

## Application of “Hand Function Scoring System” on the Reconstructed Post-Burn Hand Deformities

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### ABSTRACT

Evaluation of hand functions after surgical reconstruction of post burn hand deformities is still vague and controversial. We tried in this work to apply the well known “hand function scoring system” which was primarily developed to evaluate hand trauma to evaluate the reconstructed post-burn hand deformities objectively. Case series study conducted on patients presented with post burn hand deformities among 40 cases. Seventy percent were males while 30% were females; mean age was 11.5 years [3 years to 41 years]. Type of deformity, method of reconstruction, pre and post scoring were documented. We found that hand function scoring system is considered to be a good assessment tool for evaluation of the level of hand function and to measure the magnitude of improvement of hand functions after reconstruction in post burn hand deformities patients. Also we conclude that there is a strong objective evident that we should perform minor procedures of reconstruction once it indicated to these patients as it may dramatically improves their lives.

### INTRODUCTION

Burn injuries and their related morbidity, disability and mortality represent a public health problem of increasing importance in Egypt as a leading cause of premature death and disability [1]. The hands are the most commonly injured part of our body. Hand burns can render the limb completely dysfunctional, thereby detrimentally impacting lives of patients and their families [2].

While thermal injury is the most common form of burn, electrical and chemical injuries are the varieties that are associated with devastating morbidity and mortality [3].

Despite advances in the overall management of burn injuries, post burn deformities still occur. To release these contractures, a number of surgical techniques have been described. The limitations of surgery and the prognosis of the final, functional outcome of hand burns depend not only on the severity and extent of the initial injury, but also

on the patient’s age, underlying health condition, overall expectations, compliance, and psychosocial disposition. Each of these factors can be a significant variable that must be kept in mind in the final functional outcome [4].

As techniques in reconstruction after extremity injury were developing, a variety of scoring systems for injured extremities emerged in the trauma literature. The goals for each of these systems were to establish guidelines for the treatment of mangled extremities and, depending on injury severity, to provide surgeon and patient with some idea of the prognosis of a functional outcome [5]. Unlike other scoring systems, the “hand function scoring system” is a subjective assessment based on activities of daily living that is used to plan and monitor progress in rehabilitation after hand trauma [6-13].

Because of there are great arguments about the benefits from surgical interventions in this patients; we used in this study the “hand function scoring system” for assessment of the results of surgical reconstruction of post burn hand deformities.

### PATIENTS AND METHODS

This study was carried out as a case series study conducted in Plastic Surgery Unit in Suez Canal University Hospital from April 2007 to October 2008. After approval of our ethical committee, 40 patients with unilateral post burn hand deformities were randomly included in the study. Any patients with chronic illness, mental or psychological disturbances were excluded. All patients showed good compliance.

Routine Pre-operative Preparations as laboratory investigations and hand X-rays [Antero-posterior view and lateral view] were done. Local, regional and general anesthetics were used as needed.

*All the patients were subjected to a questionnaire which contained:* Name, age, sex, address, occupation, dominant hand, medical history, history and nature of the injury, date of injury, causative agent, affected part of the hand, degree and extent of the burn, admission in burn unit, early surgical intervention, rehabilitation, physiotherapy, the period between the initial burn injury and the start of surgical reconstructive procedures, number of operations done for reconstruction during the period of the study.

*Types of deformities were classified into:* Flexion contractures involving digits, palmar contractures, contractures of the dorsum of the hand and inter-digital syndactyly.

*Methods of reconstruction were:* Surgical release, skin graft, Z-plasty, V-Y flaps, local flaps, cross finger flaps, reversed radial forearm flap,

abdominal flap, tenotomy, tenoplasty, K-wire and capsulotomy.

Activities of daily living used for the objective assessment of hand function and to give a hand function score of between 25 and 100 as shown in Table (1) [6].

Some of the items of the scoring system were not applicable for children so they are considered to be (not relevant) e.g.: Item no. (12,21,22,23). A score of 25 is considered to be ideal as the candidate is performing the entire 25 task easy, with increasing score the hand function declines. Scoring was done pre-operative and post-operatively at 3, 6, 9 and 12 months.

Data was processed by SPSS v.11 computer package. *p*-value and Chi-square tests were used to test the significance of relations between different variables.

Table (1): Hand function scoring system [6].

Activity	Easy [Score 1]	Fair [Score 2]	Difficult [Score 3]	Impossible [Score 4]	Not relevant [Score 1]
1- Doing up buttons					
2- Operating zips					
3- Tying shoelaces					
4- Putting on socks					
5- Tying a tie					
6- Using the toilet					
7- Turning on/off taps					
8- Wringing out a flannel					
9- Using soap/washing					
10- Cleaning teeth					
11- Getting in/out bath					
12- Using cutlery					
13- Cutting bread/meat					
14- Unscrewing lids					
15- Using a tin opener					
16- Lifting a saucepan					
17- Lifting/pouring kettle					
18- Opening packets					
19- Putting in/taking out electric plugs					
20- Using the door key					
21- Using the car key					
22- Using car hand brake					
23- Driving					
24- Handling money					
25- Using scissors					

Table (2): Frequency of post operative deformities in the studied population.

Deformity	Web contractures	Volar contracture	Dorsal contracture	Mixed	Total
Number	11	16	11	2	40
Percent	27.5	40	27.5	5	100

Table (3): Shows types and frequency of surgical procedures.

Surgical techniques	Frequency	Percent
Abdominal flap + K-wires	2	5
Dorsal Pedicle Flap + full thickness skin graft	5	12.5
Z-Plasty + K-wires	15	37.5
Local flap + full thickness skin graft	11	27.5
Capsulotomy + Tenotomy	1	2.5
Cross finger flap	3	7.5
V-Y Advancement	1	2.5
Reversed radial forearm flap	1	2.5
Full thickness skin graft+Z-plasty+K-wires+Post pedicle flap	1	2.5
Total	40	100

**RESULTS**

Analysis of the socio-demographic characteristics of our studied patients revealed that 28 cases (70%) were males and 12 cases (30%) were females, mean age was 11.5 years and standard deviation ± 9.05 with minimum 3 years and maximum 41 years.

Only 25% did early skin grafting after initial injury while the remaining patients completed their treatment with dressing. Eleven patients (27.5%) treated with physiotherapy courses after recovery from initial injury. These physiotherapy periods ranged from 1 month to 12 months (mean 3.82± 3.09).

Pre-operative evaluation of hand function score of the 40 patients revealed that the minimum score

was 30 and the maximum score was 90 (mean 51.88±16.54).

In the first 3 months there were 5 patients to be followed-up. After 6 months the number of patients became 9 patients. After 9 months we followed-up 21 patients. Last 3 months there were only 5 patients in the follow-up. Mean duration of follow-up was 5.7 months.

The improvements in the hand function scores are presented in the Fig. (1).

We found that the hand function scores improved in all cases. The minimum improvement was 17 while the maximum improvement was 68 (mean 43.3±13.89).

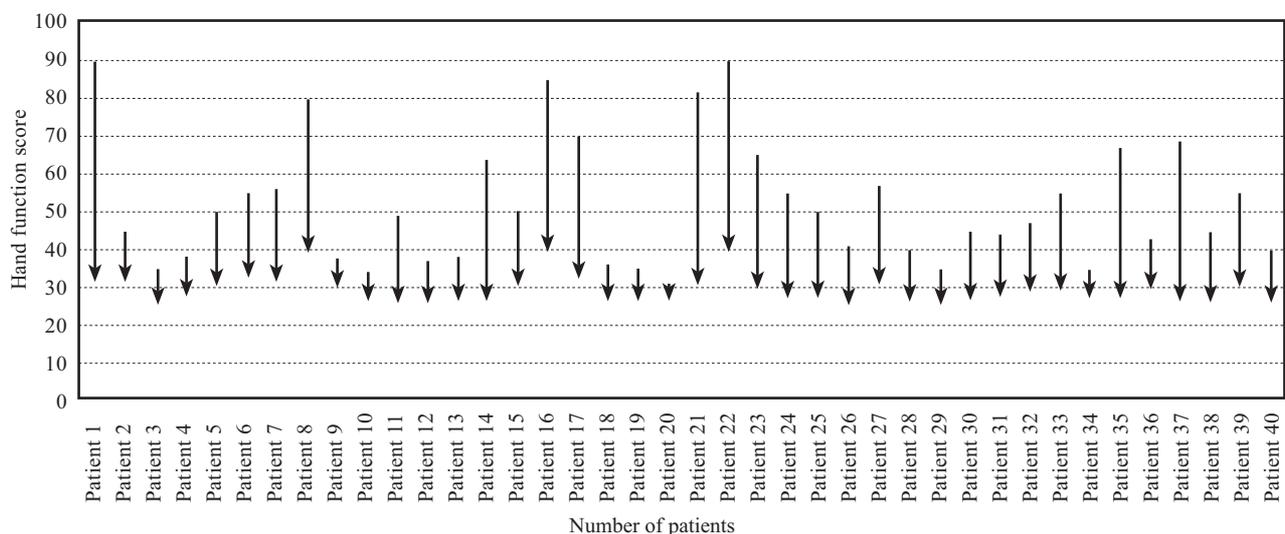


Fig. (1): The progress of all cases after reconstruction using hand function score. [p-value ≤0.05 (significant improvement) for all patients except numbers 9,18,19&20].

## DISCUSSION

Most of the studied population was not admitted to the burn unit (65%) at initial injury. This explains the high frequency of post burn hand contractures due to lack of good medical follow-up. We found that the initial surgical treatment of burned hand by skin grafting or fasciotomies was very deficient. Only 10 cases (25%) had this management. We can explained that by the fact that of mismanagement due to lake of experience of the ideal management of burned hands. In the present study only 11 cases (27.5%) underwent post burn physiotherapy with mean period of 3.82 months, only one case had 1 year of continuous physiotherapy. Seven of the patients whom underwent physiotherapy (7 cases) were not satisfied with the program and their progress. In another study carried in Egypt most of the cases were delayed for average 5-7 days to seek medical advice in hand burns considering it a trivial burn especially in children which leads to development of serious post burn hand contractures [14].

The studied population showed that most burn injuries of the hand affected mainly skin only; volar (16 cases), followed by dorsal surface with variable degree of web space contractures (27 cases in total). Other studies confirmed that skin is the most common layer affected in hand burns. In other worldwide studies the most common contracture is volar contracture, in volar contractures, however, the palmar surface is burnt, but interdigital space, especially the rectangular area, is relatively preserved. Volar contractures are followed by dorsal contractures, in dorsally directed injuries; the dorsal surface and the interdigital area are widely exposed, resulting in contracture [15,16].

Goal of all secondary burn reconstruction is twofold: To restore function and the appearance. After initial wound closure, surgical intervention proceeds only when the recovery process has plateaued [16].

In this study multiple surgical operations were done to the cases to correct their hand deformities (24 case undergone 1 operation, 8 case had 2 operations, 7 cases had 3 operations, 1 case had 4 operations), Patients who undergone multiple surgical procedures were operated multiple times as a completion procedure and not due to failure of previous procedures. Full thickness skin grafts and Z & V-Y plasties were 100 operations out of 119 with 84%, this show the importance of simple reconstructive procedures which cause significant improvement of hand function without using com-

plex or sophisticated techniques. In similar studies the use of Z-plasties to correct hand deformities resulting from burn injury was more common than other more complex procedures [16].

There are various techniques available for the subjective assessment of hand function [12]. These have been shown to be favored by hand therapists, but the results are largely ignored by clinicians because of their lack of validity and reliability [13].

The crucial element of validity for any test is that it accurately measures what it sets out to measure. The patient's subjective view of impaired hand function is influenced by many immeasurable factors, including the patients' psychological state, level of motivation, intelligence and expectations. It is therefore difficult to design a test which both accurately reflects the patient's view and which can also be used for comparisons between patients and departments. Nevertheless, the patient's subjective view of hand function and level of satisfaction with treatment are both important in rehabilitation [11].

The patient's impression of hand function has been in use for several years in planning individual rehabilitation programs. High levels of overall patient satisfaction have been found in association with this approach [11], and we have shown in this study that the improvement in the hand function score during the rehabilitation process is statistically significant.

The progress of cases in different groups of the studied population was assessed using the hand function scoring system it was applied pre and post operatively. Overall, our experience suggests that, alongside objective validated measurements, subjective measures of hand function should play an important role in the assessment of a patient's progress through reconstruction and then rehabilitation. They enable the identification of significant subjective factors which might otherwise impede this progress, and also may aid the assessment of outcome from the rehabilitation process.

### *Conclusion:*

Hand function score is considered to be a good assessment tool for evaluation of the level of hand function and to measure the magnitude of improvement of hand functions after reconstruction in post burn hand deformities patients. Also we conclude that there is a strong objective evidence that we should perform minor procedures of reconstruction once it indicated to these patients as it may dramatically improves their lives.

*Conflict of interest:*

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