reduction of the number of cords at both MCP and PIP joint levels after one year as illustrated in Figure 1(B)

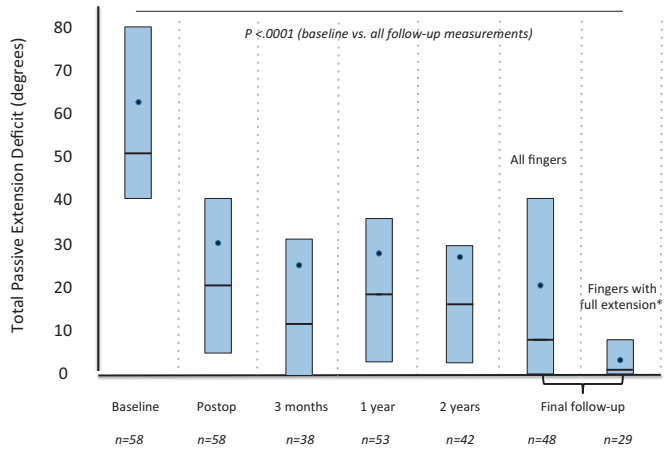

Figure 2. Median total passive extension deficit in degrees (MCP + PIP). The boxes represent the interquartile ranges, the lines the medians and the dots the average. The TPED had decreased significantly (<0.0001) compared to baseline throughout the study. *Fingers retaining full postoperative correction of the contracture.

Table 2. Long-term results after NF. "Final follow-up" refers to the last measurements in each patient.

Extension deficits	
TPED (MCP + PIP)	Figure 2
All MCP joints – degrees, median (IQR); range	
Baseline	45 (29); −30–92, *n* = 58
Postop	10 (20); −30–78, *n* = 58
3 months	10 (21); 0–60, *n* = 38
1 year	2 (15); −5–80, *n* = 53
2 year	8 (15); −32–70, *n* = 42
Final follow-up	0 (20); −40–65, *n* = 48*
PIP joints with >5° degrees, median (IQR)	
Baseline	34 (52); 6–94, *n* = 29
Postop	26 (39) 0–90, *n* = 29
3 months	17 (54); 0–74, *n* = 16
1 year	20 (28); 0–92, *n* = 27
2 year	22 (41); 0–90, *n* = 20
Final follow-up	30 (47); 0–80, *n* = 20*
Palpable cords	Figure 1
MCP joint- *n* (%)	
Baseline	53 (90)
1 year	29 (56)
2 year	19 (45)
Final follow-up	32 (57)
Decrease from baseline to final follow-up	21 $p = 0.001$
PIP joint- n^{Ψ}	
Baseline	47
1 year	27
2 year	21
Final follow-up	27
Decrease from baseline to final follow-up	20 $p = 0.006$
Patient reported outcome measures	
DASH - median (IQR); range	
Baseline	6 (14); 0–53
1 year	4 (13); 0–43
2 year	2 (8); 0–93
Final follow-up	7 (18); 0–93
Quick-DASH – median (IQR); range	
Baseline	9 (18); 0–50
1 year	5 (10); 0–48
2 year	2 (11); 0–92
Final follow-up	5 (25); 0–70
Additional procedures#-n (%)	
Needle fasciotomy	13 (22)
Limited fasciectomy	4 (7)

*Four patients (with a total of 8 fingers) were deceased and two patients (with a total of 2 fingers) denied follow-up.
ΨTotal number of PIP cords (central, ulnar and radial).
#Secondary procedure either performed (*n* = 13) or planned (*n* = 4) at final follow-up for all fingers.

($p < 0.05$). This significant decrease was consistent for the MCP and PIP joints throughout the study ($p < 0.05$, Table 2).

Seventeen fingers were found to have recurrent contracture and had undergone another procedure ($n = 13$) or were scheduled for a secondary procedure of the finger ($n = 4$) as described in Table 2. In 13 of these patients, NF was performed again. Four patients had LF instead: two due to painful nodules associated with the cord that the patient wanted excised, and two because of PIP engagement which warranted artholysis. An analysis regarding the prevalence of cords in patients who had secondary treatment showed that 17 (89%) had one or more PIP cord at baseline while only 2 (11%) had isolated MCP cords. A total of 29 fingers had had no further treatment for Dupuytren contracture. The median TPED in these remaining 29 fingers was 0° (range −35°–42°).

DASH and Quick-DASH did not show any significant change between baseline and follow-up at any time (DASH $p = 0.30$–0.69, Quick-DASH $p = 0.47$–0.9), with the exception of Quick-DASH at the one year follow-up which showed a significant decrease ($p = 0.009$).

Discussion

This study showed that all fingers treated by needle fasciotomy for a Dupuytren contracture had a significant reduction of the extension deficit in the affected joints, and that half of all fingers retained a satisfying result without any need for further treatment during the follow-up time. A similar recurrence rate three years after NF has been described earlier [11], while another study have shown recurrence in 22% after five years [7] . An explanation for the discrepancy between the latter study and our results may be found in the different study designs (e.g. mixed MCP and PIP joints) and different definitions of recurrence. The definition of an extension deficit of >20° in a previously straightened finger has been generally accepted [12], and if applied to our data a total of 13 fingers (25%) had a recurrence of the contracture which corresponds well to the five-year results of the previous study on NF [7]. Despite the high recurrence rate in this study by the initial definition, a vast majority of patients with recurrent disease (75%) preferred another needle fasciotomy, which represents a slightly higher percentage compared to the five-year results presented by Van Rissjen *et al* [7]. While the most common adverse event was skin rupture (28%), no severe complications to NF (e.g. infections, flexor tendon or permanent nerve injuries) were seen. In a systemic review by Krefter *et al,* the overall complication rate for NF was 19%, which represents the lowest rate for all Dupuytren treatments and this corresponds well to our results [13]. Although the objective measurements of joint motion showed significant improvement throughout the study, a corresponding improvement could not be detected in the PROMs applied, the DASH and the Quick-DASH. Budd *et al* have shown that this questionnaire can detect subjective improvement in patients treated for Dupuytren's contracture, but its sensitivity and specificity to this condition has been questioned in recent years [14].

Needle fasciotomy disrupts the Dupuytren cord, but a recent study has suggested that this division may lead to resorption of the residual collagen [15] and half of the fingers in this study had no residual cord at final follow-up (Figure 1) which lends support to this thesis.

Even though the follow-up time surpasses most other longitudinal studies of Dupuytren treatment, there are several methodological limitations in this study to be considered. The cohort was relatively small, and the patients were not followed on a regular annual basis after the one-year follow-up. The follow-up at three years included only 34 fingers, and the main reason for this was that patients probably lost interest in follow-up visits unless they had recurrence and that our resources were limited in contacting the patients beyond sending them a letter. The inclusion criteria were not strict compared to other studies (i.e. no specific degree of the contracture, mixed MCP and PIP-joints, recurrent contractures from earlier treatment), and our primary definition of recurrence as the need for another treatment in a previously straightened finger is certainly outdated today. The number of patients excluded from the study, and the reasons for exclusion, were also not recorded and no disease-specific PROM was used. Furthermore, all but the final measurements were made by the surgeons who had also treated the patients, giving way to possible bias.

Minimally invasive treatment options for Dupuytren's contracture have become increasingly popular since the introduction of Collagenase *Clostridium Histolyticum* (CCH), with a renewed interest in NF since the latter method is considerably less expensive [16]. A recent systematic review has concluded that there are no known differences in the outcome between NF and treatment by collagenase [17], but the follow-up time of randomized controlled studies between the two methods have not yet surpassed three years [18]. Our study offer long-term results after NF in a population of mixed contractures, and shows that it is an effective and safe treatment without any serious adverse events. The overall high recurrence rate could be considered acceptable, given that a vast majority of patients with recurrence chose to be treated by NF again.

Disclosure statement

The authors report no conflicts of interest.

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