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**The impact of self-reported hand-arm vibration on the outcome of surgery for
Dupuytren's Contracture**

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Abstract

Background

Dupuytren's contracture was recently designated a prescribed occupational disease when it occurs in patients with previous hand-arm vibration (HAV) exposure.

Aims

The aims of this study were to describe the impact of self-reported HAV-exposure on upper limb function and satisfaction following surgery for Dupuytren's contracture.

Methods

Paired pre and postoperative QuickDASH and patient satisfaction questionnaires were prospectively collected from all patients undergoing surgery for Dupuytren's contracture over a six-year period. Patients self-reported HAV-exposure duration.

Results

Results were available for 425 hands (65%) at mean 13 months postoperatively. There were 111 patients (26%) that reported HAV-exposure. The prevalence of HAV-exposure was significantly greater in male compared with female patients (32% vs 4%; $p < 0.001$). A statistically significant difference in preoperative (difference 7.47; 95% Confidence Interval 4.78 – 10.17; $p < 0.001$) and postoperative QuickDASH score (difference 6.78; 95% Confidence Interval 2.69 to 10.88; $p < 0.001$) was observed between the two groups, but difference in QuickDASH improvement was not significantly different (difference 1.76; 95% Confidence Interval -1.58 to 5.10; $p > 0.05$). No significant difference in satisfaction rate or return to work was observed between the two groups.

Conclusions

Previous HAV-exposure influenced the pre and postoperative function in patients undergoing surgery for Dupuytren's contracture, but had no effect on satisfaction or return to work. Further prospective research will be required to determine whether the introduction of a compensatory framework will have a more profound effect on the functional outcomes of surgery.

1. What is already known about this subject?

- Dupuytren's contracture was recently classified as an occupational prescribed disease when it occurs in the context of hand-arm vibration exposure
- Hand-arm vibration has been shown to impact on the functional outcome of surgery for Carpal Tunnel Syndrome, another occupation prescribed disease
- The impact of Hand-arm Vibration on the outcome of surgery for Dupuytren's Contracture has not been described

2. What this study adds?

- Patients with previous Hand-arm Vibration exposure report worse hand function before and after surgery
- The observed difference, however, may not be clinically relevant.
- No significant differences were observed in change in hand function, satisfaction, or return to work following surgery

3. What impact this may have on practice or policy?

- This study will be useful in informing patients with previous Hand-arm Vibration exposure who are considering surgery for Dupuytren's Contracture
- Further research will be necessary to determine whether the introduction of compensatory frameworks influences preoperative or postoperative function in patients undergoing surgery for Dupuytren's Contracture.

INTRODUCTION

Hand-arm vibration (HAV) exposure negatively influences the outcome of surgery for Carpal Tunnel Syndrome (CTS)[1], although its effect on the symptoms of Dupuytren's contracture is unclear. The comparatively recent classification of Dupuytren's contracture as an occupational prescribed disease (PD) presents an opportunity to analyse the impact of HAV-exposure on the outcomes of surgery without the confounding factors of patient awareness of compensatory frameworks, or previous medicolegal claims (MLCs). The primary aim of this study was to determine if previous HAV-exposure affected patient-reported functional outcomes (PROMs) following surgery for Dupuytren's contracture. The secondary aims were to investigate the impact of HAV-exposure on patient satisfaction, and return to work following surgery.

METHODS

Between November 2013 and June 2019, patients undergoing surgery for Dupuytren's contracture at a single centre prospectively completed the Quick version of Disabilities of the Arm, Shoulder and Hand (QuickDASH) score[2] preoperatively and one-year postoperatively. This is scored from 0 (least disability) to 100 (most disability). Goniometric measurements of contracture severity were not collected as these correlate poorly with PROMs[3]. 655 procedures were undertaken in 562 patients. Ninety patients (21%) were female and the mean age was 67 (SD 10 years). Paired PROMs data was available for 425 hands in 377 patients (67%).

Satisfaction was evaluated by asking “How satisfied are you with your surgery?” and recording responses on a visual analogue scale from 0 (“least satisfied”) to 100 (“most satisfied”). Patients scoring 50 or more were considered “satisfied”.

Patients self-reported the number of hours per week and for how many years they had been exposed to HAV. Data recording frequency of vibration was unavailable.

The cohort was divided into patients with and without HAV-exposure: categorical variables were compared using the chi-square test or Fisher’s exact test if there were fewer than five observations. Correlation between HAV-exposure and QuickDASH was examined using Spearman’s correlation. Binary logistic regression was used to investigate predictors of satisfaction. Age and sex were selected as covariates as these influence PROMs in other hand conditions[4]. The level of statistical significance was set at $p < 0.05$.

RESULTS

One hundred and eleven patients (26%) reported HAV-exposure. The median weekly exposure was 10 hours (IQR 2-20) and the median exposure duration was 19 years (IQR 4-30), both of which exceed the qualification thresholds for PDs[5]. Demographic differences between the groups are summarised in Table 1. The proportion of HAV-exposed patients was greater in males (32% vs 4%; $p < 0.001$). HAV-exposed patients reported a longer duration of symptoms before surgery.

A statistically-significant difference in preoperative and postoperative QuickDASH score was observed between the two groups, with worse scores observed in HAV-exposed patients (table 2). The QuickDASH did not improve significantly following surgery in either

group, and no significant difference was observed in QuickDASH change between the groups (Table 2). A weak correlation was observed between duration of HAV-exposure and preoperative QuickDASH ($r=-0.15$; $p<0.01$); no correlation was observed between HAV-exposure and postoperative, or change in QuickDASH.

The satisfaction rate was 93% in both groups. Binary regression analysis revealed no significant effect of HAV-exposure on satisfaction (Odds Ratio: 0.67, 95% Confidence interval 0.27 to 1.66; $p>0.05$).

Ninety-nine patients were employed at the time of surgery, and 92 returned to work (93%). No difference in return to work rate was observed between the groups (97% vs 91%; Fisher's exact test, $p>0.05$). Although both groups required a similar absence period before returning to light duties (3 vs 2 weeks; Independent Samples Mann-Whitney U [ISMWU] test $p>0.05$), HAV-exposed patients required a significantly longer absence period before returning to full duties (6 vs 3 weeks; ISMWU $p<0.05$).

DISCUSSION

Patients with previous HAV-exposure report worse pre and postoperative function following surgery for Dupuytren's contracture, however we cannot conclude if this variation is clinically relevant, as the observed differences were less than the minimum clinically-important difference for the QuickDASH[6]. No statistically-significant difference was observed in satisfaction or QuickDASH improvement between patients with and without previous HAV-exposure. The majority of patients were able to return to work following surgery, however HAV-exposed patients required a longer absence period before returning to full duties.

The primary limitation of this study is the number of patients lost to follow-up which raises the possibility of non-responder bias. This study also relied upon self-reporting of HAV-exposure and data relating to vibration frequency were unavailable, however this limitation is consistent with previous studies[1,7].

The recent designation of Dupuytren's contracture as a PD may result in development of compensatory frameworks or an increase in MLCs, and previous studies have described the epidemiology of HAV-exposure in this condition[8]. Our study demonstrated a statistically-significant difference in function before and after surgery in patients with previous HAV-exposure. In addition, no significant improvement in function was observed in either group. These findings may have arisen due to the use of the QuickDASH: previous studies have suggested that this PROM may not be targeted particularly well towards the symptom profile of Dupuytren's contracture, due to bias towards shoulder symptoms[9]. Thus, the use of the QuickDASH may represent another limitation, although in the absence of a universally-accepted gold-standard PROM, it is difficult to conceive an improvement to this methodology. It is possible that HAV-exposure may have aggravated subclinical coexisting conditions of the upper limb[1], such as CT. As these symptoms are not addressed by treating Dupuytren's Contracture, this could result in worse pre and postoperative QuickDASH scores in HAV-exposed patients. A weak but statistically-significant correlation between HAV-exposure and preoperative QuickDASH score was observed, which could support this hypothesis. Alternatively, the low QuickDASH scores in both groups both pre and postoperatively, and small differences less than the MCID observed between the groups, raise the possibility that the observed variation was not clinically relevant.

Satisfaction and return to work rate was comparable in both groups. It is well-recognised that prior MLCs negatively influence PROMs following hand surgery[10]. Prior to the introduction of any compensatory framework, our study has shown that patients with Dupuytren's disease associated with HAV-exposure are likely to experience similar levels of satisfaction and return to work rate as those without.

References

- 1 Stirling PHC, Jenkins PJ, Clement ND, *et al.* The Influence of Self-Reported Hand–Arm Vibration Exposure on Functional Outcomes Following Carpal Tunnel Release. *J Hand Surg Am* 2020;**45**:1029–36. doi:10.1016/j.jhsa.2020.08.018
- 2 Beaton DE, Wright JG, Katz JN, *et al.* Development of the QuickDASH: Comparison of three item-reduction approaches. *J Bone Jt Surg* 2005;**87**:1038–46. doi:10.2106/JBJS.D.02060
- 3 Zyluk A, Jagielski W. The effect of the severity of the dupuytren’s contracture on the function of the hand before and after surgery. *J Hand Surg Am* 2007;**32**:326–9. doi:10.1016/j.jhsb.2006.10.007
- 4 Melamed E, Beutel BG, Goldstein S, *et al.* Predictors of Outcomes Following Fasciectomy for Dupuytren’s Disease in Diabetic and Non-Diabetic Patients. *J Hand Surg Asia Pac* 2017;**22**:309–14. doi:10.1142/S0218810417500356
- 5 Industrial Injuries Advisory Council. 2014. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/308645/dupuytren-contraction-report.pdf (accessed 30 May 2020).
- 6 Franchignoni F, Vercelli S, Giordano A, *et al.* Minimal clinically important difference of the disabilities of the arm, shoulder and hand outcome measure (DASH) and its shortened version (quickDASH). *J Orthop Sports Phys Ther* 2014;**44**:30–9. doi:10.2519/jospt.2014.4893
- 7 Mathieu S, Naughton G, Descatha A, *et al.* Dupuytren’s Disease and exposure to vibration: Systematic review and Meta-analysis. *Jt Bone Spine* 2020;**87**:203–7. doi:10.1016/j.jbspin.2020.02.001

- 8 Stirling PHC, Jenkins PJ, McEachan JE. Previous vibration exposure in patients undergoing surgical treatment of Dupuytren's contracture. *J Hand Surg Eur* 2020;**45**:525–7. doi:10.1177/1753193420903675
- 9 Rodrigues JN, Zhang W, Scammell BE, *et al.* Recovery, responsiveness and interpretability of patient-reported outcome measures after surgery for Dupuytren's disease. *J Hand Surg Eur* 2017;**42**:301–9. doi:10.1177/1753193416677712
- 10 Higgs P, Edwards D, Martin D, *et al.* Carpal tunnel surgery outcomes in workers: effect of workers' compensation status. *J Hand Surg Am* 1995;**20**:354–60.

TABLES

Table 1: Analysis of demographic data between patients with and without history of vibration exposure

Descriptor	Vibration exposure	No vibration exposure	P-value
Number	111	314	-
Age (mean, SD)	66 (9)	67 (10)	>0.05*
N male (%)	107 (96)	228 (73)	<u><0.001**</u>
Duration of symptoms in months (median, IQR)	48 (24 - 96)	36 (22 - 60)	<u><0.01***</u>

*= Student *t*-test

**= Chi square test

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

SD: Standard deviation

IQR: interquartile range

Table 2: Comparison of preoperative, postoperative, and change in QuickDASH in patients with and without vibration exposure

	Preoperative QuickDASH (mean, 95% CI)	Postoperative QuickDASH (mean, 95% CI)	Change in QuickDASH (mean, 95% CI)
Vibration Exposure			
Yes	19.8 (17.5 to 22.1)	19.1 (15.6 to 22.6)	-0.89 (-3.73 to 1.96)
No	12.3 (11.0 to 13.7)	12.3 (10.3 to 14.4)	+0.87 (-0.79 to 2.54)
Mean difference	7.47 (4.78 to 10.17)	6.78 (2.69 to 10.88)	1.76 (-1.58 to 5.10)
p-value	<u><0.001*</u>	<u><0.001*</u>	>0.05**

*Analysis of Covariance controlling for age and gender

**Two way repeated measures Analysis of Variance controlling for age and gender

95% CI: 95% Confidence Interval

QuickDASH: Quick version of the Disabilities of the Arm, Shoulder and Hand questionnaire