

# Short term functional results in traumatic hand reconstruction at Hospital General de Zona #1.

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**INTRODUCTION:** Post-traumatic hand reconstruction, it is a complex process, mainly due to bone, muscular, tendon, neurovascular and skin injury.

**OBJECTIVE:** To determine the short term functional results in patients undergoing post-traumatic hand reconstruction in General Hospital No.1.

**METHODS:** Descriptive, prospective, longitudinal and single-centered study, conducted during July 2019 to July 2020, evaluating patients with hand injury due to falling, collision, or burns and who underwent emergency reconstructive surgery. "Disabilities of the Arm, Shoulder and Hand"(DASH) questionnaire was used to assess postoperative functionality.

**RESULTS:** 16 patients, mean age was 33+8.6 years, 31.3% were female, 68.8% male, right hand was injured in 50% and left hand in 50%. Mechanism of injury was crushing in 25%, falling 18.8%, collision 37.5%, burns 6.3% and others 12.5%; reconstruction was 25% vascular, 12.5% nerve, 12.5% bone, and 50% multiple, there were complications in the 75%. DASH score at the beginning was 86, at 3 and 6 months was 84. The reconstruction did not show a significant difference according to sex or etiology, when comparing the baseline DASH questionnaire and at 3 months there was no difference, the DASH at 3 to 6 months did not show a significant difference either.

**CONCLUSIONS:** It is concluded that patients with traumatic hand had high DASH scores, showing that functionality did not improve despite undergoing surgical procedure. Physiotherapy treatment is key factor in order to improve the functionality in patients, this study did not follow up if the patients had an adequate therapy nor if they were constant.

**Keywords:** Hand reconstruction, hand trauma.

The reconstruction of post-traumatic hand involves invasive procedures that require flaps, bone grafts, blood vessel anastomosis<sup>1</sup>, tendinoplasty. These tissues can be obtained from different sites for grafts and flaps, and entails multiple surgeries, long term joint immobilizations and joint stiffness.<sup>2,3</sup>

It is estimated that hand injuries correspond to the 29.77% of all trauma patients in the United States<sup>3</sup>. Among the most affected structures are tendons, which warrant hand reconstruction trained surgeons in order to achieve the most effectivity and to decrease anatomic, functional and psychological repercussions.<sup>4,5</sup> Although the reconstruction may involve different organic tissues, the aesthetical aspect is also fundamental.<sup>6</sup>

The surgical treatment and postoperative care are the processes that require constant supervision, in addition to assessment through functional tests or questionnaires which allow to evaluate the result of the surgery; one example is the "Disabilities of the Arm, Shoulder and Hand" (DASH),<sup>5,7</sup> that the higher the score, the higher the degree of disability. Because of

the aforementioned, this instrument has the capacity to assess the reconstructed anatomic sites in order to perform daily life tasks that involve flexion, extension, abduction, opposition and deviation.<sup>8</sup>

## Methods

Descriptive, prospective, longitudinal and unicentric study that was conducted in patients that were attended by the plastic surgery service of the General Hospital No. 1 of the Mexican Institute of Social Security. The study period was from July 1st, 2019 to July 1st, 2020. Population was patients that had injuries due to falls, collisions, burns and others, while working, and were transferred immediately to the emergency service. Attention to bleeding and affected tissues was given and consultation to plastic surgery service in order to perform emergency reconstructive procedures, which allowed better tissue viability. The latter was assessed by "Disabilities of the Arm, Shoulder and Hand" (DASH) questionnaire. Patients of both sexes were selected, older than 18 and that underwent post-traumatic hand reconstruction and

	Mean	Standard Deviation	Minimum	Maximum
Age	33.1250	8.65544	19.00	47.00
DASH immediate postoperative	86.3750	7.91518	72.00	99.00
DASH at 3 months	84.8750	6.18466	70.00	91.00
DASH at 6 months	84.8750	8.01561	68.00	100.00

**Table 1.** Descriptive statistics of patients.

were given physiotherapy treatment. Polytraumatized patients and did not continue 6 months follow up were eliminated. Demographic variables were age and sex; independent variables were side of injured hand, etiology, complications and hand biomechanic; the dependent variables were reconstruction and DASH score. Statistic applied was descriptive (central tendency and dispersion measures) and correlational (chi square and t-student for DASH score at the beginning, 3 and 6 months), using the SPSS v25 software. The study fulfilled the Health Research Guidelines and was considered minimal risk research, anonymity of the individuals was kept and results were used for scientific research purposes.

## Results

A total of 16 patients, mean age was  $33 \pm 8.6$  years, 31.3% were female, 68.8% male (Chart1), right hand was injured in 50% and left hand in 50%. Mechanism of injury was crushing in 25%, falling 18.8%, collision 37.5%, burns 6.3% and others 12.5%; reconstruction was 25% vascular, 12.5% nerve, 12.5% bone, and 50% multiple (Chart II), there were complications in the 75%. DASH score at the beginning was 86, at 3 and 6 months was 84.

Measurement of biomechanics was assessed by movements and included wrist extension, wrist flexion, radial deviation, cubital deviation, metacarpophalangeal extension of the last four fingers, proximal interphalangeal flexion, proximal interphalangeal extension, distal interphalangeal flexion, distal interphalangeal extension, abduction and adduction of thumb, thumb opposition, metacarpophalangeal flexion of the thumb, metacarpophalangeal extension of the thumb and interphalangeal extension of the thumb (Chart III).

The reconstruction did not show significant difference according sex or etiology. It was fundamental to assess functionality with DASH score at the beginning, 3 and 6 months. (CHART IV). The reconstruction did not show a significant difference according to sex ( $p=0.106$ ) or etiology ( $p=0.759$ ), when comparing the baseline DASH questionnaire and at 3 months there was no difference, the DASH at 3 to 6 months did not show a significant difference either.

## Discussion

Post-traumatic hand is a pathology of complex surgical treatment which seeks the preservation of functionality such as biomechanic and anatomy. This condition is frequent in surgery services of the regional general hospitals that attend workers and that require reconstruction in order to continue their daily activities and work.<sup>9,10</sup> Surgical treatment depends on priorities such as ischemia (vascular reconstruction), followed by nerve reconstruction, use of osteosynthesis and suture of the injured tendon.<sup>11</sup>

Ju JH and cols, conducted a study in 31 patients, 22 male and 9 female, mean age 28, injuries were produced while working and due to the mechanism of contusion, laceration and twisting, all underwent surgical treatment. Mean DASH score in immediate postoperative was 52.9, 48.9 at 3 months and 46 at 4 months. When comparing these results with our results, there was improvement in both at 3 months after surgery.

Spark T and cols, studied 65 patients, mean age was 31, 63% were male and 37% female, injured hand was 91% the right one, left 9%, 63% were employed, 26% unemployed, 11% others. Cause of injury was accidental in 43%, violence related 37%, contusion by car 3%, work related 8%, and self-inflicted 9%. Injured structures were nerve laceration in 59.5%, 7% fracture, 14% vascular lesion, 10% tendons and 32% none. Mean DASH score at 3 months was  $27.9 \pm 28.3$  and at 6 months was  $15.9 \pm 23.7$ ; there was a statistically significant difference<sup>4</sup>.

		n	%	P value
Sex	Male	11	68.8	0.106
	Female	5	31.3	
Hand affected	Right	8	50.0	0.682
	Left	8	50.0	
Etiology	Crushing	4	25.0	0.759
	Falling	3	18.8	
	Collision	6	37.5	
	Burns	1	6.3	
	Others	2	12.5	
Reconstruction	Vascular	4	25.0	0.112
	Nerve	2	12.5	
	Bone	2	12.5	
	Multiple	8	50.0	
Complications	No	4	25.0	0.021
	Si	12	75.0	

n=sample,%=percentage

**Table 2.** Proportions of variables

		n	%	P value
Wrist extension	No	8	50.0	0.682
	Yes	8	50.0	
Wrist flexion	No	4	25.0	0.721
	Yes	12	75.0	
Radial deviation	No	8	50.0	1.000
	Yes	8	50.0	
Cubital deviation,	No	5	31.3	0.832
	Yes	11	68.8	
Metacarpophalangeal extension of the last four fingers	No	10	62.5	0.659
	Yes	6	37.5	
Metacarpophalangeal flexion of the last four fingers	No	6	37.5	0.545
	Yes	10	62.5	
Proximal interphalangeal flexion	No	13	81.3	0.412
	Yes	3	18.8	
Distal interphalangeal flexion	No	6	37.5	0.912
	Yes	10	62.5	
Proximal interphalangeal extension	No	6	37.5	0.139
	Yes	10	62.5	
Distal interphalangeal extension	No	7	43.8	0.347
	Yes	9	56.3	
Abduction and adduction of thumb	No	10	62.5	0.785
	Yes	6	37.5	
Thumb opposition	No	9	56.3	0.425
	Yes	7	43.8	
Metacarpophalangeal flexion of the thumb	No	10	62.5	0.659
	Yes	6	37.5	
Metacarpophalangeal extension of the thumb	No	6	37.5	0.234
	Yes	10	62.5	
Interphalangeal extension of the thumb	No	5	31.3	0.693
	Yes	11	68.8	
n=sample,%=percentage				

**Table 3.** Biomechanics.

Abdullah and col, in 2019 analyzed 27 patients who underwent partial or total amputation of phalanges, 18 required revascularization, 10 replantation; recovery period was 9.6 months (range from 3 to 24 months). DASH score was employed reporting high disability, despite of performing immediate procedures of hand reconstruction. A positive correlation was found between DASH score and delay of surgical procedure ( $r=0.193$ ), which represents a poorer outcome in patients. Similar results were obtained in our investigation that showed more disability cases regardless undergoing complex surgical procedures involving revascularization, bone material insertion and flaps.<sup>12</sup>

Mayra P and cols., carried out a randomized controlled trial, in which a total of 20 patients were selected with traumatic hand injury that required cubital nerve and flexor tendon repair. In order to evaluate functionality results in 3 and 6 months after surgical intervention, DASH scored was applied, obtaining progressive clinical improvement; however, no significant difference was reported.

When comparing to our results, the same outcome was found, patients with follow up at 3 and 6 months had disability despite undergoing surgery and physiotherapy.<sup>13</sup>

Yuan F and cols, analyzed 1659 studies, 43 fulfilled selection criteria, which analyzed patients with traumatic hand; their evolution and functional recovery were evaluated, in 93% they reported active movement after the first 72 hours of postoperative period, 90 % used local flaps and 95% required amputation of a phalanx, 77% reported intolerance to cold after amputation, 91% gave satisfactory scores regardless of treatment, contrary to our study which identified patients with disabilities despite 6 months after the surgical event.<sup>14</sup>

Frech A et al., in 2016, made a retrospective analysis of 117 records of patients with traumatic hand associated with arterial injuries, 87 patients were men, the average age was 35 years, blunt trauma represented 82% of the cases, of which 36% presented concomitant nerve injury, 60% bone injuries. All patients underwent a surgical procedure and

	Pearson Correlation	P value
DASH immediate postoperative & DASH at 3 months	-0.260	0.330
DASH immediate postoperative & DASH at 6 months	-0.528	0.036
DASH at 3 months & DASH at 6 months	0.219	0.415

**Table 4.** Study correlations.

rehabilitation therapy, when evaluated 5 years after the surgical event, disability was observed by the DASH questionnaire in 60% of the patients, having an average score of 37, however, when compared to this research, the scores exceeded 80, having a high disability.<sup>15</sup>

## Conclusion

Patients with traumatic hand had high DASH scores, showing that functionality did not improve despite undergoing surgical procedure. Physiotherapy treatment is key factor in order to improve the functionality in patients, this study did not follow up if the patients had adequate therapy nor if they were constant.

Although the traumatic hand develops mainly in patients who are working, all human beings are exposed to injuries that could damage the entire hand structure, leading to multiple tissue injuries, which maintain the balance in their movements and functionality; therefore, the need for providing partial to full recovery is the goal of reconstructive surgeons. However, the psychosocial aspect has long-lasting consequences, leading to isolation and the need to request aesthetic modification.

One of the factors observed in the functional deterioration of patients with traumatic hand, is the late attention due to the distance from the medical units. The World Health Organization has demanded to improve the medical access in patients with this pathology, due to its repercussions functional and psychological, due to loss of employment or manual skills.

## Conflicts of interests

The authors declare no conflict of interest.

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