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**Self-reported disability following surgery for Dupuytren's disease in diabetic and non-diabetic patients**

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**Self-reported disability following surgery for Dupuytren's disease in diabetic and non-diabetic patients**

**Running title: Diabetes and Dupuytren's Disease**

**Abstract**

**Background**

The aims of this study were to investigate the impact of Diabetes Mellitus on patient-reported functional outcome measures (PROMs) and satisfaction following surgical treatment of Dupuytren's contracture.

**Methods**

Preoperative and one-year postoperative PROMs were collected prospectively over six-years (2013-2019). Patients completed the QuickDASH score and were asked "how normal is your hand?", recording responses on a 100-point visual analogue scale. Patient satisfaction was also self-reported.

**Results**

Paired responses were available for 520 hands (478 patients; 72% follow-up rate). There were 62 diabetic hands (12%). Pre (12.5 vs 9.1;  $p=0.01$ ) and postoperative (11.4 vs 6.8;  $p=0.02$ ) QuickDASH scores were significantly, but not clinically, worse in diabetic patients. Patient satisfaction was high in both groups. A large and significant improvement in self-perceived hand normality was observed in both groups ( $p<0.05$ ). No significant differences were observed in preoperative or change in hand normality between the groups, but the postoperative normal hand score was significantly higher in non-diabetic patients (94 vs 90;  $p=0.02$ ).

**Conclusions**

Our study has demonstrated statistically significantly worse disability in diabetic patients with Dupuytren's disease both pre and postoperatively, although the observed differences were far below the minimum clinically important difference for the QuickDASH. Both groups reported a large and statistically significant improvement in self-perceived hand normality following surgery.

**Keywords:** Dupuytren's disease; diabetes mellitus; diabetic hand

## **Introduction**

The prevalence of Dupuytren's contracture is significantly greater in diabetic compared with non-diabetic patients.<sup>1, 2)</sup> The worldwide prevalence of diabetes mellitus is projected to increase by 51% by 2045,<sup>3)</sup> and this figure mandates a re-examination of the potential impact of this disease on conditions affecting the hand. Understanding the spectrum and pathophysiology of the "diabetic hand" has increased dramatically since the condition was first described in the 1980s,<sup>4)</sup> and the presence of diabetes mellitus has been linked with poorer functional outcomes following surgery for common conditions affecting the hand, including A1 pulley release for trigger finger,<sup>5)</sup> and carpal tunnel decompression.<sup>6-8)</sup> It has been noted, however, that there is a dearth of studies describing the outcome of surgery for Dupuytren's contracture in patients with diabetes.<sup>9, 10)</sup> Eckerdal et al described a case series of paired patient-reported functional outcome measures (PROMs) following surgery for Dupuytren's disease with a follow-up rate of 71% and 20 diabetic patients (10%): no significant differences were observed in preoperative, postoperative, or change in PROMs between patients with or without diabetes.<sup>11)</sup> Rodrigues et al subsequently examined a larger patient cohort and concluded that diabetes resulted in poorer postoperative PROMs, although the cross-sectional nature of that study prevented comparison of preoperative PROMs, or change in PROMs.<sup>12)</sup> Neither study investigated the relationship between diabetes mellitus and recurrence following surgery.

The aim of this study was to investigate the PROMs and satisfaction following surgical treatment of Dupuytren's contracture in patients with and without diabetes mellitus. The null hypothesis is that the presence of diabetes mellitus does not influence PROMs following surgery.

## **Methods**

### *Study setting and patient pathway*

This was a routine service evaluation, with no allocation or concealment of treatment. Therefore, this study did not meet the criteria for formal ethical approval, although it was registered with the local musculoskeletal quality improvement committee. This study was undertaken over a six-year period (November 2013 to September 2019) in a single hospital that is the only regional provider of hand surgery to a population base of 370,000 people. The study cohort was identified retrospectively. The inclusion criteria were surgical treatment of Dupuytren's disease with available pre and one-year postoperative PROMs data. Patients who underwent simultaneous or staged bilateral treatment completed separate PROMs questionnaires for each hand and thus each hand was included in the analysis. Patients who underwent repeat intervention for disease recurrence during the study period, and who had already returned their one-year postoperative PROMs questionnaire, were only included once within the analysis for their first procedure; PROMs data relating to subsequent procedures were not analysed as we felt that including cases of revision surgery may have altered the homogeneity of the preoperative cohort (n=28; two diabetic patients). Aside from this, the other exclusion criterion was simultaneous surgery for concurrent conditions of the hand such as trigger finger or carpal tunnel syndrome (n=0).

Patients with a diagnosis of Dupuytren's disease were referred to the virtual hand clinic. Based on the information given by the General Practitioner, patients were either sent information on the diagnosis and treatment options with a patient-initiated review on request ("opt in") approach, or referred directly to a nurse-led clinic. A full discussion of the risks and benefits of surgical versus non-surgical treatment was offered to all patients, and those who wished to proceed to surgery were treated with either needle fasciotomy, open fasciotomy, open fasciectomy, or dermofasciectomy with full thickness skin graft depending

on the severity and pattern of contracture. All procedures were done under the care of a single consultant hand surgeon with level V experience.<sup>13)</sup> Following surgery, patients were discharged the same day. Needle fasciotomy patients were discharged with the option of patient-initiated review if necessary. Patients undergoing open surgery were reviewed within two weeks in a nurse led clinic, and referred to hand therapy if necessary.

#### *Patient-reported functional outcome measures*

Patients self-reported the presence or absence of medical comorbidities including diabetes mellitus. Patients completed PROMs questionnaires on the morning of surgery; they were subsequently contacted by postal questionnaire one year following surgery in order to complete postoperative PROMs.

The QuickDASH score<sup>14)</sup> was used as the primary outcome measure to evaluate self-perceived hand disability. This has been shown to be a suitable PROM for the evaluation of the outcome of surgery for Dupuytren's disease.<sup>15)</sup> The value for the minimum clinically-important difference (MCID) for this score was defined as 12.85 points.<sup>16)</sup> Patients were also asked "how normal is your hand?" before and after surgery and recorded responses by placing an "X" on a 100-point visual analogue scale (VAS) with 10-point graded intervals from 0 ("least normal") to 100 ("most normal"). This score has been utilised previously in patients with Dupuytren's disease and has been shown to correlate with hand disability and patient satisfaction following surgery.<sup>17)</sup> Patient satisfaction was also measured on a 100-point VAS from 0 ("not at all satisfied") to 100 ("completely satisfied"); patients scoring 50 or over were considered to be satisfied, consistent with previous studies investigating satisfaction following related hand conditions.<sup>18–20)</sup> Because the primary aim of this study was to report PROMs following surgery, goniometric measurements of joint contracture were not collected, as these have been shown to correlate poorly with PROMs.<sup>21, 22)</sup>

### *Statistical analysis*

The Shapiro-Wilk test was used to check for normality: parametric data are presented as mean with standard deviation (SD) and non-parametric data are presented as median with interquartile range (IQR). Categorical data were compared between groups using the Chi-square test, or Fisher's exact test if there were fewer than five values in an observation cell. Unpaired median values were compared using the independent samples Mann-Whitney *U* test, and paired median values were compared using the paired Wilcoxon rank sum test. Unpaired mean values were compared using the unpaired *t* test. A *p*-value of less than 0.05 was considered to represent a statistically significant result. A post hoc power calculation was undertaken based on the previously-reported value of 12.85 points for the MCID of the QuickDASH score. This demonstrated that 59 patients in each group would result in 95% power with an alpha of 0.05.

## **Results**

### *Patient cohort*

During the study period 748 procedures were undertaken. Twenty-eight cases corresponding to repeat surgical intervention for disease progression on the same hand were identified and excluded, giving a final cohort of 720 hands in 648 patients. Complete paired pre and postoperative PROMs were available for 520 hands, undertaken in 478 patients (72% follow-up rate at one-year). Sixty-two procedures (12%) were undertaken in patients with a previous history of diabetes mellitus. No significant demographic differences were observed between patients with and without diabetes (Table 1). The pattern of disease and incidence of different surgical procedures did not differ between diabetic and non diabetic patients (Table 1).

### *Patient-reported functional outcome measures*



Pre and postoperative QuickDASH scores were significantly worse in diabetic patients compared with non-diabetic patients (Figure 1; Table 2). A statistically significant improvement in median QuickDASH was observed in non-diabetic patients (9.1 preoperatively vs 6.8 postoperatively;  $p=0.03$ ), although the small improvement in median QuickDASH values observed in diabetic patients did not reach statistical significance (12.5 vs 11.4;  $p=0.54$ ). The overall median value of the change in QuickDASH scores was 0 in both groups. High rates of patient satisfaction were observed in both groups (Table 2).

A statistically significant improvement in normal hand score was observed in both diabetics (50 vs 90;  $p<0.001$ ) and non-diabetics (50 vs 94;  $p<0.001$ ) following surgery. No significant differences were observed in preoperative or overall change in normal hand score between the groups, although the postoperative normal hand score was higher in non-diabetic patients. The observed difference was small but statistically significant (Table 2).

A greater number of non-diabetic hands underwent repeat surgical intervention for disease progression during the study period but this did not reach statistical significance (5% vs 2%; Fisher's exact test,  $p=0.49$ ). The median time to repeat surgical intervention was 28 months (range: 14-57 months). No complications were reported in either group.

## **Discussion**

Our study has demonstrated statistically significantly worse disability in diabetic patients with Dupuytren's disease both pre and postoperatively, although it should be noted that the observed improvement in QuickDASH score in the non-diabetic group, as well as the observed differences between diabetic and non-diabetic patients, were below the value of the MCID for the QuickDASH. Therefore, this raises the possibility that these observed differences were not clinically relevant. Patients without diabetes reported significantly higher postoperative self-perceived hand normality, although no difference in this metric was observed

preoperatively, and both groups reported a significant improvement. No differences were observed in patient satisfaction between the groups.

The primary limitation of this study is the number of patients lost to follow-up, which introduces the risk of non-responder bias. Non-responder analysis was undertaken which demonstrated that non-responders were significantly younger compared to responders, and it is possible that this led to skewed PROMs data (Table 3). The follow-up rate is comparable with previous studies reporting PROMs following surgery for Dupuytren's disease, and our study is strengthened by a comparatively larger patient cohort.<sup>11, 23)</sup> A further limitation is a lack of data relating to the severity of diabetes, which precluded a more detailed analysis of the impact of glycaemic control on PROMs. This limitation is in common with the two previous studies in this area.<sup>11, 12)</sup>

To our knowledge we have presented the largest study investigating the impact of diabetes mellitus on paired pre and postoperative PROMs after surgery for Dupuytren's disease. A possible explanation for the findings in our study is that diabetes may result in a different disease pattern, which may predispose patients to worse functional outcomes. Dupuytren's contracture is typically expected to affect the fourth and fifth digits in non-diabetic patients, and the third and fourth digits in diabetic patients.<sup>1, 2, 24)</sup> Our results do not support this explanation, with no significant differences in disease site observed between groups. Considerable clinical overlap exists between Dupuytren's contracture and cheiroarthropathy: the pathophysiology is comparable<sup>24)</sup> and the two conditions can coexist.<sup>1)</sup> This could have resulted in a worse QuickDASH score in diabetic patients, whilst maintaining an improvement in self-perceived hand normality following the procedure. Although we are unable to confirm this hypothesis with certainty, the fact that the relative proportions of different surgical

procedures were not significantly different between the groups would suggest that this was not the case.

Another possible explanation, previously proposed by Rodrigues et al.,<sup>12)</sup> is the coexistence of separate pathologies affecting the upper limb in diabetic patients. When considering the secondary outcome measures in our study, diabetic patients reported a large and statistically significant improvement in self-perceived hand normality following surgery. The observed improvement was less than that observed in non-diabetic patients, however, and this observation trended towards statistical significance. Self-perceived hand normality is a recently introduced concept in the assessment of Dupuytren's disease. As such, this approach has not been validated and no MCID has been calculated. Therefore, further interpretation of this finding is problematic, however it should be noted that the QuickDASH score is not a hand-specific PROM, and the presence of separate pathologies which are more common in diabetics such as frozen shoulder, carpal or cubital tunnel syndrome, or trigger finger, could have led to a worse pre and postoperative QuickDASH score in this patient cohort, while accounting for an improvement in self-perceived hand normality.

In conclusion, while statistically significant differences were observed in pre and postoperative hand function between diabetic and non-diabetic patients, these differences were small and therefore unlikely to be clinically significant. Both diabetic and non-diabetic patients can be advised that they can expect significant improvements in self-perceived hand normality after surgery for Dupuytren's disease, with no significant difference in satisfaction levels or complication rates between the two groups.

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**Table 1: Comparison of demographics and procedure data between patients with and without diabetes**

	Diabetics	Non-diabetics	p-value
N	62	458	-
N male (%)	50 (81)	364 (79)	0.83*
Age (mean, SD)	68 (9)	66 (10)	0.14**
Primary disease site (n, %)			
<i>Palm</i>	2 (3)	7 (2)	0.29***
<i>Thumb</i>	2 (3)	6 (1)	0.35***
<i>Index</i>	2 (3)	14 (3)	-
<i>Middle</i>	4 (6)	37 (8)	0.81***
<i>Ring</i>	14 (23)	111 (24)	0.77*
<i>Little</i>	38 (61)	283 (62)	0.94*
Needle fasciotomy (n, %)	19 (31)	113 (25)	0.31*
Open Fasciotomy (n, %)	11 (18)	48 (10)	0.09*
Open fasciectomy (n, %)	28 (45)	230 (50)	0.46*
Dermofasciectomy (n, %)	4 (6)	67 (15)	0.11***

\*= Chi-square test

\*\*= unpaired t-test

\*\*\*=Fisher's exact test

**Table 2: Comparison of PROMs between diabetic and non-diabetic patients**

	Diabetics	Non-diabetics	p-value
Preoperative QuickDASH (median, IQR)	12.5 (6.8 – 24.4)	9.1 (2.3 – 18.2)	<b><u>0.01*</u></b>
Postoperative QuickDASH (median, IQR)	11.4 (2.3 – 34.1)	6.8 (0 – 18.2)	<b><u>0.02*</u></b>
Change in QuickDASH (median, IQR)	0 (-6.8 – 4.6)	0 (-6.8 to 8.5)	0.26*
Preoperative Normal Hand (median, IQR)	50 (40 – 70)	50 (40 – 70)	0.52*
Postoperative Normal Hand (median, IQR)	90 (70 – 98)	94 (80 – 100)	<b><u>0.02*</u></b>
Change in Normal Hand (median, IQR)	29 (15 – 49)	40 (15 – 60)	0.07*
Satisfaction (n, %)	51 (82)	406 (89)	0.15**

\*= Independent Samples Mann-Whitney *U* test

\*\*= Chi-square test



**Table 3: Nonresponder analysis**

	Responders	Nonresponders	p-value
N	520	200	-
N male (%)	414 (80)	160 (80)	0.91*
N Diabetes (%)	62 (12)	31 (16)	0.19*
Age (mean, SD)	67 (10)	63 (12)	<u>&lt;0.001**</u>

\*= Chi-square test

\*\*= unpaired t-test

Figure 1

