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Evaluation of quality of life in subjects with zone II flexor tendon repair: A cross sectional study

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Abstract---Introduction: Hand injuries can affect anyone at any age, causing impairment in hand and arm function as well as a reduced quality of life. However, no research has looked at hand disability and quality of life following Zone II flexor tendon repair following a hand injury. Our goal is to gather more data and gain a better knowledge of the challenges patients face following a hand injury so that we may better allocate resources in the health-care sector in the future based on patient numbers, injury patterns, and health condition. Methods: Patients aged between 20 – 55 years with Zone II flexor tendon injury treated January 2019 to December 2021 department of Plastic Surgery, Saveetha Medical College and Hospital were included. Health-related outcome questionnaires, i.e. Quick DASH, SF-36, Visual Analogue Scale (VAS), and general information were mailed to the patients (time from injury: > 1.5–2.5 years). The participants were categorized based on the age, gender, severity of injury, and previous employment status. Results: Fifty three participants responded [response rate 60%; non-responders (n = 36); Women were older than men at the time of injury (p = 0.04) and differed regarding living conditions. The main differences in QuickDASH, all NPRS scale, and the majority of SF-36 subscales (p < 0.05) were found in the participants who experienced more impairment. More serious injuries (Modified HISS) were found to have higher Quick DASH with more functional impairment (p < 0.05). Few differences were found in groups divided according to age, gender (although men experiencing

less functional impairment in QuickDASH), previous occupation and injured hand. Conclusions: Patients aged between 20 – 40 years at the time a hand injury was sustained, generally experience a high-level quality of life and limited functional problems after such an injury, but patients with HISS > 50 and with a more serious injury were more severely affected.

Keywords---zone II repair, flexor tendon, hand injury, quality life.

Introduction

Hand injuries can affect anyone at any age, causing impairment in hand and arm function as well as a reduced quality of life. However, no research has looked at hand disability and quality of life following Zone II flexor tendon repair following a hand injury. Today, there is widespread agreement that quality of life is a multidimensional notion, with each of the areas listed below playing a significant role in its assessment.¹ psychological (fear, depression, and well-being), physical (health status, complaints, disease, and treatment-related symptoms), and ability to operate (self-care, mobility, profession, home, and leisure time) (number, value and maintenance of relationships to family and friends). Spilker also considers two more domains: economic circumstances and spiritual religious status.² Each domain is viewed as a separate region that is influenced by a person's experiences, beliefs, expectations, and perceptions.³

Health Domains can be subjected to measure by two ways: objective function or health status assessment and more subjective health perceptions. Although the objective dimension is critical in determining a patient's level of health, the subjective perceptions and expectations of the patient integrate the objective assessment into the real quality of life experienced.⁴ The World Health Organization (WHO) has defined health as the presence of physical, mental, and social well-being in addition to the absence of sickness and infirmity,⁵ quality-of-life concerns have grown increasingly relevant in health-care practice and research. The process of evaluating the efficacy of care is always evolving. Treatment choices are no longer assessed solely on the basis of their morbidity and mortality rates. Rather, treatments are assessed by looking at how they affect long-term functioning, well-being, and quality of life.^{6,7}

A majority of upper extremity injuries are located in the hand and wrist ^{8,9} as well as affected individuals being of any age ^{9,10} but any musculoskeletal disorder may occur in the upper extremity. ¹¹⁻¹³ Young men usually injure their hands during leisure time and the injuries are minor. ^{9,14,15} The hand is one of the most commonly damaged body parts. A serious injury can have long-term physical, psychological, social, and financial ramifications.¹⁶ For patients who may have a poor quality of life (QOL), it is critical and the need to adjust to a long-term disability QOL can be measured in a variety of ways by a thorough evaluation of physical impairment and the consequences of treatment, as well as their global impact on a person's day-to-day life.

Patients experience various problems after flexor tendon injury, including functional limitations, inability to perform physical activities, pain, mood disorders and trauma-related stress.¹⁷ Many of these problems diminish, or are even resolved, during the first year after the injury.¹⁷ Several studies show that greater problems with the impairment of hand function do not necessarily affect the patients' activity level or reduce their quality of life.^{18,19}

Evaluation of health-related quality of life and patient reported outcome measurements (PROMS) after injuries are crucial. Health-related quality of life is often measured using self-reported outcome instruments.²⁰ Patient-reported outcome instruments can measure various aspects of the patient's health status. This type of data can be accessed from qualitative interviews or questionnaires, where the information comes directly from the patient without interpretation by any mediators. There are a wide variety of questionnaires evaluating patient-reported outcome measurements, ranging from symptomatic questions, including pain and other symptoms (e.g. Disability of Arm Shoulder and Hand; DASH), to those that deal with more complex concepts, such as quality of life, e.g. SF-36 [Short Form-36 Health Survey],²¹ but focus has not been on old individuals. Our aim was retrospectively, to compare quality of life and functional limitations in groups of patients after a flexor tendon injury in order to gain a better understanding of the problems of the patients experience after this kind of injury.

Method

Subjects: This is a cross-sectional study using mainly patient-reported questionnaires to collect data. Some additional data were taken from medical records. Subjects aged between 20- 60years at the time of injury, who were admitted to the Department of Plastic Surgery, Saveetha Medical College and Hospital, with Zone II flexor tendon injury, from January 2019 to December 2021 were assessed and were included in the study. The patients who were at least 6 months post-injury and clinically stable following the surgical procedure and hand rehabilitation were included into the study. Patients with history of other severe hand injury, amputation, peripheral nerve involvement and difficulty with communication (i.e. language barrier) were excluded from the study.

The study proposal was evaluated by the ethical committee of Saveetha Institute of Medical and Technical Sciences and was approved on 10/11/2020 with approval number as 002/10/2020/IEC/SMCH. The study was also registered under the Clinical Trials Registry of India under the reference no CTRI/2021/07/035275. After obtaining written consent, eighty nine patients aged from 20–60 years participated in the study.

Information concerning age when injured, gender, type of injury, and the injured hand information was obtained from medical records in the hospital registry. Subjects with a non-injured hand (dominant or non-dominant) were put into groups. The participants answered questions concerning status at time of follow up current and previous occupation, since these socioeconomic factors and other factors, may influence the experienced function and health status in a variety of conditions and disorders.²²⁻²⁴

Occupation was divided into manual work (e.g. laborers, craftsmen, lorry drivers, nursing assistants and other types of physical work) and non-manual work (e.g. teachers, shop-assistants and clerical workers). The Modified Hand Injury Severity Score (MHISS), which is based on the original Hand Injury Severity Score (HISS),²⁵ were used to classify the severity of the injury, based on patient records.²⁶ Depending on the injured structures, a score is obtained. The injuries can then be divided into broad categories, such as “Minor” (≤ 20), “Moderate” (21–50), “Severe” (51–100) and “Major” (> 100).

Questionnaires

- a) Quick disabilities of the arm shoulder and hand (QuickDASH):
The QuickDASH questionnaire (English language) was used to assess present symptoms and physical functioning in the patients which is similar with the full length version of DASH questionnaire. The questionnaire is region specific and covers daily activities, questions related to symptoms, self-image and social functioning. The score ranges from 0 to 100, while 0 indicating no disability and 100 indicating severe disability.²⁷
- b) Short form (36) Health Survey Questionnaire(SF-36):
The SF-36 questionnaire (English language) is a 36-item generic questionnaire, comprising questions under sub-scales such as: physical functioning (PF), role limitations due to physical problems (RP), role limitations due to emotional problems (RE), social functioning (SF), bodily pain (BP), vitality, mental health (MH) and general health (GH). Low score from 0-100 indicates impaired health status.²⁸
- c) Visual analogue scale (VAS):
Six VAS questions, related to current pain, hand mobility, sensory function, grip strength, fine motor skill and sleeping impairment, were asked. A VAS scale is a 100 mm continuous line with two verbal items in the extremes.^{29,30} A score between 0 and 100 was given; 0 indicating no pain/impairment while 100 indicates maximal pain/impairment. The participants were instructed to answer the VAS with respect to the affected hand.

Data Analysis

The Kruskal-Wallis and Mann-Whitney U tests were used to compare continuous data. Mann-Whitney U test was used for comparison of two groups. Pearson's chi-squared test and Fisher's exact test were used to examine differences in categorical data [presented as n (%)]. If the studied groups tended to be very small they were merged (i.e. MHISS severe and major). The significance threshold was set at $p < 0.05$ in this study.

Results

Subjects: For eighty nine subjects the questionnaires were given, 36 did not answer, eight subjects declined participation, 16 forms were returned which was incomplete 12 forms were not returned. Fifty three subjects were included in the study, giving a response rate of 60%. The follow-up time varied from 6 to 20 months depending on when the injury occurred and when the subjects returned the questionnaires.

General characteristics and gender

The characteristics of all the subjects are presented in Table 1 and 2.

Table 1: Characteristics of after a Zone II flexor tendon injury evaluated 6-20 months after the injury

Parameters		n(%)
Gender	Male	37(70%)
	Female	16(30%)
Age (years)	20-30	8(13.2)
	31-40	22(41.5%)
	41-50	16(30.1%)
	51-60	7(13.20%)
Hand dominance	Right	42(79.24%)
	Left	11(20.75%)
Previous employment	Manual	32(60.37%)
	Non-Manual	21(39.62%)
Currently working	Yes	43(81.1%)
	No	10(18.8%)

Table 2: Characteristics of after a Zone II flexor tendon injury evaluated 6-20 months after the injury

		All(53)	Men n=37(69%)	Women n= 11(30.18%)	P value
Dominant hand	Right	42 (79%)	31(58.49%)	11(20.75%)	0.73
	Left	11(20.7%)	6(11.32%)	5(9.4%)	
Uninjured hand	Dominant	37(69.8%)	29(54.7%)	8(15.09%)	0.86
	Non-dominant	16(30.18%)	7(13.20%)	9(16.98%)	
MHISS grade	Mild	23	17	6	0.13
	Moderate	14	9	5	
	Severe	9	5	4	
	major	7	4	3	

Hand function/symptoms and general health – gender

In Table 3, Quick DASH scores, VAS scales and SF-36 are presented, showing lower scores in SF-36 subscales physical functioning (PF), bodily pain (BP) and mental health (MH) among women.

Table 3- Gender differences in hand function/symptoms and general health after a Zone II flexor injury sustained at an age between 20-55years after 6 -20 months after the injury

	All n=53	Men n=37(69%)	Women n= 11(30.18%)	P value
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QuickDASH ^a Score	10.3 [2.3–34.1]	8.2[0.6–27.3]	12.6[2.5–42.5]	0.116
VAS ^b Pain	5.0[2.0–30.8]	5.0[2.0–24.5]	5.5[2.0–37.0]	0.395
VAS Hand Mobility	10.0[3.0–43.0]	11.0[3.0–48.8]	9.0[2.0–39.0]	0.419
VAS Sensory Function	6.5[2.0–36.3]	6.0[2.0–39.3]	6.5[2.0–33.8]	0.998
VAS Grip Strength	14.0[3.0–51.0]	14.0[3.0–54.8.0]	16.5[2.3–49.8]	0.473
VAS Fine Motor Skill	15.0[3.0–54.0]	15.0[3.0–58.0]	14.0[3.0–53.0]	0.995
VAS Sleep	3.0[1.8–20.8]	3.0[1.0–11.8]	3.5[2.0–36.3]	0.090
SF-36 ^c PF ^d	70.0[50.0–95.0]	83.0[65.0–95.0]	72.0[41.3–95.0]	0.013
SF-36 RP ^e	100.0[43.8–100.0]	100.0[25.0–100.0]	100.0[50.0–100.0]	0.796
SF-36 RE ^f	100.0[66.7–100.0]	100.0[66.7–100.0]	100.0[33.3–100.0]	0.781
SF-36 SF ^g	100.0[75.0–100.0]	100.0[75.0–100.0]	100.0[62.5–100.0]	0.322
SF-36 BP ^h	73.0[41.0–100.0]	72.0[46.0–100.0]	51.0[41.0–84.0]	0.041
SF-36 Vitality	71.0[52.5–85.0]	73.0[60.0–87.5]	62.0[45.0–85.0]	0.092
SF-36 MH ⁱ	83.0[68.0–96.0]	87.0[72.0–96.0]	81.0[65.0–92.0]	0.045
SF-36 GH ^j	73.0[55.5–87.0]	71.0[52.0–91.0]	74.0[55.5–87.0]	0.696

a=Quick Disabilities of the Arm, Shoulder and Hand Score; b = Visual Analogue Scale; c = Short Form (36) Health Survey; d = Physical Functioning; e = Role Physical; f = Role Emotional; g = Social Functioning; h = Bodily Pain; i = Mental Health; j = General Health; The score for Quick DASH range from 0 to 100; 0 indicating no disability and 100 signifying the most severe disability. For SF-36, an impaired health status produces low scores on a scale from 0 to 100. For VAS, a score between 0 and 100 was given; 0 = no pain/impairment to 100 = maximal pain/impairment

Hand-arm function/symptoms and general health – MHISS

Table 4 shows differences between the MHISS grades (mild, moderate and severe-major) in QuickDASH, VAS scales and two SF-36 subscales.

Table 4: Differences in hand-arm function/symptoms and general health in patients after a Zone II flexor injury evaluated 6-20 months after the injury, divided into groups according to Modified Injury Severity Score (MHISS)

	Mild n=23(43.9%)	Moderate n=14(26.4%)	Severe-major n=16(30.18%)	P value
QuickDASH ^a Score	6.6[0.0–21.5]	11.5[6.8–42.0]	37.2[15.9–54.0]	< 0.001
VAS ^b Pain	3.0[2.0–13.0]	22.5[3.3–42.5]	40.0[10.5–64.5]	< 0.001
VAS Hand Mobility	4.0[2.0–24.0]	16.0[3.5–43.8]	53.0[26.5–80.0]	< 0.001
VAS Sensory Function	3.0[2.0–16.0]	16.0[2.0–41.5]	50.0[27.5–78.0]	< 0.001

VAS Grip Strength	6.0[2.0–41.0]	30.0[3.5–65.0]	52.0[29.0–82.0]	< 0.001
VAS Fine Motor Skill	6.5[2.0–34.5]	17.0[3.5–52.3]	81.0[46.0–86.0]	< 0.001
VAS Sleep	3.0[1.0–20.0]	4.0[1.3–36.3]	8.0[2.3–34.5]	0.471
SF-36 ^c PF ^d	80.0[60.0–95.0]	70.0[41.3–95.0]	77.5[32.5–90.0]	0.417
SF-36 RP ^e	100.0[50.0–100.0]	100.0[50.0–100.0]	37.5[0.0–100.0]	0.045
SF-36 RE ^f	100.0[75.0–100.0]	100.0[66.7–100.0]	100.0[0.0–100.0]	0.088
SF-36 SF ^g	100.0[75.0–100.0]	100.0[65.6–100.0]	75.0[46.9–100.0]	0.058
SF-36 BP ^h	74.0[51.0–100.0]	52.0[41.0–84.0]	41.0[22.0–100.0]	0.004
SF-36 Vitality	70.0[55.0–85.0]	65.0[51.3–88.8]	67.5[42.5–85.0]	0.766
SF-36 MH ⁱ	88.0[72.0–96.0]	84.0[69.0–98.0]	78.0[62.0–93.0]	0.602
SF-36 GH ^j	77.0[57.0–90.0]	67.0[50.5–85.8]	68.5[35.0–93.3]	0.611

a=Quick Disabilities of the Arm, Shoulder and Hand Score; b = Visual Analogue Scale; c = Short Form (36) Health Survey; d = Physical Functioning; e = Role Physical; f = Role Emotional; g = Social Functioning; h = Bodily Pain; i = Mental Health; j = General Health; The score for Quick DASH range from 0 to 100; 0 indicating no disability and 100 signifying the most severe disability. For SF-36, an impaired health status produces low scores on a scale from 0 to 100. For VAS, a score between 0 and 100 was given; 0 = no pain/impairment to 100 = maximal pain/impairment

Hand-arm function/symptoms and general health - previous occupation

Subjects with an earlier manual occupation had lower scores on several of the SF-36 subscales Hand function - dominant or non-dominant VAS sensory function and grip strength were better in participants who did injured their non-dominant hand compared with those who did injured their dominant hand.

Table 5: Differences in hand-arm function/symptoms and general health in patients after a Zone II flexor injury evaluated 6-20 months after the injury, divided into groups according to previous occupation (manual/not-manual)

	Manual n = 32 (60.3%)	Non-manual n = 21 (39.6%)	P-value
QuickDASH ^a Score	18.2[2.3–37.5]	9.1[0.0–25.0]	0.072
VAS ^b Pain	5.0[2.0–41]	4.0[2.0–30.0]	0.439
VAS Hand Mobility	12.0[3.0–44.0]	8.0[2.0–43.0]	0.261
VAS Sensory Function	9.0[2.0–40.0]	5.0[1.0–33.0]	0.408
VAS Grip Strength	17.0[4.0–73.0]	21.0[3.0–46.0]	0.176
VAS Fine Motor Skill	19.0[2.0–55.8]	13.0[3.0–55.0]	0.675
VAS Sleep	4.0[2.0–29.0]	3.0[1.0–19.5]	0.245
SF-36 ^c PF ^d	70.0[46.3–85.0]	85.0[60.0–95.0]	0.003
SF-36 RP ^e	75.0[25.0–100.0]	100.0[75.0–100.0]	0.001
SF-36 RE ^f	100.0[33.3–100.0]	100.0[100.0–100.0]	0.043
SF-36 SF ^g	87.5[75.0–100.0]	100.0[84.4–100.0]	0.040
SF-36 BP ^h	62.0[41.0–100.0]	74.0[48.5–100.0]	0.299
SF-36 Vitality	65.0[50.0–78.8]	75.0[55.0–90.0]	0.033

SF-36 MH ⁱ	84.0[72.0–92.0]	92.0[68.0–96.0]	0.324
SF-36 GH ^j	67.0[41.3–87.0]	77.0[57.0–92.0]	0.129

a=Quick Disabilities of the Arm, Shoulder and Hand Score; b = Visual Analogue Scale; c = Short Form (36) Health Survey; d = Physical Functioning; e = Role Physical; f = Role Emotional; g = Social Functioning; h = Bodily Pain; i = Mental Health; j = General Health; The score for Quick DASH range from 0 to 100; 0 indicating no disability and 100 signifying the most severe disability. For SF-36, an impaired health status produces low scores on a scale from 0 to 100. For VAS, a score between 0 and 100 was given; 0 = no pain/impairment to 100 = maximal pain/impairment

Discussion

Characteristics of the population

For hand injuries, age and gender are key epidemiological variables with majority of cases were between the ages of 30 and 50. This finding was in par with earlier research that show young boys between the ages of 15 and 30 are more affected.³¹ Males outnumbered females in our study by 70% and 30% respectively. This discrepancy could be attributed to changes in culture and/or work.³² Males are more prone to such incident due to industrial settings leading to industrial injuries as most of the subjects were manual labours who had been injured on the job, especially in glass and plastic manufacturing plants.

Injured hand

The right hand was injured in 42 patients (79%), the left hand injured in 11 patients (20.7%), dominant hand in the study was more commonly involved, whether they were right- or left- dominant people. The results of our study were similar to other studies performed and maybe because one is more likely to injure the hand that is used most frequently used.[6] The dominant hand was the right hand in 42 patients (79.24%)and the left hand in 11 patients (20.7%). The non-dominant hand primarily functions in term of stabilization and positioning whereas the dominant hand has a more active role and so is more prone to injury.[7]

The majority of the patients in this study had tendon injuries that were surgically treated using a modified Kessler's approach and was given a dorsal blocking splint for flexor tendon injuries and a volar blocking splint for extensor tendon injuries. In the past, the focus of outcome was based on impairment (e.g., radiographic data, strength, and range of motion). However, few studies have shown that impairment is not necessarily the best method to measure outcome as it does not always reflect activity and or participation restrictions. So we measured health by self-report questionnaires. Subjective measures have been criticized in the past, because of variability in patient response and attitudes, lack of reliability and difficulty in validating these measures. It is precisely this data, however, that represents the outcomes that are often the most relevant to the patient. Hand therapist must address those issues that are most important to

patients if they are to be able to provide the most cost-efficient care of the highest quality.³³

The present cross sectional retrospective study has shown differences in hand disability and quality of life in participants of zone II flexor tendon repair who had sustained a hand injury more than 1.3 years earlier, grouped by variables, such as gender, age, severity of injury and injured hand. No existing studies have highlighted these aspects based on a variety of questionnaires showing various aspects of health and disability. Men and women differed regarding their living situation, reflecting the current general population.

The severe and major MHISS grade groups were combined since they had fewer participants and involved more advanced injuries, both of which were difficult.²⁵ Men had higher MHISS total scores than women, but not to the point where the MHISS classes (mild, moderate, and severe-major) were different. Within the severe-major MHISS groups, there were several disparities in QuickDASH and VAS when compared to mild injuries, but there were essentially no differences in the quality of life areas (SF-36).

However, it was discovered that moderate and severe-major MHISS grades were related with significantly higher overall QuickDASH scores at follow-up. The results of QuickDASH and other quality of life factors show that even if a person's hand function is impaired, they can still have a good quality of life and learn to cope with the injury and any residual problems to the extent that it does not influence their quality of life.^{18,19,34}

Subjects who had previously worked in a manual job scored lower on some SF-36 subscales. In accordance to the analysis of the study, the quality of life one year after hand injury, "blue-collar workers faced functional limitation to a greater extent than white-collar professionals".¹⁷ These patients had a long-term job position, and it's reasonable to believe that as they utilize their hands more frequently on a regular basis, their life status deteriorated.¹⁷ Our study, which assessed the participants' current circumstance, could possibly indicate a result of a former physical job scenario in their previous professional life.

There were few variations (sensory function and grip strength) in whether the subjects had damaged their non-dominant or dominant hand, for which a logical explanation is difficult to come up with. Given the current follow-up period (i.e. 6-20 months) and the fact that the majority of the participants had light injuries according to the MHISS, there may not have been any long-term impairment to the injured hand. With a shorter follow-up time, while the damaged hand is still impaired, this type of examination may be more informative.¹⁷

Conclusions

Self-report questionnaires provide an assessment of the patient's condition in the immediate post-operative period, when physical data are unavailable. Questionnaires combined with a physical evaluation allow more thorough assessment of hand injury patients' outcomes. Bearing in mind that the world can expect an increasing number of physically active people, more careful

investigation of this group of patients is relevant. Few differences in quality of life, assessed in groups by gender, age, previous occupation and injured hand were found. In general, the participants felt they had a good quality of life and few daily limitations, although hand functions, evaluated by QuickDASH, were influenced by female gender and severity of the hand injury. Gaining a better knowledge in prospective studies about the health, as well as the complex and integrated hand function, of patients after hand injuries could lead to a better evaluation of ongoing clinical practice and provide an opportunity for improving quality of care.

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