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Hand

Patient Experiences after Open Trigger Finger Release in Patients with Type 1 and Type 2 Diabetes—A Retrospective Study Using Patient-reported Outcome Measures

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Background: Trigger finger is overrepresented among patients with diabetes mellitus (DM). Whether DM affects the outcome after open trigger finger release (OTFR) in patients with DM is not known. Our aim was thus to explore outcomes after OTFR in patients with type 1 (T1D) and type 2 DM (T2D).
Methods: Data included patient-reported outcome measures (PROMs) from all OTFRs performed between 2010 and 2020 registered in the Swedish national registry for hand surgery in individuals over 18 years cross-linked with the Swedish National Diabetes Register (NDR). PROMs included QuickDASH and HQ8, a questionnaire designed for national registry for hand surgery, preoperative and at 3 and 12 months postoperative. HQ8 included pain on load, pain on motion without load, and stiffness. Outcome was calculated using linear-mixed models and presented as means adjusted for age and stratified by sex.
Results: In total, 6242 OTFRs were included, whereof 496 had T1D (332, 67% women) and 869 had T2D (451, 52% women). Women with T1D reported more symptoms of stiffness ($P < 0.001$), and women with T2D reported more pain on load ($P < 0.05$), motion without load ($P < 0.01$), and worse overall result at 3 months. At 12 months, however, no differences were found in any of the HQ-8 PROMs among men or women. Women with T2D had slightly higher QuickDASH scores at 3 and 12 months.
Conclusion: Patients with T1D and T2D can expect the same results after OTFR as individuals without DM, although the improvement might take longer especially among women with T2D. *(Plast Reconstr Surg Glob Open 2023; 11:e5037; doi: 10.1097/GOX.0000000000005037; Published online 21 June 2023.)*

INTRODUCTION

Trigger finger (TF), also called flexor tenosynovitis, is a hand condition that painfully locks the affected finger in a flexed position. First choice of treatment is usually splinting or cortisone injection,[1] but surgical release of the first annular (A1) pulley of the flexor tendon sheath is often required if conservative treatment fails.[2] TF is more prevalent among individuals with diabetes mellitus (DM),[3] and DM has been confirmed in several studies as a major risk factor for the development of TF.[4–6] Recently, we published data indicating increased risk of development of TF with increasing HbA1c levels among individuals with DM; thus, poor glycaemic control seems to increase the risk of TF among individuals with DM.[7]

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In recent years, hand surgical quality registers have been increasingly used to explore outcomes after various surgical procedures.[8] In Sweden, the Swedish national registry for hand surgery (HAKIR) has been used to explore patient-reported outcomes (PROs) after surgery for carpal tunnel syndrome[9] and ulnar nerve entrapment[10] in individuals with DM. A recent smaller study from the United Kingdom reported overall satisfactory outcomes after open trigger finger release (OTFR) among both patients with and without diabetes[11]; however, this study did not stratify for the type of diabetes. Because both the etiology[12] and complication spectrums[13] are different in type 1 diabetes (T1D) and type 2 diabetes (T2D), outcome after OTFR might also differ. Thus, the aim of this study was to use data from HAKIR to explore surgical outcomes after OTFR in individuals with T1D and T2D, with individuals without DM as controls.

Takeaways

Question: Trigger finger (TF) is overrepresented among patients with diabetes mellitus (DM). Whether type 1 (T1D) or type 2 DM (T2D) affects the outcome after surgery for TF is still unanswered.

Findings: Using patient-reported outcome measures (PROMs) from the Swedish hand surgical quality register, we present data that patients with DM had more symptoms of pain and stiffness after 3 months but not after 12 months.

Meaning: Patients with T1D and T2D can expect the same results after open trigger finger release as individuals without DM, although the improvement might take longer.

METHODS

Data Sources and Study Population

HAKIR (www.hakir.se)[14] was launched in 2010 and includes patients from the seven hand surgery hospital departments and from several private hand surgical units in Sweden (population of 10 million). More than 90% of all procedures at the participating units were registered in HAKIR during 2022 (www.hakir.se). Patient sex, age, and the operated on side are recorded, as well as the total number of operations performed on each patient. All patients are asked to complete two different patient-reported outcome measures (PROMs) preoperatively, after 3 months, and after 12 months postoperatively. The first questionnaire is the Swedish version of QuickDASH, with 11 questions, resulting in a disability score of 0–100 where higher score indicates worse function.[15] The second PROM (HQ-8) is a validated,[16] eight-point single-item questionnaire designed for HAKIR, addressing pain on load, pain on motion without load, pain at rest, stiffness, weakness, numbness, cold sensitivity, and ability to perform daily activities. A question regarding the overall result of surgery (0–100) is also included in the postoperative HQ-8 questionnaire. (**See figure, Supplemental Digital Content 1**, which shows the HQ-8 questionnaire, translated to English, **http://links.lww.com/PRSGO/C590**.) In this study, only responses regarding pain on load, pain on motion without load, stiffness, and overall result as well as QuickDASH scores were included. The total number of procedures for each patient is recorded in HAKIR but not the number of fingers undergoing OTFR at the same time. Moreover, no data on previous steroid injections are available.

Data from HAKIR were crosslinked with the Swedish NDR. The NDR includes yearly data and information on the type of diabetes, medication, complications, and risk factors. It has a coverage rate of approximately 85%–90% of all individuals with DM in Sweden. The register and its data collections and definitions of T1D and T2D have been thoroughly described in previous publications.[17–19]

Inclusion and Exclusion Criteria

All individuals aged 18 years or older registered in HAKIR between 2010 and 2020 with a main ICD-10 diagnostic code of M653 and a surgical code of NDM-49 were included in this study (n = 7129), and data were crosslinked with the NDR. Only data from the primary surgery were included, although the total number of procedures registered in HAKIR for each patient was also recorded. Patients undergoing other types of surgery at the same time were excluded (n = 670). Patients with OTFR before the year of DM diagnosis (n = 188) and patients with an undefinable type of diabetes (n = 29) were excluded.

Statistical Analysis

Continuous variables are presented as median and range, and categorical variables, as numbers and percentages. Background characteristics of responders and nonresponders to the PROM questionnaires were compared with the Mann-Whitney *U* test for continuous variables and the chi-square test for categorical variables. Subsequent linear-mixed models were used to model how PROMs evolved over time for the controls, T1D, and T2D patients, and all models were adjusted for age and an AR(1) covariance structure and subject as a random effect and stratified by sex.[20] Estimated means and corresponding standard errors are presented from the models and comparisons of these age-adjusted means. A *P* value below 0.05 was considered statistically significant.

Ethics Approval

The study was approved by the regional ethics committee (DNR 2017/2023-31, 2019-00880, 2021-00902) and conducted in accordance with the declaration of Helsinki.

Informed Consent

All individuals provided written or oral informed consent before registration in HAKIR.

Disclosure statements are at the end of this article, following the correspondence information.

Related Digital Media are available in the full-text version of the article on www.PRSGlobalOpen.com.

Table 1. Patient Characteristics Stratified for Control, T1D, and T2D

Variable	Control	Type 1 Diabetes	Type 2 Diabetes
No. OTFR	4,877	496	869
Sex, female (%)	3105 (64)	332 (67)	451 (52)
Age at OTFR, y, (range)	61 (18–99)	52 (26–81)	66 (27–92)
Nonresponder (%)*	47	47	51
RR preoperatively (%)	37	40	32
RR 3 months (%)	25	26	24
RR 12 months (%)	23	22	21

Age presented as median (range).
*Nonresponders did not answer a single questionnaire.
RR, response rate.

RESULTS

Characteristics

In total, 6242 individuals from HAKIR aged 18 years or older were included after OTFR between 2010 and 2020, whereof 496 had T1D (332, 67% women) and 869 had T2D (451, 52% women). Table 1 presents all patient characteristics, sex, diabetes type, and response rates.

Number of Operations

The number of individuals having undergone two or more OTFRs during the study period was higher among T1D (130/496, 22%; chi-square $P < 0.001$) and T2D (153/869, 18%; chi-square $P = 0.01$) compared with the control group (711/4,877, 15%).

Nonresponder Analysis

In total, 3287 (53%) patients responded to at least one of the questionnaires. For response rates in the respective group, see **table, Supplemental Digital Content 2**, which shows study population characteristics stratified for responders/nonresponders, **http://links.lww.com/PRSGO/C591**. There were slightly more T2D patients ($P = 0.048$) in the nonresponder group; however, there was no difference in sex or age between responders and nonresponders.

PROs, within Group Comparisons

All the estimated means from the PROMs preoperatively, at 3 months, and at 12 months are presented in Table 2. Both the control group and T1D and T2D patients improved their overall QuickDASH scores

Table 2. Estimated Means from Linear-mixed Models for Respective Sex, Adjusted for Age and Presented as Mean with SE Preoperatively and at 3 Months and 12 Months, Respectively

Women	PROM	Preoperative	3 Months	P*	12 Months	P†
Control	QuickDASH	41 (2)	20 (2)	**<0.001**	18 (2)	**0.002**
	Pain on load	74 (3)	43 (3)	**<0.001**	36 (3)	**<0.001**
	Pain on motion without load	52 (2)	28 (3)	**<0.001**	23 (3)	**<0.001**
	Stiffness	67 (3)	38 (3)	**<0.001**	27 (3)	**<0.001**
	Overall results		34 (4)		29 (4)	**<0.001**
T1D	QuickDASH	43 (3)	21 (3)	**<0.001**	17 (3)	**0.027**
	Pain on load	78 (3)	45 (3)	**<0.001**	30 (3)	**<0.001**
	Pain on motion without load	56 (3)	30 (3)	**<0.001**	20 (3)	**0.001**
	Stiffness	73 (3)	47 (3)	**<0.001**	31 (4)	**<0.001**
	Overall results		40 (4)		30 (4)	**0.001**
T2D	QuickDASH	50 (3)	27 (3)	**<0.001**	23 (3)	**0.028**
	Pain on load	85 (4)	49 (4)	**<0.001**	39 (4)	0.099
	Pain on motion without load	62 (3)	35 (3)	**<0.001**	25 (3)	**<0.001**
	Stiffness	69 (4)	42 (4)	**<0.001**	28 (4)	**<0.001**
	Overall results		41 (5)		31 (5)	**<0.001**
Men	**PROM**	**Preoperative**	**3 Months**	P*	**12 Months**	P†
Control	QuickDASH	36 (3)	21 (3)	**<0.001**	17 (3)	**<0.001**
	Pain on load	71 (4)	46 (4)	**<0.001**	36 (4)	**<0.001**
	Pain on motion without load	46 (3)	29 (4)	**<0.001**	23 (3)	**<0.001**
	Stiffness	63 (4)	41 (4)	**<0.001**	32 (4)	**<0.001**
	Overall results*		45 (6)		38 (6)	**<0.001**
T1D	QuickDASH	40 (3)	22 (4)	**<0.001**	18 (4)	0.306
	Pain on load	80 (4)	47 (5)	**<0.001**	37 (6)	0.078
	Pain on motion without load	56 (4)	31 (5)	**<0.001**	25 (5)	0.205
	Stiffness	71 (4)	45 (5)	**<0.001**	34 (6)	0.076
	Overall results*		45 (7)		40 (7)	0.395
T2D	QuickDASH	41 (3)	22 (3)	**<0.001**	19 (3)	0.164
	Pain on load	73 (4)	45 (5)	**<0.001**	34 (5)	**0.002**
	Pain on motion without load	53 (4)	27 (4)	**<0.001**	23 (4)	0.120
	Stiffness	66 (4)	43 (5)	**<0.001**	31 (5)	**<0.001**
	Overall results*		46 (6)		35 (7)	**<0.001**

*P value for comparison between preoperative and 3 months.
†P value for comparison between 3 and 12 months.
Values in boldface indicate $P < 0.05$.

and all studied HQ-8 questions 3 months after surgery ($P < 0.001$). Moreover, in all groups, further improvement was seen in both QuickDASH as well as in several of the HQ-8 questions between 3 and 12 months.

PROs, Control versus T1D and T2D

Women with T1D experienced more stiffness ($P < 0.001$), and women with T2D experienced more pain on load ($P < 0.05$), motion without load ($P < 0.01$), and slightly worse overall results ($P = 0.021$) at 3 months compared with the control group. At 12 months, however, there were no differences in any of the HQ-8 questions studied. Men with T1D and T2D experienced more pain preoperatively ($P < 0.01$); however, there was no difference in any HQ-8 questions either at 3 or 12 months compared with the control group. Women with T2D had higher QuickDASH scores preoperatively as well as at 3 and 12 months postoperatively. There were no differences in QuickDASH between women with T1D and the control group or between men with T1D or T2D and the control group at 3 or 12 months (Figs. 1, 2). (**See table, Supplemental Digital Content 3**, which shows group comparison of estimated means from linear mixed models with standard error (SE), adjusted for age, comparing the different PROs preoperatively and at 3 and 12 months, using the control group as reference. Boldface indicates $P < 0.05$. *Only available at 3 months and 12 months. PRO; patient-reported outcomes, T1D; type 1 diabetes, T2D; type 2 diabetes. **http://links.lww.com/PRSGO/C592**.).

DISCUSSION

Major Findings

This study presents data confirming good PROs 1 year after OTFR among individuals with T1D and T2D when compared with individuals without DM. The results were similar between the groups, although it seems to take longer for women, especially with T2D, to improve as indicated by higher self-reported scores 3 months after OTFR. Women with DM reported more pain and stiffness 3 months after OTFR; however, 1 year after surgery, there was no longer any difference in any of the HQ-8 questions studied. Our results are in line with both previous studies exploring surgical outcome after OTFR among individuals with DM,[11–21] but also with our clinical experience that individuals with DM sometimes initially present with residual symptoms after surgery, symptoms that often resolves over time.

Previous studies have consistently reported excellent outcomes after OTFR,[22] also for individuals with DM.[11–21] However, these studies have not stratified for the type of DM, that is, T1D or T2D, and because both pathophysiology and complications[13] are different in the two types of DM, it is an important distinction. This study adds data stratified for T1D or T2D, confirming equally good results after 12 months for patients with both types of DM. Taking this together, the results from this study are important in the sense that the clinician can inform the patient with DM that it might take longer to achieve a satisfactory outcome, especially in the presence of T2D. To the best of our

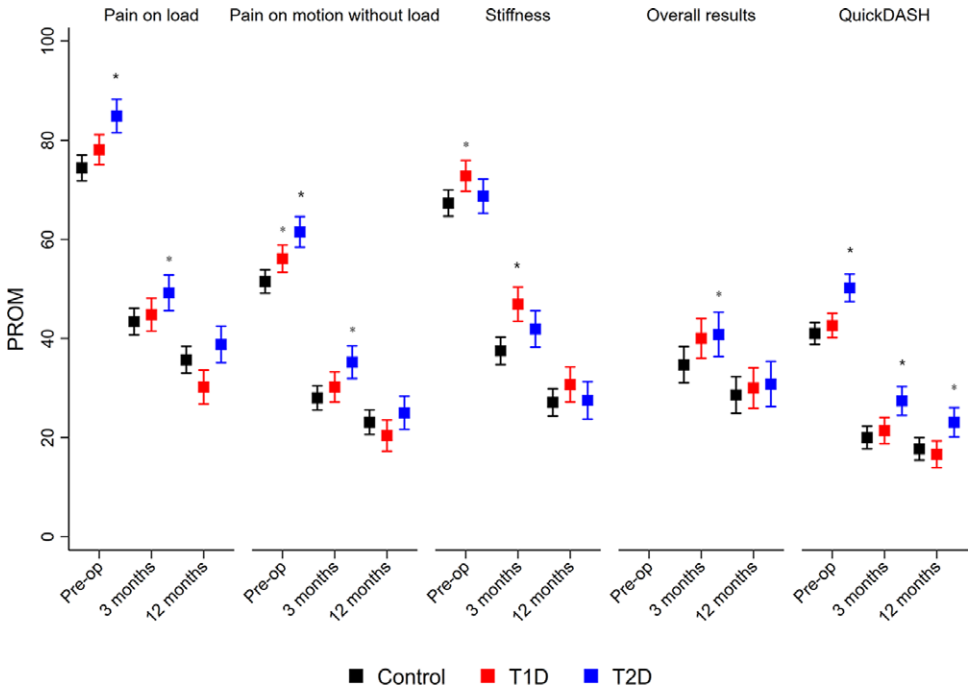

Fig. 1. Group comparison of estimated means with standard error bars among women, presenting the different PROMs preoperatively, at 3 and 12 months. *Indicating $P < 0.05$ for comparison between DM and controls at the respective time. PROM indicates patient-reported outcome measure; T1D, type 1 diabetes; T2D, type 2 diabetes.

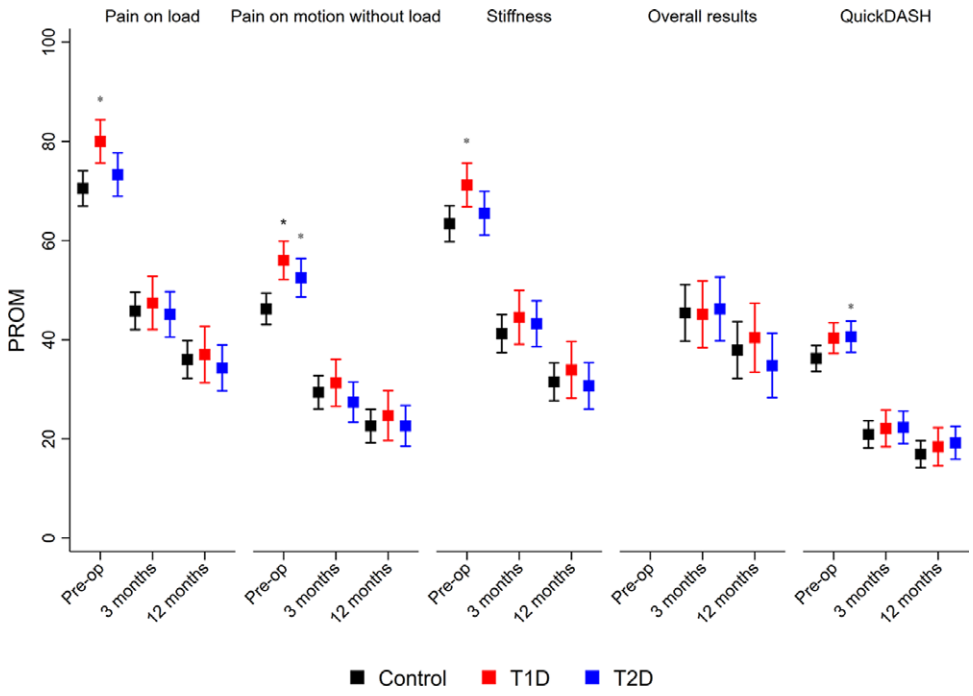

Fig. 2. Group comparison of estimated means with standard error bars among men, presenting the different PROMs preoperatively, at 3 and 12 months. *Indicating $P < 0.05$ for comparison between DM and controls at the respective time. PROM indicates patient-reported outcome measure; T1D, type 1 diabetes; T2D, type 2 diabetes.

knowledge, this is the first study using PROM data from a large hand surgical quality register to explore outcomes after OTFR and adequately stratifying for diabetes type.

Pathophysiology

The pathophysiological background to TF is still not fully understood, although most researchers agree that the triggering phenomenon is caused by abnormal tendon gliding within the tendon sheet. This might be caused by the formation of a flexor tendon noduli,[23] inflammation of the tenosynovium,[24] thickening of the A1 pulley,[25,26] or a combination of these three phenomena, together limiting the space for the flexor tendon and causing the finger to lock in a flexed position. In patients with DM, prolonged hyperglycaemia results in the formation of advanced glycation end products that accumulate in tendons, resulting in increased tissue stiffness.[27] Together with increased oxidative stress,[28] also in the A1-pulley among individuals with DM,[29] these pathological processes could possibly lead to a thicker tendon and a size mismatch between the tendon and the tendon sheet, resulting in the trigger phenomenon.

Surgical release of the A1 pulley is often enough to resolve the triggering in the affected finger[30]; however, recent studies[31,32] have suggested that not only the A1 pulley but also the A0 pulley, also called palmar fascia pulley,[33] might be involved in the development of TF. Studies have been done both in cadaveric models[31] and in a clinical setting,[32] suggesting the potential need for additional release of the A0 in a number of patients with TF. Interestingly, individuals with DM in the study conducted by Wu et al[32] were more likely to still have triggering symptoms after initial A1 release, resolving first after further release of the A0. One might postulate that failure to sufficiently release enough of the pulley system (both A1 and A0) during OTFR might explain the remaining symptoms found in this study after 3 months among individuals with DM. However, although no such causative explanation can be drawn from this study, different pulley releases among patients with DM would be an interesting topic for further research in a controlled clinical trial setting to improve the results and potentially make a more rapid recovery after surgery. Finally, a recently published study reviewing the pulley system in 48 cadaveric hands reported high variability in the anatomy of the pulley system.[34] Unfortunately, the authors did not present data on A0, but the variability of both the length and morphology of the A1 pulley is striking.

Strengths and Limitations

The major strength of this study is the large number of individuals included in HAKIR, and to our knowledge, this is the largest study to date exploring patient experiences after OTFR. The large study sample allows for stratification not only for diabetes type, but also for sex, which is important, considering the difference in both incidence and prevalence of TF in men and women.[3] Furthermore, the high coverage rate and high quality of the NDR and meticulous reporting from primary care to the NDR are strengths worth mentioning.

Nevertheless, a noteworthy limitation of this study is the low response rate to surveys in HAKIR, and low response rates are a problem in many quality registers. Interestingly, a recent study from the UK investigated PROs among nonresponders in a single hand surgical center and found no difference in predicted QuickDASH scores at 12 months between responders and nonresponders.[35] Another study investigating PROs after knee and hip arthroplasty among nonresponders found equally good results among responders as in nonresponders.[36] Thus, even though this study's response rate is low, the results are applicable and in line with previous studies and our clinical view.

Finally, although the results in this study are both stratified for sex, and the calculations are age-adjusted, there might always be other confounding factors, known or unknown, influencing the results. For example, other comorbidities, for example, rheumatoid arthritis, or environmental factors, such as smoking and alcohol consumption, would have been interesting to adjust for in the models. Furthermore, occupation and medications are additional variables that could potentially influence the findings in this study, and this should be kept in mind when interpreting the results. On a final note, glycaemic control among patients with DM, for example, HbA1c levels at the time of surgery, could also possibly affect the outcome after OTFR, a potential subject for future research.

CONCLUSIONS

Patients with T1D and T2D can expect the same results after OTFR as individuals without DM, although the improvement might take longer, especially among women with T2D. From a clinical standpoint, these results are important to communicate to the patient with DM when discussing surgical intervention for TF and patient expectations after OTFR.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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