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Postoperative hand therapy in Dupuytren's disease

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Abstract

Background. Postoperative hand therapy in patients after surgery for Dupuytren's contracture is common medical practice to improve outcomes. Until now, patients are referred for postoperative hand rehabilitation on an empirical basis.

Purpose. To evaluate whether referral criteria after surgery because of Dupuytren's disease were actually adhered to, and, to analyse differences in outcomes between patients who were referred according to the criteria (correctly referred) and those who were not referred but should have been (incorrectly not referred).

Methods. Referral pattern was evaluated prospectively in 46 patients. Total active/passive range of joint motion (TAM/TPM), sensibility, pinch force, Disability Arm Shoulder Hand questionnaire (DASH) and Michigan Hand outcomes Questionnaire (MHQ) were used as outcome measures preoperatively and 10 months postoperatively.

Results. In total 21 patients were referred correctly and 17 patients were incorrectly not referred. Significant improvements on TAM/TPM, DASH and MHQ were found at follow-up for the total group. No differences in outcomes were found between patients correctly referred and patients incorrectly not referred for postoperative hand therapy.

Conclusion. Referral criteria were not adhered to. Given the lack of differences in outcomes between patients correctly referred and patients incorrectly not referred, postoperative hand therapy in Dupuytren's disease should be reconsidered.

Keywords: *Dupuytren's disease, hand therapy, outcomes*

Introduction

Dupuytren's disease is characterized by the occurrence of nodules and cords in the palmar fascia. Due to the cords, progressive contractures of one or more fingers develop. The etiology and pathogenesis of the disease is still unclear.

A Dupuytren's diathesis has been described [1], based on four features, supposedly influencing progressiveness of the disease and tendency to recurrence. These features include: early onset of the disease (< 40 years of age), bilateral involvement, ectopic lesions (knuckle pads, fascia plantaris, and penile fascia) and a positive family history. The Dupuytren's diathesis is associated with unfavourable outcomes: Multiple involvements of fingers of the same hand or the occurrence of excessive postoperative inflammatory reactions. Recently a higher risk for recurrence, in the presence of three of these features, has been reported [2]; a positive family history did not seem to influence the risk of recurrence. Clinically it is assumed that recurrence is related to worse outcomes [3,4].

Already in 1831, Dupuytren himself emphasized the importance of postoperative splinting to improve or preserve joint mobility. Since then, hand rehabilitation to enhance surgical outcomes is advocated [3,5,6]. Postoperative hand rehabilitation, including regular range-of-motion exercises, static or dynamic splints, scar and oedema management, should start after the inflammatory phase of wound healing, that is 3–5 days post-surgery [7]. It has been stated that an effective postoperative management accounts for 50% of surgical outcomes [8]. In Ireland, 98% of

the surgeons use splints as part of the postoperative regimen [9].

At our hospital (UMCG, Groningen, The Netherlands), only patients with an expected poor outcome after surgery for a Dupuytren's contracture are referred for postoperative hand therapy in order to gain or preserve optimal joint mobility (see Appendix for the treatment protocol). Referral criteria for postoperative hand therapy at our hospital are:

Preoperatively:
(1) Recurrent Dupuytren's contracture;
(2) The presence of a flexion contracture of more than 40° in the metacarpophalangeal (MP) or the proximal interphalangeal (PIP) joint.

Postoperatively:
(1) Extended surgical scars, after combined fasciectomy and capsulotomy;
(2) A progressive fast loss of passive joint mobility of more than 15°, compared to the preoperative state.

These referral criteria were developed on the basis of clinical experience. No scientific evidence exists for the adequacy of these referral criteria. Although referral of patients from the Department of Plastic Surgery to the Centre for Rehabilitation is discussed frequently in order to optimize the postoperative hand therapy of patients with Dupuytren's disease, the clinical impression was that referral criteria were not strictly met.

The aim of this research was two-fold: Firstly to evaluate whether the referral criteria for postoperative hand therapy in patients who were operated upon because of Dupuytren's disease were actually adhered to; and secondly, whether differences in outcomes existed between patients who were referred according to the criteria (correctly referred) and those who were not referred but should have been, according to the referral criteria (incorrectly not referred).

Patients and methods

All patients who were planned for surgery at our hospital because of a Dupuytren's contracture in the period October 2003 and December 2004 were eligible for the study.

Inclusion criteria were: At least 18 years of age, the ability to read and write Dutch. Exclusion criteria were: Withdrawal of surgery, inability to come to the research unit for follow-up, other surgical interventions besides the correction of a Dupuytren's contracture at the same time or severe cognitive or mental disabilities.

Demographics and the medical history were assessed by means of a questionnaire or retrieved from the medical records. The assessment included age, sex, recurrence, features of the Dupuytren's diathesis, co-morbidity, medication, intoxications, and complications.

Additionally, criteria for referral were registered for each patient and (correct) referral or (incorrect) absence of referral was determined.

All patients were invited to come to the research unit at the rehabilitation ward twice, preoperatively as well as approximately 10 months postoperatively. At both occasions, the joint mobility of the affected fingers, sensibility and pinch grip were measured and the Disability of the Arm, Shoulder and Hand questionnaire (DASH) and Michigan Hand Outcomes Questionnaire (MHQ) were filled out.

The range of motion of all affected finger joints was measured with a finger goniometer, as described by the American Academy of Orthopaedic Surgeons [10]. The Total Active Mobility (TAM), defined as the sum of the active flexion in MP, PIP and DIP-joints minus the lack of active extension in the same joints, was calculated. The Total Passive Mobility (TPM), defined as the sum of passive flexion in MP, PIP and DIP-joints, minus the lack of passive extension in these joints, was calculated [11]. Sensibility was assessed by using a moving 2-point touch discriminator at the volar part of the finger tip, ulnarly and radially. Finally, the strength of the affected fingers was measured using a digital pinchmeter. In case of involvement of multiple fingers, the averages of the above measurements of the fingers involved were used for further analysis. All data were stored and processed using a digital measurement system.

Disabilities and symptoms associated with hand function limitation were assessed by means of the DASH questionnaire (Dutch language version). The DASH is a 30-item self-report questionnaire. Scores range from 0 – 100, where lower scores represent a better hand function. The DASH is valid, reliable, and sensitive to change in patients with limitations of the upper extremity function of diverse origin [12].

Limitations in hand function in general were assessed by means of the MHQ (Dutch language version). The MHQ is a hand-specific, 57-item self-report outcome instrument that includes six distinct scales, enabling the patient to describe specific hand problems. The six scales are divided into: Overall hand function, activities of daily living, pain, work performance, aesthetics and satisfaction. Scores range from 0 – 100, where a higher score implies better hand function. The MHQ is valid, reliable and responsive to change [13]. The psychometric properties of both questionnaires are unknown in patients with Dupuytren's disease.

Statistical analyses were performed with SPSS software (version 12.0). A paired sample *t*-test was used for the continuous variables in pre- and postoperative comparisons. The independent sample *t*-test was used to compare between group differences. The Mann-Whitney test was used for between group differences for variables of an ordinal data level. The *p*-value for significance was set at 0.05.

Multivariate linear regression analyses were performed to predict the change in TAM, DASH and MHQ (outcome variables) on the basis of the following variables: Sex, age, number of fingers operated upon, recurrence, MP or PIP contracture $>40°$, first signs before 40 years of age, a positive family history, ectopic lesions, bilateral involvement, number of features of the Dupuytren's diathesis, alcohol consumption, postoperative complications, and postoperative hand therapy (predictor variables). In univariate analyses, the predictor variables related to the outcome variables were identified ($p \leq 0.10$). These predictor variables were entered in the linear regression analysis (stepwise forward). The study was approved by the local medical ethics committee.

Results

During the study period, 75 patients were operated upon because of a Dupuytren's contracture. Of those, 27 did not participate in the study. Reasons for not participating in the study were: Living too far from the hospital, too much research done previously and insufficient time to perform the preoperative measurements due to planning of surgery very shortly after the first consultation to the plastic surgeon. Two additional patients were excluded from the statistical analysis because of loss to follow-up. The non-participants did not differ significantly from the participants, regarding age and sex. Further data on the former patients were not available. Descriptive statistics of the participants with complete follow-up ($n = 46$) are summarized in Table I.

Besides diabetes mellitus and cardiovascular diseases, half of all patients reported further co-morbidity: COPD (6 patients), chronic pain (6), internal diseases (5), psychological or psychiatrical diseases (4), oncology (2), prostate problems (1) and glaucoma (1). The results of the pre- and postoperative measurements of the participants with complete follow-up ($n = 46$) are summarized in Table II.

Outcomes according to referral criteria

Of the 38 patients (83%) who met the criteria for postoperative hand therapy, 21 (55%) were actually referred to a hand therapy program. The group of

Table I. Descriptive statistics of the study population ($n = 46$).

Variables	
Male/female ratio	38/8
Mean age in years (SD)	62 (9.9)
Number of fingers operated	7
Mean follow-up time in months (range)	10 (7–13)
Features of the Dupuytren diathesis:	% (*n*)
First sign of Dupuytren's disease at age <40 years	28 (13)
Positive family history	37 (17)
Ectopic lesions	37 (17)
Bilateral involvement	52 (24)
Any feature of the Dupuytren's diathesis	78 (36)
1 feature present	33 (15)
2 features present	20 (9)
3 features present	22 (10)
4 features present	4 (2)
Preoperative criteria for referral to hand therapy*	
Recurrent Dupuytren's disease	57 (26)
MP or PIP deformity $>40°$	57 (26)
Meeting criteria for referral for postoperative hand therapy*	83 (38)
Correctly referred	46 (21)
Incorrectly not referred	37 (17)
Alcoholic consumptions ≥ 2 units/day	41 (19)
Smoking	26 (12)
Diabetes Mellitus	9 (4)
Cardiovascular diseases	46 (21)
Co-morbidity	50 (23)
Postoperative complications**	50 (23)
Initial wound healing problems	37 (17)
Loss of sensibility	15 (7)
Pain >3 weeks after surgery	4 (2)

MP, Metacarpo Phalangeal joint; PIP, Proximal Inter Phalangeal joint; *Referral criteria are described in the introduction section of this paper; **Some patients experienced more than one complication.

patients correctly referred for postoperative hand therapy was similar to the group of patients incorrectly not referred, regarding age and sex (see Table III). There were significantly less patients with bilateral involvement in the referred group ($p = 0.02$). A considerable difference in the presence of flexion contractures in MP or PIP joints of $>40°$ and of first signs of Dupuytren's disease before the age of 40 years ($p = 0.07$) was found.

Postoperative improvements on outcome variables did not differ between patients who were correctly referred and those who were incorrectly not referred. There was a tendency for better improvement on TAM scores within the group of correctly referred patients ($p = 0.08$). Patients who were incorrectly not referred showed better improvement on MHQ scores, but this difference also failed to reach statistical significance ($p = 0.07$). Results are shown in Table IV.

The results of the multivariate linear regression analyses are summarized in Table V. The mean increase in TAM was 35.6°. For patients with an MP

Table II. Population means (46 patients/78 fingers) of pre- and postoperative measurements.

	Preoperative mean (SD)	Postoperative mean (SD)	Improvement mean (SD)	95% Confidence Interval of the difference
TAM in degrees	184 (49)	222 (39)	38 (36)	−49.5 to −27.9*
TPM in degrees	236 (52)	266 (47)	30 (43)	−42.0 to −16.4*
Sensibility in mm	4.8 (1.3)	4.3 (1.6)	0.5 (1.7)	−0.04 to 0.95
Pinch grip in kg	3.3 (2.1)	3.5 (1.9)	0.2 (1.2)	−0.16 to 0.60
DASH	12.1 (12.9)	6.6 (8.8)	5.5 (10.0)	2.55 to 8.47*
MHQ	74.7 (12.8)	83.9 (14.9)	9.2 (14.4)	4.93 to 13.5*

TAM, Total Active Mobility in MP, PIP and DIP joint; TPM, Total Passive Mobility in MP, PIP and DIP joint; Sensibility: measured by assessing the moving 2-points discrimination at the fingertip; Pinch force, measured using a pinch grip meter. Measurements were averaged if more than one finger per patient was involved; DASH, Disability Arm Shoulder Hand questionnaire; MHQ, Michigan Hand Outcomes Questionnaire; *Confidence intervals not including the neutral value of no difference (0) are statistically significant ($p \leq 0.05$).

Table III. Descriptive statistics of patients correctly referred ($n = 21$), incorrectly not referred ($n = 17$)* respectively for postoperative hand therapy.

Variables	Correctly referred	Incorrectly not referred	Difference between groups (95% CI)
Mean age (SD)	59.2 (11.3)	62.6 (8.9)	−3.4% (−9.5 to 3.4)
Males	86% (18)	71% (12)	15% (−10 to 41)
Flexion contracture >40°	81% (17)	53% (9)	28% (−2 to 53)
Recurrence	67% (14)	71% (12)	−4% (−30 to 24)
Bilateral involvement	48% (10)	71% (12)	−23% (−48 to 8)
Other localizations	38% (8)	41% (7)	−3.5% (−31 to 26)
First signs before age 40	48% (10)	12% (2)	36% (6 to 58)**
Positive family history	43% (9)	35% (6)	8% (−22 to 35)

95% CI, 95% confidence interval; *Referral criteria are described in the introduction section of this paper; **Confidence intervals not including the neutral value of no difference (0) are statistically significant ($p \leq 0.05$).

Table IV. Postoperative improvements on outcome variables in patients correctly referred ($n = 21$), incorrectly not referred for hand therapy ($n = 17$).

	Correctly referred mean (SD)	Incorrectly not referred mean (SD)	95% Confidence Interval of the difference
TAM, in degrees	50 (40)	29 (27)	−43.9 to 2.4
TPM, in degrees	29 (52)	22 (28)	−33.5 to 20.6
Sensibility, in mm	0.6 (1.7)	0.3 (1.8)	−0.9 to 1.4
Pinch grip, in kg	0.13 (1.4)	0.14 (1.3)	−0.9 to 0.9
DASH	5.2 (12.0)	4.6 (8.1)	−6.3 to 7.5
MHQ	3.2 (15.9)	11.8 (10.7)	−17.7 to 0.7

TAM, Total Active Mobility in MP, PIP and DIP joint; TPM, Total Passive Mobility in MP, PIP and DIP joint; Sensibility, measured by assessing the moving 2-points discrimination at the fingertip; Pinch force, measured using a pinch-grip meter; Measurements were averaged if more than one finger was involved; DASH, Disability Arm Shoulder Hand questionnaire. MHQ, Michigan Hand Outcomes Questionnaire; Confidence intervals not including the neutral value of no difference (0) are statistically significant ($p \leq 0.05$).

or PIP contracture of >40° the increase is an additional 33.1°. For patients with bilateral involvement the increase in TAM is 29.8° less. The mean increase in scores on the DASH for females was 14.6 and for males the increase was 11 points less. The average change in MHQ-global was 9.4 points less for those patients who underwent postoperative hand therapy compared to those who did not undergo hand therapy. Additionally, the increase in MHQ was averagely 8.8 points less for patients who were operated upon for a recurrent Dupuytren's disease.

Discussion

After surgery for Dupuytren's disease, the active and passive range of joint motion of the affected fingers and the patient's opinion on their hand function (DASH score and MHQ scores) improved significantly between pre- and postoperative measurements. Surprisingly, the features of the Dupuytren's diathesis did not influence the outcomes, except for patients with bilateral involvement. This finding is in contrast with previous studies in which more features of the diathesis were associated with unfavourable outcomes [14]. As a consequence, patients with bilateral involvement should be monitored carefully after surgical correction of Dupuytren's disease and referral criteria for hand therapy should probably

Table V. Results of multivariate linear regression analyses to predict change in TAM, DASH and MHQ.

Dependent	Independent	β	95% CI β	R^2 Change
TAM	Flexion contracture $>40°$ (no = 0, yes = 1)	33.1	15.2 to 50.9	19%
	Bilateral involvement (no = 0, yes = 1)	−29.8	−47.5 to −12.1	17%
	Constant	35.6	19.5 to 51.6	
DASH	Gender (female = 0, male = 1)	−11.0	−18.2 to −3.8	18%
	Constant	14.6	8.1 to 21.1	
MHQ	Postoperative hand therapy (no = 0, yes = 1)	−9.4	−17.2 to −1.5	15%
	Recurrence (no = 0, yes = 1)	−8.8	−16.7 to −0.9	9%
	Constant	18.5	12.0 to 24.9	

β, regression coefficient; 95% CI, 95% Confidence Interval; R^2 Change, Explained variance per predictor entered in the regression equation; TAM, Total Active Mobility in MP, PIP and DIP joint, averaged if more than one finger was involved; DASH, Disabilities Arm Shoulder Hand questionnaire; MHQ, Michigan Hand Outcomes Questionnaire.

include patients with bilateral involvement of the disease.

No statistically significant differences in outcome variables between the correctly referred and the incorrectly not referred patients were found. However, the correctly referred patients showed a tendency for a larger improvement on total active joint mobility scores compared to those incorrectly not referred. On the other hand, the incorrectly not referred patients had a larger improvement in MHQ scores compared to those who were correctly referred, although the difference in improvement was not statistically significant. An explanation for smaller improvement in MHQ scores in the patients who were referred for postoperative hand therapy might be that these patients were (made) more aware of the restraints in hand function because of the attention paid to restrained hand function during hand therapy. Patients not referred for postoperative hand therapy were perhaps less aware of their restrained hand function. In further research evaluating outcomes in Dupuytren's disease, it might be advisable to add a functional test to assess the hand function in a more objective way [15].

Considering the significantly larger improvement of the total active range of joint motion in patients with a preoperative MP or PIP joint flexion contracture of $40°$ or more compared to those without such a substantial contracture, one should be aware of these patients' greater ability to gain range of joint motion. Patients with a smaller limitation of the extension have fewer degrees to win (ceiling effect).

A limitation of this study was the considerable amount of non-participation of all eligible patients. This non-participation limits generalization of our results to all patients surgically treated for contractures due to Dupuytren's disease. However, we have no reason to believe that participation or non-participation might be related to clinical outcomes.

The outcomes of correctly referred and incorrectly not referred patients (according to our referral criteria) were compared. Although both groups seem similar regarding most features, the difference in bilateral involvement, the tendency to differences in age of onset of Dupuytren's contracture and joint mobility may account for some dissimilarities. Prior to the study we considered performing a randomized clinical trial with an experimental group receiving hand therapy after surgery and a control group not receiving hand therapy. However, looking at the common practice after surgery for Dupuytren's disease, withholding postoperative hand therapy to the patients seemed to be unethical. Subsequently, we chose a prospective cohort design. As a consequence, we are unable to clarify the influence of the above-mentioned dissimilarities on the outcome of the current study.

Finally, the small sample size of the study population resulted in limited statistical power, which may contribute to the lack of statistically significant differences between patients correctly referred and patients incorrectly not referred.

Little evidence has been published on post-surgery regimens in Dupuytren's disease and their outcomes [16,17]. In western common medical practice, patients usually receive postoperative hand therapy. Recently, data were published on referral, where 84% of all surgeons advocated the use of night splints after surgery, with a considerable variation of duration [16]. The characteristics of the therapy applied vary considerably [9,18]: From postoperative night extension splints only, to frequent consultation and instructions for daily exercises, combined with splint therapy. However, given the results of our study, the effectiveness of postoperative hand therapy in Dupuytren's disease in general, is not evident. Our results raise the question whether postoperative hand therapy should be applied as general as it is in Dupuytren surgery nowadays. Given the lack of statistically significant differences between outcome in patients with and without postoperative hand therapy, we must reconsider whether this therapy is as effective and as necessary as thought by most referring doctors.

Conclusion

Based on this study, reconsideration of our referral criteria for postoperative hand therapy seems appropriate, although it is not clear what the criteria should consist of.

Our results at least suggest that more research on referral criteria is needed. Additionally, the actual post surgical regimen should be evaluated. Prior to this study, a randomized clinical trial evaluating the effects of postoperative hand therapy compared to a control or placebo group did not seem feasible because postoperative hand therapy is common medical practice. Withholding patients' 'correct' aftercare was assumed unethical. Given our results, future research using the design of a randomized clinical trial seems warranted.

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Appendix

Postoperative hand rehabilitation protocol after surgery for Dupuytren's disease

The postoperative hand therapy regimen was as follows:

Until wound healing is complete, the operated digits were immobilized with a dorsal thermoplastic static splint, during 24 hours a day. Once every two hours, the patients are to remove the splint and perform range of motion exercises of the digits. Furthermore, the patients received instructions to reduce oedema.

After wound healing, the operated digits are immobilized with a volar thermoplastic static splint during the night and three 1.5-hour periods during the day. When wearing the splint, a silicon dressing covers the scar in order to limit scar hypertrophy. Patients perform range of motion exercises and massage the scar three times a day in this period. After that, the splint use is gradually reduced during the day, but is continued during the night for six months on average.