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Correlation of Return to Work Outcomes and Hand Impairment Measures Among Workers with Traumatic Hand Injury

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Abstract *Introduction* Hand impairment is a common and serious occupational injury among workers because it can affect the outcome to return to work (RTW) and even cause permanent dysfunction. The hand measures can directly describe the primary hand function and limitation. This study investigated the correlation of RTW and the overall hand impairment measures in the workers with traumatic hand injury. *Methods* Ninety-six subjects with occupational hand injury were recruited in this study to answer the RTW questionnaire and received the hand evaluation and motion analysis for their affected hands. RTW outcomes assessed whether the subjects successfully returned to work, either from a job change or salary reduction, and the length of the time it took for them to return to work (TRTW). The hand impairment measures included the hand impairment ratio, total active motion loss, motion area loss, grasp power loss, lateral-pinch power loss, and palmar-pinch power loss. *Results* A stepwise regression indicated that grasp power loss was a significant predictor for the length of TRTW. The motion area loss was firstly adopted to show statistically significance with RTW outcomes. Besides, the hand impairment ratio was also found to have mild positive correlation with TRTW significantly. *Conclusions* This study presented the subtle correlation of RTW outcomes and hand impairment measures. Both the strength loss and the motion area loss of the hand showed the significant correlation with RTW outcomes. The findings can point to some practical focuses in occupational rehabilitation for the workers with hand trauma.

Keywords Return to work · Traumatic hand injury · Hand evaluation · Motion area loss

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Introduction

Hand impairment is a common and serious occupational injury for workers because it may cause permanent dysfunctions. The permanent dysfunctions of hand injured workers not only hinder their daily activities but also directly affect their outcomes in their return to work (RTW) [1–5]. In Taiwan, a modern country with a fast-growing industry, the official statistical data showed that fingers and hands were the most frequently injured sites with 23∼25% prevalence in all reported occupational injuries since 2003 [6–8]. Most of their hands were crushed, clamped and rolled-in by machines or cut or sawed by tools resulting in impairment and disability. For a worker with hand injury, RTW plays an important role in economic productivity and gaining meaningfulness in life [9, 10]. Some researchers already revealed the considerable economic impact and labor costs of hand injuries in current society [11, 12]. The RTW outcome of the workers with hand injury thus has gradually drawn public concerns from governments and insurance corporations. Although the determinants of RTW outcome are very complicated and may include physical factors, psychosocial factors, and employment factors [13–15], the components of hand function are still the most essential ones. To our knowledge, previous studies on RTW outcome of workers with hand injury have mostly focused on individuals with peripheral nerve injuries after certain interventions [1–3, 5, 15–17]. These studies indicated the outcomes of RTW were influenced by the injury-related variables including the persistence of symptoms and complications, level of injury, sensory as well as strength recovery, and other non-physical variables such as age, level of education, type of job, and compliance with hand therapy. Less emphasis was placed on the correlation of RTW outcome and hand impairment measures among workers with traumatic hand injury. Actually, hand impairment measures can infer the limitation and residual ability of an injured hand and thus are key references in work rehabilitation and insurance reimbursement. Several studies reported that the initial anatomy severity of hand injury could refer to the final hand function as well as disability after maximal recovery [18–21]. Moreover, the hand impairment measures at the final plateau could also be the key determinants to the RTW outcome. Understanding the correlation of RTW outcome and hand impairment measures can assist to examine which measurement parameters effectively reflect the RTW possibility and to provide further discussion for appropriate prediction through hand impairment evaluation.

The clinical hand evaluation including the movement range of finger joints, strength of various prehension, and sensory function has been generally used for hand therapy and work rehabilitation [22, 23]. A widely used framework on rating of permanent hand impairment was developed by the American Medical Association (AMA) in 1971 entitled, "*AMA Guides to the Evaluation of Permanent Impairment*" (*AMA Guides*) and has gone through multiple reversions [24, 25]. The *AMA Guides* measure hand impairment mainly regarding the amputation level, location of sensory loss, and active range of motion (ROM) in the injured hand. The guidebook defined not only the measuring method but also the scales and formulae to convert the impairment components into a hand impairment ratio (HIR) in order to represent overall hand impairment. Although originally, the *AMA Guide*s were not intended to determine disability and compensation, the impairment ratio and its measurement methods with some miscellaneous modification have often become a principle reference in the consideration of the disability level and labor reimbursement for many years in various areas [26]. The reliability and validity of the impairment rating and its functional sensitivity for patients with lower extremity fracture have been verified [27, 28]. However, the correlation of the HIR along with other clinical hand measures and the RTW outcomes has not been well studied and reported. The main purpose of this study was to investigate and compare the hand impairment measures including HIR in predicting the RTW outcomes for the workers with traumatic hand injury.

The conventional hand evaluations used to adopt the simple tools such as tape, caliper, goniometer, and dynamometer to quantitatively measure and provide objective evidence of the hand impairment. These tools can quickly measure the instant performance of the hand in a moment, but they cannot continuously record the dynamic motion of the hand. With recent improvement of motion-capture and computer-aid technology, the advanced motion analysis system was applied to investigate the movement loci and provide more precise and reliable information about functional movements of the hand [29]. The ROM, seen as the working space of each finger, is an important component of hand function [30]. The maximal working area of an injured hand, which can be exactly measured by Motion Analysis System, was reported as one practical index of hand disability [31]. Therefore, this study also aimed to adopt the motion analysis system to investigate the relationship of this factor with other hand impairment measures and RTW outcomes among workers with traumatic hand injury.

Materials and Method

Subjects

The study recruited patients who suffered occupational hand trauma and who were admitted for surgery from 2003 to 2006 at a tertiary referral hospital center in southern Taiwan. The patients were at least 6 months post-injury and clinically stable following treatment and rehabilitation. Patients that had a history of other severe hand injury and difficulty with communication (i.e. language barrier) were excluded from the study. Concerning the homogeneity of the study population, the left-handed patients, which accounted for $\sim 1\%$ of the possible participants, were also excluded. The study proposal was evaluated by the IRB of National Cheng Kung University Hospital. After providing written consent, ninety-six right-handed subjects (80 males and 16 females) aged 18–68 years (average: 40.2 years)

Table 1 The demographic background and RTW information

	All	RTW level			Salary reduction[a]		TRTW
	$N = 96$	RTW without job change ($N = 59$)	RTW with job change ($N = 31$)	No RTW ($N = 6$)	No ($N = 78$)	Yes ($N = 12$)	($N = 90$) Mean (SD)
Age							
Mean (SD)	40.2 (12.5)	42.2 (11.6)	37.8 (12.4)	32.8 (17.7)	40.5 (12.3)	41.8 (10.6)	–
Gender							
Male	80	52	23	5	67	8	11.3 (13.0)
Female	16	7	8	1	11	4	23.2 (25.8)
Education level							
Elementary school or less	19	13	4	2	13	4	21.8 (26.0)
Junior high school	16	10	6	0	15	1	10.7 (9.2)
Senior high school or vocational school	41	27	14	0	37	4	12.2 (14.4)
College or university	20	9	7	4	13	3	9.2 (10.1)
Injured hand							
Right (dominant)	39	23	14	2	34	3	12.7 (13.4)
Left (non-dominant)	57	36	17	4	44	9	10.7 (12.4)

[a] Chi-square analysis showed significant difference in RTW groups ($P < .01$)

participated in the study. Fifty-seven of the participants had injury in the left hand and the remaining thirty-nine in the right hand. Demographics of the participants and their RTW information are displayed in Table 1. Sixty-eight subjects (70.8%) had hand trauma due to machine crushing and clamping as well as rolling-in. Twenty-eight subjects (29.2%) injured their hands by cutting or sawing while operating tools. Although they had involved various digits and hand sites with different severities in their occupational injuries, all were reported to reach the stable and maximal recovery after operation and rehabilitation. The average time interval between injury onset and assessment was 11.3 months (SD: 4.1 months).

Record of Return to Work

A questionnaire was developed to investigate the demographic information, work history before and after the injury, economic level, and self-reported work status. There were three main variables to depict the RTW outcomes for analysis. *RTW level* classified the subjects into three levels: RTW without job change, which represented the best outcome for them with little or no handicap from the injury; RTW with job change, which inferred that the workers had to modify their jobs due to functional limitation; and no RTW, which implied the worst outcome that they lost the ability as well as confidence to work. *Salary reduction* was assessed if it occurred in the patients after the hand injury to infer their work capacity after recovery. The weeks after the subject was injured and until the day he or she returned back to work was counted as *time to RTW* (TRTW). TRTW has been previously seen as an objective outcome of RTW [1]. A less TRTW meant the better RTW outcome.

Measurement of Hand Impairment

The following evaluation procedures were applied to measure the impairment status of the injured hands at their final stable conditions:

1. Photograph the injured hand to record the general appearance, skin condition, palm arch, and deformity;
2. Measure both the active and passive ROMs of the joints in the injured hand by conventional goniometer;
3. Apply sensation test on the injured hand to judge the level and location of sensation impairment;
4. Justify the amputation level of the injured hand;
5. According to the *AMA Guides*, convert all the above data into a HIR, in terms of 100% as totally impairment of a hand;
6. Measure the grasp power (GP), lateral-pinch power (LP), and palmar-pinch power (PP) of both the injured and intact hand by JAMAR dynamometer and pinch meter. According to Mathiowetz et al.'s [32] procedure, the subject was introduced to sit with shoulder adducted and neutrally rotated, elbow flexed at 90° and forearm as well as wrist were in neutral position. The subject made an optimal cylindrical grasp with thumb opposing to all fingers on the dynamometer three times to get a mean grasp power. Under the same arm position the pinch meter was placed between the thumb and the lateral aspect of the subject's index to

measure the optimal lateral-pinch power. For the palmar-pinch power, the pinch meter was placed between the thumb pad and the pads of the index as well as long fingers. Both the pinch powers were averaged over three trials with rest intervals of seconds. The power loss was defined as the deficient power of the injured hand from the intact hand and was divided by the power value of the intact hand to present as percentage loss, in terms of 100% as totally loss. The 10% corrections for hand dominance were also modified [33]. The left, none-dominant hand was supposed to have 10% less strength than the right dominant hand. If the individual's injured hand was stronger than his or her non-impaired hand, 0% strength loss was noted [17];

7. Calculate the total active motion range loss (TAML) from the ROM data by conventional goniometer. For decades, the total active motion ranges has been used to assess digital performance [34]. The TAML was defined as the percentage of the deficient range from normal range over the normal range; and
8. Measure the maximal working area of the injured finger in three-dimensional space through the motion analysis system. The injured finger was to move from total extension to total flexion by flexing the metacarpal joint first, then the proximal phalangeal joint, then the distal phalangeal joint step-by-step, and back to the total extension by extending the metacarpal joint first, then the proximal phalangeal joint, and finally the distal phalangeal joint step-by-step. The loci of the finger tip thus made an envelope. The area of the envelope can be calculated to examine the motion area according to Chiu and Su's algorithm [29]. The motion area of the contrast finger in the intact hand was also measured. The motion area loss (MAL) was defined as the percentage of the area difference between the injured and contrast fingers over the motion area of the intact finger.

Data Analysis

Descriptive statistics were used to illustrate the demographic background and hand impairment measures of the subjects with different RTW outcomes. Chi-square analysis was used for nominal variables and t-tests and ANOVA for continuous variables were used to compare different RTW groups. Multiple logistical regression analysis was conducted on the predictor variables of age, gender, education level, injured hand, and all the impairment measures with the RTW levels. To investigate the relationship of the hand impairment measures and the TRTW, the correlation coefficients were calculated and the regression analysis was applied. All tests were two sided and a P value of <0.05 was considered statistically significant. Data analyses were performed by using statistical software, SPSS® (11th edition).

Results

RTW Levels and Salary Reduction

The demographic statistics and RTW information in Table 1 reveal a total of 59 subjects returned to their previous jobs without any job modification, while 31 subjects returned to work at the same company with a job change to a different company. Only six subjects in this study did not return to work after their hand injury; two had a moderate hand impairment (HIR: 34.5 and 39.2%), were aged above 55 years old, and only had a basic education level (elementary school). The remaining four subjects had only slight hand impairment (HIR below 12%), were between the ages of 20–25 years old, and decided to return to college instead of going back to work. Among the three RTW level groups, the analyses found no significant differences in age, gender, education level, and dominance of the injured hand. In the 90 subjects who returned to work, 78 subjects did not have a salary reduction, but 12 subjects did receive a salary reduction after the injury. No significant difference was observed in age, gender, education level, and dominance of injured hand between these two groups. However, the chi-square analysis showed a large significant difference in salary reduction between the two RTW groups with and without job change ($P = .001$). The RTW group without job change tended to have no salary reduction.

The distribution of the hand impairment measures in different RTW groups is shown in Table 2. The one-way ANOVA with Scheffe's post hoc comparison indicated that the MAL of the RTW group without job change was significantly different from the RTW group with job change. In addition, a significant difference was also found in the MAL between the RTW groups with and without salary change. The contribution of the hand impairment measures in the context of the relative demographic variables was assessed with multivariate logistic regression analysis using RTW with/without job change. The results are summarized in Table 3. The logistic regression equation combining all these variables correctly classified 56% of the subjects who returned to work with job change, 90% of the subjects who returned to work without job change, and 78.7% of the overall subjects. The overall percentage observations was significantly higher ($P < .01$) than the chance rate (65.6%) of discriminating whether job change in the RTW subjects. The statistics found that gender factor

Table 2 The distribution of the hand impairment measures of different RTW groups

	Unit = %	All	RTW level[a]			Salary reduction[b]	
		$N = 96$	RTW without job change ($n = 59$)	RTW with job change ($n = 31$)	No RTW ($n = 6$)	No ($N = 78$)	Yes ($N = 12$)
HIR[c]	Mean (SD)	16.5 (15.8)	13.9 (13.6)	21.2 (18.8)	17.1 (15.9)	15.7 (15.6)	21.5 (17.0)
TAML[d]	Mean (SD)	15.2 (14.2)	13.2 (12.4)	18.8 (16.9)	16.1 (14.1)	14.0 (13.8)	22.4 (15.4)
MAL[e]	Mean (SD)	12.2 (13.1)	9.4 (10.5)	18.2 (14.8)	14.4 (20.3)	10.8 (10.9)	19.0 (18.8)
GP loss[f]	Mean (SD)	17.4 (24.6)	15.8 (23.8)	20.7 (27.6)	15.6 (15.5)	17.3 (25.2)	18.8 (25.6)
LP loss[g]	Mean (SD)	14.9 (21.7)	13.8 (21.4)	15.8 (22.9)	20.2 (20.8)	14.1 (22.0)	17.0 (21.3)
PP loss[h]	Mean (SD)	22.4 (26.4)	22.2 (25.2)	24.7 (30.3)	12.8 (15.9)	23.7 (28.2)	18.8 (16.6)

[a] Significant difference in MAL between two RTW groups without and with job change ($P < .05$)

[b] Significant difference in MAL between the RTW groups without and with salary reduction ($P < .05$)

[c] Hand impairment ratio: measured according to *AMA* guide, in terms of 100% as total impairment in a hand

[d] Total active motion loss: the percentage of the deficient range over the normal range

[e] Motion area loss: the percentage of the deficient motion area over that of the contrast and intact digit

[f] Grasp power loss: the percentage of the deficient grasp power over that of the contrast and intact hand

[g] Lateral-pinch power loss: the percentage of the deficient lateral-pinch power over that of the contrast and intact digit

[h] Palmar-pinch power loss: the percentage of the deficient palmar-pinch power over that of the contrast and intact digit

Table 3 The multivariate logistic regression analysis of RTW with/without job change likelihood

Variable	Regression coefficient (β)	Standard error	χ^2	P	Odds ratio	95%CI
Constant	−0.238	2.422	0.01	0.922	0.788	–
Gender	−1.742	0.897	3.78	0.052	0.175	(0.030, 1.015)
Age	−0.041	0.034	1.50	0.221	0.960	(0.898, 1.025)
Education level	0.332	0.409	0.66	0.416	1.394	(0.626, 3.107)
Injured hand	0.618	0.624	0.98	0.322	1.856	(0.546, 6.305)
HIR	0.078	0.044	3.14	0.076	1.081	(0.992, 1.179)
TAML	−0.007	0.042	0.03	0.865	0.993	(0.914, 1.079)
MAL	0.045	0.034	1.74	0.187	1.046	(0.978, 1.118)
GP loss	−0.017	0.026	0.46	0.500	0.983	(0.935, 1.033)
LP loss*	0.072	0.030	5.74	0.017	1.075	(1.013, 1.140)
PP loss*	−0.083	0.034	5.85	0.016	0.921	(0.861, 0.984)

Multivariate logistic model: −2 log-likelihood = 71.023, $\chi^2 = 24.45$, $P < .01$. Observations correctly classified = 78.7%

* $P < .05$

($\chi^2 = 3.78$, $P = .05$) showed a nearly significant relation to the RTW levels of whether there was a job change; males tended to return to their original work without job change. However, age, education level, and dominance of the injured hand were not significantly significant. In the hand impairment measures, LP loss ($\chi^2 = 5.74$, $P = .02$) and PP loss ($\chi^2 = 5.85$, $P = .02$) were related to RTW with/without job change. The PP loss showed to decrease the likelihood while the LP loss showed to improve the likelihood of RTW without job change. The multivariate logistic regression analysis examined the contribution of the hand impairment measures together with the relative demographic variables to the RTW with/without salary reduction and demonstrated no significant difference in the model and variables.

Time to Return to Work

The average TRTW of all subjects was 13.3 weeks (SD: 16.3 weeks). The means of the TRTW in different demographic groups are shown in Table 1. There was no statistically significant difference between the relative groups in gender, education level, and dominance of the injured hand. However, there was a statistically significant

Table 4 Correlation of hand impairment measures and TRTW ($N = 90$)

Variables	TRTW	
	Pearson's r	Adjusted[a] R^2
HIR	0.31**	0.61*
TAML	0.25*	0.51
MAL	0.26*	0.51**
GP loss	0.42***	0.69***
LP loss	0.36***	0.07
PP loss	0.38***	0.29

[a] Adjusted for age, gender, education level, and injured hand as covariates

* $P < .05$; ** $P < .01$; *** $P < .001$

difference in TRTW between the RTW groups with and without salary reduction ($P < .05$), but no difference between the RTW groups with and without job change. The *Pearson's* correlation coefficients demonstrated that all the measured variables had a mild positive correlation with TRTW at the significant level (Table 4). After adjusting for gender, age, education level, and dominance of the injured hand, the HIR, MAL, and GP loss were found to have a moderate positive influence in TRTW with statistical significance (Table 4). Table 5 summarizes the stepwise regression analysis for TRTW by hand impairment measures. Only GP loss could significantly predict TRTW, accounting for 17% of the variance. No other measured variables in the regression model were significant predictors of TRTW.

Hand Impairment Measures Correlation

All the hand impairment measures were mutually examined by *Pearson's* correlation analysis and the coefficients are shown in Table 6. HIR, TAML, and MAL were found to have significantly moderate and positive correlations with each other. Specifically, HIR demonstrated to be highly related to TAML ($r = .79$, $P < .01$). Besides, GP loss, LP loss, and PP loss also showed to have significantly moderate and positive correlations with each other.

Table 5 The stepwise regression model of hand impairment measures for TRTW

Variable	Beta	R^2	Summed R^2	95%CI
Constant	8.53	–	–	(2.87, 14.19)
GP loss*	0.21	0.17	0.17	(−0.02, 0.44)
PP loss	0.11	0.02	0.19	(−0.14, 0.38)
MAL	−0.05	0.00	0.19	(−0.45, 0.35)
LP loss	0.04	0.00	0.20	(−0.24, 0.32)
TAML	−0.03	0.00	0.20	(−0.43, 0.37)
HIR	−0.00	0.00	0.20	(−0.46, 0.45)

* $P < .05$

Table 6 Correlation of the hand impairment measures

Pearson's r	HIR	TAML	MAL	GP loss	LP loss	PP loss
HIR	1	0.79**	0.66**	0.03	0.04	−0.02
TAML	–	1	0.51**	−0.05	0.01	−0.04
MAL	–	–	1	−0.06	−0.05	−0.02
GP loss	–	–	–	1	0.63**	0.61**
LP loss	–	–	–	–	1	0.71**
PP loss	–	–	–	–	–	1

* $P < .05$; ** $P < .01$

Discussion

We performed a retrospective study in RTW outcomes after occupational hand trauma by measuring the subjects' hand impairments and found some heuristic correlations between the measured variables. The motion area loss measured by the motion analysis system was firstly introduced to have statistical significance that differ between the RTW groups with or without job change; similar findings were also observed for the salary reduction variable. While the other measurement variables failed to detect the difference among the various RTW groups, this new parameter set a significant differentiation. The subjects with less motion area loss tended to return to work without a job change and salary reduction, inferring that the concept of "the working space of the finger" could be converted into the motion area loss to represent the limitation of the worker's injured hand and subtly reflect the RTW outcomes related to the hand injury. Furthermore, the grasp power loss of the injured hand was found to have statistical significance in predicting the length of TRTW for the RTW workers. The grasp power has been seen as an important component of the work capacity for the worker with hand injury [35]; subjects with less grasp power loss tended to return to work sooner than those with more grasp power loss. Bruyns et al. [17] also indicated that the grip strength loss differed strongly between the RTW and non-RTW workers that have nerve injuries in their hands. Our findings support the significant correlation of the grasp power and the RTW outcome.

Many researchers indicated that the actual outcome of RTW can be very complicated and influenced by demographic variables such as age and gender [1–3, 5, 14, 16]. However, the subjects between various RTW groups in this study were found to have no significant differences in age, gender, education level, or dominance of injured hand. The reasons could be the limited and skewed distribution in samples and other undetected factors such as family economic status, employer's support, job opportunity, personal volition and confidence, etc., which need further investigation. Besides, the multivariate logistic regression analysis including all the demographic variables and hand impairment variables showed that gender had close to a significant influence on RTW with males being more likely to receive RTW without a job change. It may imply the male advantage in work while men are traditionally seen as bread earners in Taiwanese family as Jang et al. mentioned [14]. In addition, both the LP loss and PP loss were shown to have a significant influence on RTW with/without job change, but in opposite directions, respectively. The subject with more LP loss tended to increase the odds ratio of RTW with job change, while the subject with more PP loss tended to have a decreasing relationship. The PP loss results are not in agreement with those stated in Bruyn's study [17] and will need further inquiry. After consideration and adjusting for the demographic background, TRTW was shown to be significantly related to HIR, MAL, and GP loss. HIR from a holistic evaluation of the hand impairment showed a positive correlation with RTW. As suggested by the *AMA Guides*, modifications should be made when using HIR for determining the disability level; advanced investigation is needed when examining the relationship between HIR and RTW after demographic adjustment. The MAL was examined to have mild positive correlation with TRTW at significant level. The subjects with more motion area loss spent more time to return to work. The GP loss showed its significance with TRTW both in Pearson's correlation and the stepwise regression analysis. When the subjects got higher percentage in grasp power loss, it took them longer time to return to work.

In the analysis of all hand impairment measures, two groups have clear correlations. HIR, TAML, and MAL were significantly correlated with each other; GP loss, LP loss, and PP loss mutually showed a similar correlation. The range of motion of the hand is the key component in HIR, TAML, and MAL assessment when explaining their correlation. These three measures, attributed as the index for anatomical limitation, were seldom examined to their relationship with RTW [31]. This study revealed the significance of MAL and HIR with RTW outcomes, but that TAML failed to show any significant correlations in the relationships. Therefore, MAL and HIR played better predicting roles than TAML. Clearly, the three strength parameters of the hand showed a close correlation and, in turn, influenced the RTW outcome. GP loss was the predictor for TRTW and LP loss and PP loss predicted RTW with/without job change. The strength of the grasp and pinch has been attributed as components of functional work capacity and has been reported of their influence to RTW outcome [3, 17, 35]. However, results from the present study consisted of both agreements and discrepancies from those previously reported. More comprehensive investigation is strongly suggested to define their significance in RTW.

This study presented a subtle correlation between RTW outcomes and the hand impairment measures among the workers with hand trauma. However, the subjects obtained were sampled from convenience and skewed to those who already were RTW, which limited the sample size and the extent of interpretation. Data retrieved from the subjects were only able to explain the RTW outcome in regards to with/without job change or salary reduction and TRTW. Nevertheless, the RTW levels and salary reduction could be affected by other social-economic factors beyond our detection. The personal economical pressure, the employer's job offer as well as the work restriction, and the individual confidence etc. all could influence the subject's volition to return to work. These factors need to be studied comprehensively in the future. In terms of TRTW and hand impairment measures, this study found that the grasp power loss was a key predictor. Those who lost less grasp power were able to return to work earlier than those who lost more. Besides, the motion area loss and HIR by AMA guide were found significantly positive correlation with TRTW. These hand impairment measures were examined by this study to show significant correlation with RTW outcomes for workers with traumatic hand injury. The findings of this study reveal some practical considerations and area of focus in occupational rehabilitation for the workers with hand trauma.

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