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Assessment of the factors affecting the loss of workforce in patients with traumatic hand injury

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ABSTRACT

Objective: This study aimed to examine the factors affecting the loss of workforce, including the time to return to work and work-related situations in patients with traumatic hand injury who were taken to a hand rehabilitation program.

Materials and Methods: The patients aged between 18-65 years with a history of traumatic hand injury in the last five years were analyzed retrospectively. Demographic and clinic data were taken from the medical records, and work-related problems were obtained by telephone calls. The severity of hand injury was assessed with Modified Hand Injury Severity Score (MHISS).

Results: A total of 147 patients (129 males, 18 females; mean age 39.83±10.4 years) were included. The duration of return to work was correlated with total MHISS (rho=0.262 p=0.003) while not related to age, education level, gender, or injured hand's dominance (p>0.05). Duration of return to work after hand injury and total MHISS were lower in the patients who had job modifications (p<0.001, p=0.002). Job modification rate, salary reduction, and patient-reported hand dexterity loss were higher in patients with work-related injuries (p<0.05).

Conclusion: This study highlighted that the increasing severity of hand injury caused a prolonged time to return to work, or job scope changes.

Keywords: Hand injury, Modified Hand Injury Severity Score, Return to work, workplace engagement

1. INTRODUCTION

Traumatic hand injury is the leading cause of work-related disability in the productive aged population [1]. It ranges from 'simple' injuries such as an isolated fracture to complex crush injuries that places significant health and economic burdens on patients [2]. Most injuries, apart from their severity, limit daily and professional activities that result in personal, social, and work-related consequences. Work-related professional activities are known to be affected more than daily living activities [3,4]. Furthermore, the injuries that cause permanent hand dysfunctions are shown to affect returning to work directly [5]. The degree of the traumatic hand injury is found to be related to functional results that indicate the long-term disability [1,3]. It predicts the situation for returning to the same job, modifying the job scope, a complete change of position, or not working. Therefore, determining the degree of the injury is crucial for anticipating work-related problems and taking precautions. It is also important in terms of preparing patients psychologically and initiating early rehabilitation that minimizes the life-wide impacts of the injury [3].

Most countries support rehabilitation programs to facilitate patients with hand injuries for returning to work [2]. Consequently, the return to work rate for traumatic hand injury patients has been well investigated and found to be related to factors such as the degree of injury, injury site, and pre-injury salary [3,6]. However, knowledge about these factors after a comprehensive hand rehabilitation program is limited.

The aim of this study is to assess the factors affecting the time to return to work and work-related situations, including job modifications, salary changes, and indemnification in the

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patients with traumatic hand injuries who were taken to a comprehensive hand rehabilitation program.

2. MATERIALS and METHODS

This cohort study was conducted between September 2, 2020, and January 20, 2021. Participants were selected by a retrospective analysis of the patients taken into a hand rehabilitation program in the last five years at the Marmara University Physical Medicine and Rehabilitation Department, Istanbul, Turkey. The study was approved by Marmara University School of Medicine Ethics Committee (approval number 09.2020.721, date 24.07.2020), and verbal informed consent was obtained from all participants by telephone calls. The inclusion criteria were determined to have had a traumatic hand or hand and forearm injury and to be aged between 18 and 65 years by the time the patient was receiving the hand rehabilitation. Patients who had bilateral traumatic hand and forearm, who were unemployed before the traumatic hand injury, and who received a hand rehabilitation for less than fifteen sessions were excluded.

Age, gender, hand dominance, education, occupational status, the type of traumatic injury, localization of the injured area, size of the incision, the damaged structures, and surgically repaired structures, and the number of hand rehabilitation sessions were taken from the medical records. The Modified Hand Injury Severity Score (MHISS) was calculated by the same experienced orthopedist (OB). Then, time to return to work and work-related situations after the traumatic hand injury, including changes in the workplace, job scope, or salary amount, and indemnification status for the injuries due to a work-related accident were obtained from the telephone calls by two physiatrists (ZKA, MD). The time to return to work was defined as the duration between the date of the injury and the work start date. The current hand dexterity was also assessed by self-reports of patients with a 3-point Likert scale; 1: almost the same/minor as before the injury, 2: moderate decrease compared to pre-injury, and 3: severe decrease compared to pre-injury.

Modified Hand Injury Severity Score (MHISS)

Modified Hand Injury Severity Score was originally developed as a descriptive severity scoring system for hand injuries distal to the carpus (zone I, II, and III) [7]. The MHISS was designed to include injuries proximal to the carpus (zone VI, V) [3]. The MHISS has four subgroups: integument, skeletal, motor, and neurovascular components. These subgroups are calculated by considering all injured tendons and intrinsic muscles, injured zone, affected fingers, accompanying neurovascular injuries, lacerations or losses in the skin, fractures, dislocations, and ligament injuries. Each subgroup contains both absolute scores and weighted scores according to the functional importance of the affected finger. As an example, first finger injuries are weighted more significantly than other finger injuries. Additionally, the score of the subgroup is doubled by the factors such as wound contamination and crush injury. The total MHISS is finally calculated by the sum of the scores of four subgroups and expressed as Minor (MHISS < 20), Moderate (MHISS 21–50), Severe (MHISS: 51–100), or Major injury (MHISS >101) by Campbell and Kay [7].

Statistical Analysis

The Statistical Package for Social Sciences (SPSS) 22.0 was used for the statistical analysis. The Shapiro-Wilk test was used to evaluate the normality of data distribution. The descriptive statistical methods (frequency, percentage, mean, standard deviation, minimum, maximum, median, and interquartile range) were performed. The Chi-Square test was used to examine the differences between categorical variables. The Kruskal–Wallis and Mann–Whitney U tests were used to compare the differences between continuous variables. Spearman rank correlation analysis was performed to analyze correlations. $P<0.05$ was set as statistical significance at a 95% confidence interval.

3. RESULTS

A total of 403 patients taken into a hand rehabilitation program in the last five years due to a traumatic hand or hand and forearm injury were retrospectively reviewed. Of these, 322 patients were found to be eligible for the study, and 218 were reached by telephone calls and informed about the study. One patient was excluded because of miscommunication, two patients were excluded because of receiving a hand rehabilitation program for less than fifteen sessions, six patients were excluded because of bilateral hand and forearm injuries, and six patients did not agree to participate and fifty-six patients were excluded because of being unemployed before the injury. Thus 147 patients were included in the study (Figure I). The demographic characteristics and clinical features of the participants are shown in Table I. Return to work periods in different MHISS subgroups and their comparisons are displayed in Table II. Since, the number of patients in severe and major injury subgroups were relatively small, it was decided to combine them to create a sufficient number of patients for further analysis. The work-related situations including returning to the same workplace or same job or not returning, a change in salary status, indemnification, and impairment of the injured hand skill according to the patient are expressed in Table III. The return to work period and the work-related situations according to a work-related accident are shown in Table IV.

The return to work period was found to be positively weak correlated with total MHISS ($r=0.262$ $p=0.003$). There was no relationship between return to work period and age, education level, gender, or injured hand's dominance ($p>0.05$). There was no difference in the time to return to work or total MHISS in the blue-collar workers compared to white-collar workers ($p=0.095$, $p=0.821$). The time to return to work and total MHISS were significantly lower in the patients who returned to the same job

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at the same workplace when compared to the others who had job modifications (p<0.001, p=0.002).

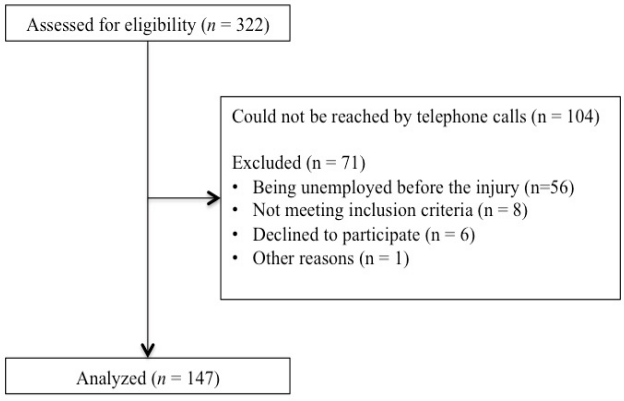

Figure I. *Flow diagram of participants*

Table I. *The demographic characteristics and clinical features of the participants*

Age (years)	*Min-Max*	18-65
	Mean±Sd	39.83±10.4
Gender	*Female*	18 (12.2%)
	Male	129 (87.6%)
Educational status	*Literate*	3 (2%)
	Primary school	44 (29.9%)
	Secondary school	19 (12.9%)
	High school	51 (34.7%)
	University	27 (18.4%)
	Postgraduate	3 (2%)
Pre-injury occupational category	*Blue collar worker*	129 (87.8%)
	White collar worker	18 (12.2%)
Reason of the traumatic hand and forearm injury	*Work-related accident*	77 (52.4%)
	Not	70 (47.6%)
Dominance of the traumatic hand and forearm injury	*Dominant side*	79 (53.7%)
	Non-dominant side	68 (46.3%)
Total MHISS	*Min-Max*	2-212
	Mean±Sd	27.27±28.5
MHISS classification	*Minor*	104 (70.7%)
	Moderate	23 (15.6%)
	Severe	14 (9.5%)
	Major	6 (4.1%)

Data= Mean±SD, n(%), MHISS= Modified Hand Injury Severity Score

Table II. *Comparison of the return to work period according to MHISS subgroups*

MHISS Subgroups	Return to work period (day) Median (IQR)	p value
Minor	60 (45-120)	[a]**<0.001**
Moderate	90 (40-180)	
Severe/Major	360 (108.75-905)	
Minor versus Moderate		[b]0.279
Minor versus Severe/Major		[b]**<0.001**
Moderate versus Severe/Major		[b]**0.003**

Data= Median (IQR), MHISS= Modified Hand Injury Severe Score, [a]Kruskal-Wallis Test, [b] Mann-Whitney U Test

Table III. *The work-related situations for the pre-injury working patients*

Return to work	*Same workplace-same job*	82 (55.7%)
	Same workplace – different job	11 (7.5%)
	Different workplace-same job	16 (10.9%)
	Different workplace – different job	21 (14.3%)
	Did not return	17 (11.6%)
Change in salary status	*Same*	111 (85.4%)
	Decreased	19 (14.6%)
Indemnification for the work-related accident	*Yes*	6 (7.8%)
	No	71 (92.2%)
The impairment of injured hand skill according to the patient	*None/minor*	61 (46.9%)
	Moderate	55 (42.3%)
	Severe	14 (10.8%)

Data= n(%)

Table IV. *The return to work period and the work-related situations for the pre-injury working patients according to a work-related accident*

		Work-related accident		*P value*
		Yes (n=71)	**No (n=59)**	
Return to work period (days)	*Median (IQR)*	70 (45-120)	60 (30-120)	[a]0.067
Total MHISS	*Median (IQR)*	20 (15-38)	20 (15-32)	[a]0.573
MHISS classification	*Minor*	42 (59.2%)	38 (64.4%)	[b]0.847
	Moderate	18 (25.4%)	13 (22%)	
	Severe/Major	11 (15.5%)	8 (13.6%)	
Job description	*Blue collar worker*	69 (95.8%)	43 (72.9%)	[c]**<0.001**
	White collar worker	2 (4.2%)	16 (27.1%)	
Job modification	*Yes*	34 (47.9%)	14 (23.7%)	[c]**0.006**
	No	37 (52.1%)	45 (76.3%)	
Change in salary status	*Same*	55 (77.5%)	56 (94.9%)	[c]**0.006**
	Decreased	16 (22.5%)	3 (5.1%)	
Dominance of the traumatic hand and forearm injury	*Dominant*	32 (45.1%)	44 (74.6%)	[c]**0.001**
	Non-dominant	39 (54.9%)	15 (25.4%)	
The impairment of injured hand skill according to the patient	*None/minor*	25 (35.2%)	36 (61%)	[c]**0.01**
	Moderate	38 (53.5%)	17 (28.8%)	
	Severe	8 (11.3%)	6 (10.2%)	

Data= Median (IQR), n (%), MHISS= Modified Hand Injury Severity Score, [a]Mann Whitney U Test, [b]Fisher Freeman Halton Test, [c]Pearson Chi-square Test

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4. DISCUSSION

This study revealed that the degree of the traumatic injury had direct effects on the time to return to work and work-related situations even in the patients who were taken to a comprehensive hand rehabilitation program. The increasing severity of the injury was found to cause prolonged resting periods, changes in the workplace, and the job scope. Age, education level, gender, or injured hand dominance were not detected to be related to the return to work period. Similarly, in previous studies, the degree of the injury was defined to be an important determinant factor for return to work, while hand dominance did not have an effect [2,3]. The patients with severe or major MHISS were shown to have a longer return to work period than the patients with minor and moderate MHISS. Consistent with this finding, Urso-Baiarda et al., also demonstrated increasing resting durations at median values of 30, 30, 118, and 760 days with minor, moderate, severe, and major subgroups [3]. However, the correlation between total MHISS and return to work period was found to be weak (r=0.262). This was unconvincing as in the study conducted by Watts et al., despite several studies that reported stronger correlation coefficients, ranging from 0.40 to 0.98 [6-10]. The results of these studies, could indicate preferring to use subgroups rather than the total score of MHISS for predicting the return to work period after a traumatic hand and forearm injury. Because the severity of injury subgroups as a classification system could reflect the return to work prediction more accurately than the scoring system as a continuous variable. Another important finding of this study was that higher severity of injury scores was detected in the patients who had to modify their jobs after the injury. Although, traumatic hand injury was confirmed to have an enormous impact on work-related activities by many studies, the workplace and job scope changes have not been assessed extensively [2,5,9,11]. One study reported that motion area loss was more significant in the patients who returned to work with a job modification after a traumatic hand injury [5]. The current functional status of the patients was not evaluated in this study; however, both severity of injury scores and return to work period were shown to be higher in the patients who had job modifications. These results indicated that the patients with higher severity of injury required more time to recover, and they needed job modifications more frequently when they reached enough abilities to start work.

This study pointed out that work-related injury ended up with a longer duration of going back to work. Besides, job modification and salary reduction were found to be significantly higher in patients with work-related injuries. In the literature, traumatic hand injury was confirmed to cause many work-related limitations by a number of studies [2,5,9,11]. However, most of these studies have mainly included patients with work-related injuries, and barely of them assessed the comparison according to work-related and non-work-related injuries. One study highlighted that patients injured by work-related damages were more likely to take longer resting durations [12]. Other studies suggested that patients who held someone else responsible for their injury had a more extended return to work period [13-15]. An interesting finding of this study was that most of the patients with work-related injuries had mainly impaired their non-dominant hands while the other patients had their dominant hands. In addition, the patients with work-related injuries self-reported to have lost more hand dexterity, despite having similar injury severity scores to the others. This could be explained by the higher ratio of blue-collar workers in the patients with work-related injuries group. These patients might have perceived more decreased hand dexterity because of the blue-collar jobs that generally require hard manual labor and high physical demands [13].

We have some limitations. As the study was conducted during the pandemic period we could not be able to perform face-to-face examinations. Therefore, the main limitation of this study was that we could not be able to assess the current functional status of the patients. Another one was evaluating hand dexterity by a patient-reported Likert scale. However, it is still a sound study because all of the patients included had taken to a comprehensive hand rehabilitation program. Moreover, patients were also investigated according to work-related injuries.

In conclusion, the degree of injury came to the forefront as a determinant factor for returning to work and work-related changes in this study. In addition, the work-related injuries showed up to be an aggravator for longer return to work period, job modification, and salary reduction. This information should be taken into consideration in the prediction and administration of workforce loss.

Compliance with Ethical Standards

Ethical Approval: Ethical approval for this study was obtained from **the** Marmara University School of Medicine Ethics Committee (approval number 09.2020.721, date 24.07.2020) and verbal informed consent was obtained from all participants by telephone calls.

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Conflict of Interest: The authors declare no conflicts of interest with respect to the authorship and/or publication of this article.

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