



## Correlation Between hand function performance and Quality of Life in post-thermal hand injured children

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**Abstract :** Children with thermal forearm and hand burn suffering from pain, limitation of range of motion (ROM), limited hand function which may be reflected on quality of life of those children. Objective: this study was conducted to detect the correlation between hand function performance and quality of life after intensive Physical Therapy hand rehabilitation program in post thermal injured children. Subjects and procedures: Thirty children suffering from forearm thermal injury ranged in age from nine to twelve years participated in this study. They were divided randomly to two groups (control and study). The control group received a selected physical therapy program directed towards improving forearm strength and upper limb performance while the study group received an intensive hand therapy rehabilitation program in addition to the same program of control group. Treatment program in both groups was conducted for two successive months. Each child in both groups was subjected to the same evaluation procedure using hand held dynamometer, hand function abilities detected by Sollerman scale and burn specific health scale brief (BSHS-B) was used for detection of quality of life before and after the suggested treatment period. **Results: regarding** pre and post treatment results in control group there was a positive correlation between hand grip strength and hand function performance, on the other hand, there was no correlation between hand grip strength, simple abilities and hand function performance. Also no correlation between hand function performance, simple ability was detected. Pre-treatment results in the study group showed a positive correlation between hand grip strength and both hand function abilities and hand function performance. A weak positive correlation between hand function performance and both simple ability was recorded. On the other hand, there was no significant correlation between hand grip strength and simple abilities. Post-treatment, in study group showed a positive correlation between hand grip strength and both simple and hand function performance. Also, there was a positive correlation between hand function performance and simple ability. No significant correlation between hand function and both hand grip strength and hand function performance.

**Key words:** forearm thermal burn, Hand function performance, hand grip strength quality of life, children.

### Introduction

Burns are one of the most significant health problems throughout the World, leading to prolonged hospitalization and hence increased expense for the Patients, their families and society. Today, the prognosis of

patients with burns is dependent, apart from adequate treatment, upon the health-care system and health-care professionals, regarding not only survival, but also lifelong quality of life<sup>1</sup>

In more than 80% of all burns, the hand is involved. Even if a burned hand does not play a major role for the survival of a patient, its function and aesthetic appearance are of utmost importance for the re-integration into society and professional life. Adequate treatment demands a number of major decisions: necessity of an escharotomy in the early post-traumatic phase, the timing of surgery and the type of wound coverage, as well as immobilization and rehabilitation. Rapid wound closure is of utmost importance, but infection control and the preservation of active and passive motion are also essential for optimal recovery of the injured hand<sup>2</sup>

Hand function is defined as “the ability to use the hand in everyday activities, which involves dexterity, manipulative skills and task performance skills. It is a functional outcome of consensual importance and is one of the most important goals of burn rehabilitation, for it is strongly predictive of successful re-integration into society and professional life and the physical aspect of quality of life of burn survivor. Appropriate hand function measures are crucially prerequisite for planning, executing, and monitoring the effects of hand function intervention and/or rehabilitation programs of burn patients<sup>3</sup>

The improved short and long term survival rate of individuals with large burn injuries has made rehabilitation for optimal recovery of the patient increasingly important. Burn injury to the hands worsens the prospect of functional recovery and good quality of life in single events, especially when included in larger burns<sup>4</sup>

## **Subjects and procedures:**

Thirty forearms thermal burned children of both sexes (20 boys, 10 girls) ranged in age from 9 to 12 years were selected from Hehia Hospital burned institute suffering from 2<sup>nd</sup> degree of thermal burn. The sample was divided randomly into control and study groups A and B respectively. Group A (4 girls, 11 boys ) received a selected physical therapy treatment program directed towards improving limited upper limb abilities of children. Group B (6 girls, 9 boys) received the same exercise program given to group A in addition to intensive hand therapy rehabilitation program. The treatment was conducted for two successive months in each group at the rate of three sessions per week.

## **Procedures**

### **Evaluation procedures:**

Evaluation of hand grip strength was detected by using hand held dynamometer as the child was asked to squeeze the dynamometer while maintaining elbow joint flexed 90 degree, forearm in mid position and rested on an arm-chair with the wrist joint in neutral position.

Burn specific health scale - brief (BSHS-B) was used for measuring quality of life. This scale was developed to assess QOL following burns. It is the only condition-specific health status instrument to be employed in patients with burns. This questionnaire was designed to assess the level of functioning and health-related QOL in burn survivors. It has 40 items covering nine well-defined domains with respect to: Simple abilities, Hand function, Affect, Body image, Interpersonal relationship, Sexuality, Heat sensitivity, Treatment regimen and Work. Responses are rated on a 5-pointscale from 0 (extremely) to 4 (none/not at all) for each of the 40 items and patients were asked to select the best answer. Mean scores were calculated for each of the domains. The final score reflects an alteration of the QOL. A higher mean score indicates a more positive evaluation of function and higher QOL.

The Sollerman Hand Function Test scale (SHFT)Used to assess grasp skills. Is a standardized hand function test based on seven common hand grips (i.e., pulp pinch, lateral pinch, tripod pinch, five finger pinch, diagonal volar grip, transverse volar grip and spherical volar grip) and was originally developed for patients. The Sollerman Hand Test include 20 unilateral and bilateral ADL tasks, each scored by the time to complete the task (allowing 60 s at most), the quality of movement during the task and the handgrip pattern used. Each task is performed with the more affected hand (except for three bilateral tasks) and with a prescribed grip pattern, any

divergence lowers the score. The SHFT is used for the evaluation of hand function in various diagnoses; however, only a few studies investigated its psychometric properties.

**Treatment procedures**

**Control group** Patients in this group were treated by an individualized selected physical therapy program based on using: Pulsed ultrasound, Active and passive motion of the hand, Stretching and strengthening exercises for wrist and fingers flexors and extensors groups and Manipulative exercises

**Study group:**

Patients in the study group received intensive hand rehabilitating program that focused on: (1) provision of structured practice increasing in complexity;

(2) provision of functional activities that necessitate bimanual hand use by using Dough, Ball, Cubes, Bottle and marbles, Stacking rings, Stringing beads and Manipulative activities.

**Statistical analysis :**

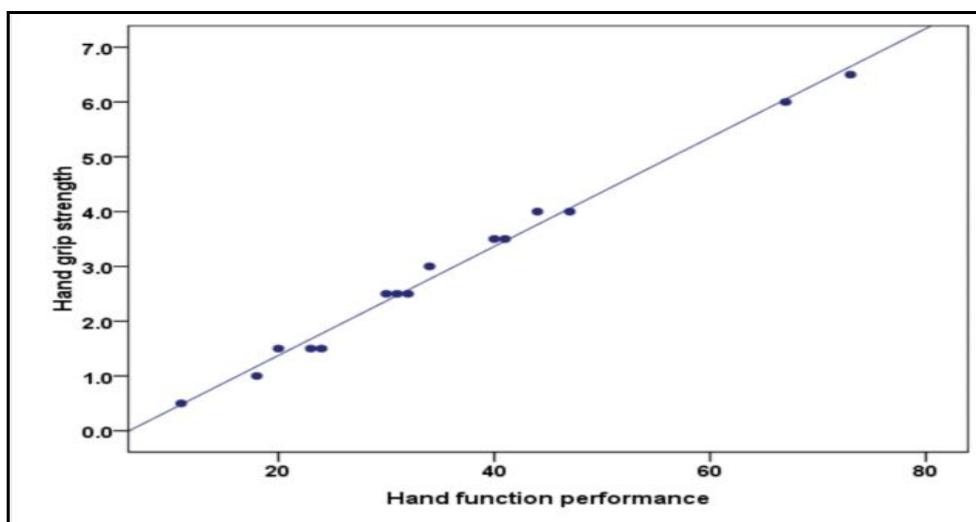
**Spearman's rho**

Pre-treatment results, in control group showed a positive correlation between hand grip strength and hand function performance detected by Sollerman scale ( $r= 0.991$ ;  $p= 0.001$ ). on the other hand , there was no correlation between hand grip strength and simple ability ( $r= 0.250$ ;  $0.368$ ) and hand function performance ( $r= 0.084$ ;  $p= 0.766$ ).

Insignificant correlation between hand function performance detected by Sollerman scale and simple ability ( $r= 0.262$ ;  $p= 0.346$ ) and hand function ( $r= 0.091$ ;  $p= 0.746$ ) (Table 1; Figs1 )

**Table(1):Correlation between hand grip strength, hand function performance and quality of life measured pre-treatment in control group.**

	hand grip strength		hand function performance	
	<i>r</i>	<i>p value</i>	<i>r</i>	<i>p value</i>
Simple ability (Q1-3) pre	0.250	0.368	0.262	0.346
Hand function (Q4-8) pre	0.084	0.766	0.091	0.746
Hand function performance	0.991	0.001**	---	---

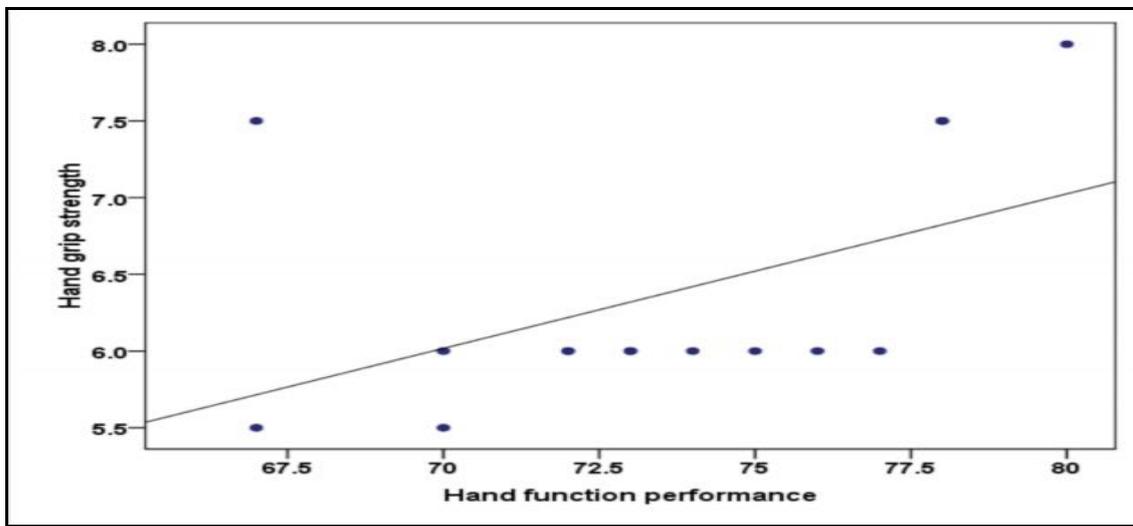


**Fig (1): Correlation between hand grip strength and hand function performance measured pre-treatment in control group**

Regarding Post-treatment results, in control group there was a positive correlation between and grip strength and hand function performance ( $r= 0.584$ ;  $p= 0.022$ ). On the other hand, there was no correlation between hand grip strength and simple ability ( $r= 0.070$ ;  $0.804$ ) and hand function ( $r= 0.337$ ;  $p= 0.219$ ). Also, there was no significant correlation between hand function performance and simple abilities ( $r= 0.155$ ;  $p= 0.580$ ) and hand function detected by quality of life measuring Scale ( $r= 0.215$ ;  $p= 0.441$ ) (Table2 ; Figs.2 )

**Table (2):Correlation between hand grip strength, Hand function performance and quality of life measured post-treatment in control group.**

	hand grip strength		Hand function performance	
	<i>r</i>	<i>p value</i>	<i>r</i>	<i>p value</i>
Simple ability (Q1-3) post	0.070	0.804	0.155	0.580
Hand function (Q4-8) post	0.337	0.219	0.215	0.441
Sollerman 3	0.584	0.022*	---	---



**Fig.(2): Correlation between hand grip strength and hand function performance measured post-treatment in control group ( $r= 0.584$ ;  $p= 0.022$ ).**

Regarding the pre-treatment results, in the study group there was a positive correlation between hand grip strength and both hand function detected by quality of life questionnaire ( $r= 0.559$ ;  $p= 0.030$ ) and hand function performance ( $r= 0.949$ ;  $p= 0.001$ ). Also, there was a positive correlation between hand function performance detected by Sollerman scale and both simple ability (weak) ( $r= 0.452$ ;  $0.091$ ) and hand function ( $r= 0.657$ ;  $p= 0.008$ ) on the other hand, there was no significant correlation between hand grip strength and simple ability ( $r= 0.434$ ;  $p= 0.106$ ) (Table 3; Figs3, 4 & 5).

**Table (3):Correlation between hand grip strength, hand function performance and quality of life measured pre-treatment in study the group.**

	hand grip strength		hand function performance	
	<i>r</i>	<i>p value</i>	<i>r</i>	<i>p value</i>
Simple ability (Q1-3)	0.434	0.106	0.452	0.091
Hand function (Q4-8)	0.559	0.030*	0.657	0.008**
Sollerman	0.949	0.001**	---	---

$r=$  Spearman's rho correlation coefficient.

$p > 0.05=$  not significant;  $p < 0.05=$  significant;  $p < 0.01=$  highly significant.

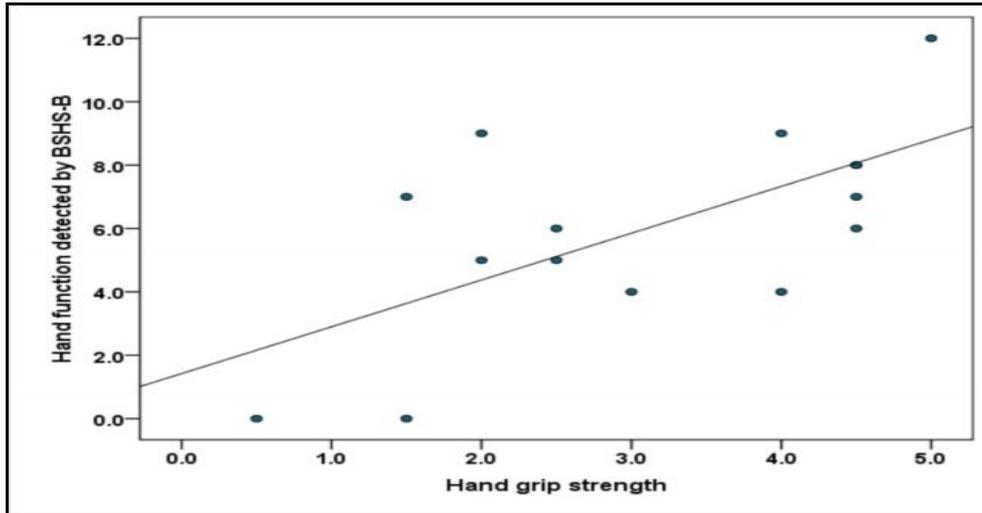


Fig.: (3) Correlation between hand grip strength and hand function detected by BSHS-B measured pre-treatment in study group ( $r= 0.559$ ;  $p= 0.030$ ).

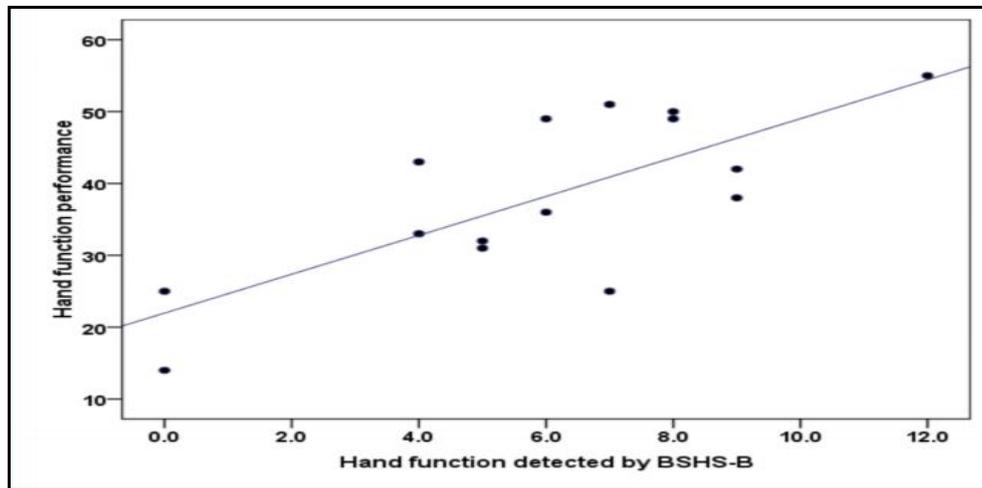


Fig (4): Correlation between hand function performance and hand function detected by BSHS-B measured pre-treatment in study group ( $r= 0.657$ ;  $p= 0.008$ ).

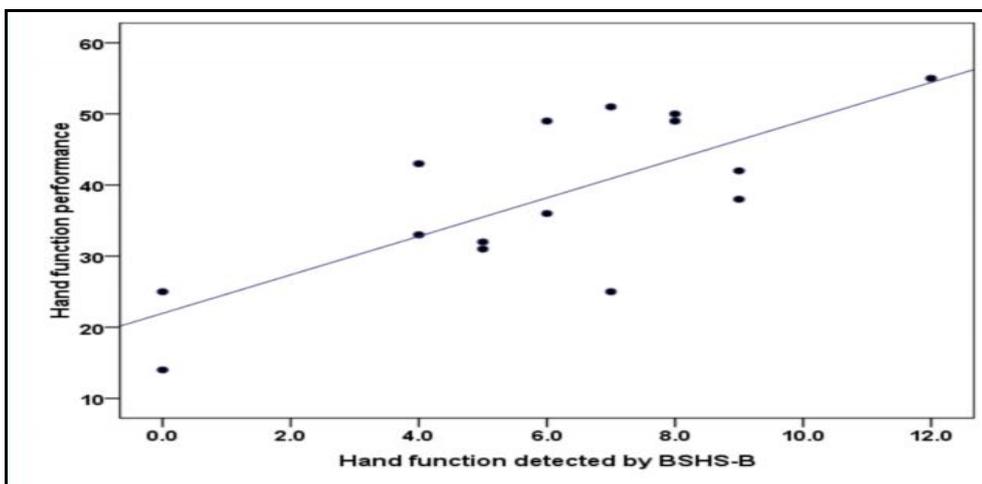


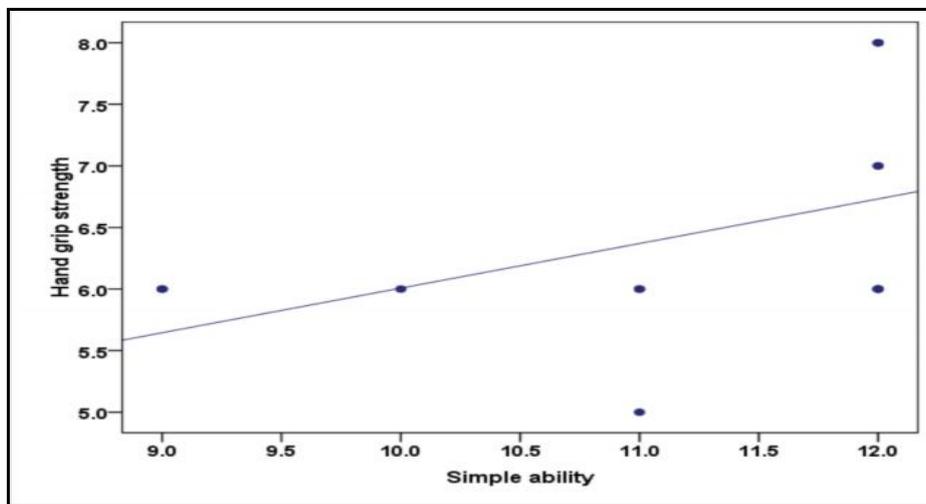
Fig. (5): Correlation between hand grip strength and hand function performance measured pre-treatment in study group ( $r= 0.949$ ;  $p= 0.001$ ).

Post-treatment results of the study group showed that there was a positive correlation between hand grip strength and both simple ability ( $r= 0.552$ ;  $p= 0.033$ ) and hand function performance ( $r= 0.867$ ;  $p= 0.001$ ). Also, there was a positive correlation between hand function performance and simple ability ( $r= 0.568$ ;  $p= 0.027$ ) (Table4 ; Figs.6, 7).

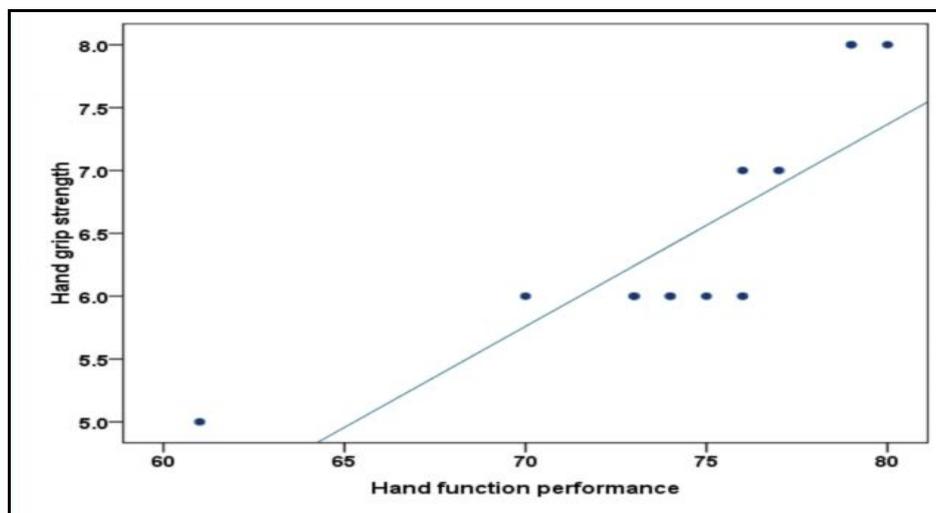
On the other hand, there was no significant correlation between hand function detected by BSHS-B and both hand grip strength( $r= 0.164$ ;  $p= 0.559$ ) and hand function performance ( $r=0.155$ ;  $p=0.582$ ) (Table 4& fig.8 ).

**Table4:Correlation between and grip strength, hand function performance and quality of life questionnaire measured post-treatment in study group.**

	hand grip strength		<i>hand function performance</i>	
	<i>r</i>	<i>p value</i>	<i>r</i>	<i>p value</i>
<b>Simple ability (Q1-3)</b>	0.552	0.033*	0.568	0.027*
<b>Hand function (Q4-8)</b>	0.164	0.559	0.155	0.582
<i>hand function performance</i>	0.867	0.001**	---	---



**Fig.(6) : Correlation between hand grip strength and simple ability measured post-treatment in study group ( $r= 0.552$ ;  $p= 0.033$ ).**



**Fig.(7) : Correlation between hand grip strength and hand function performance measured post-treatment in study group ( $r= 0.867$ ;  $p= 0.001$ ).**

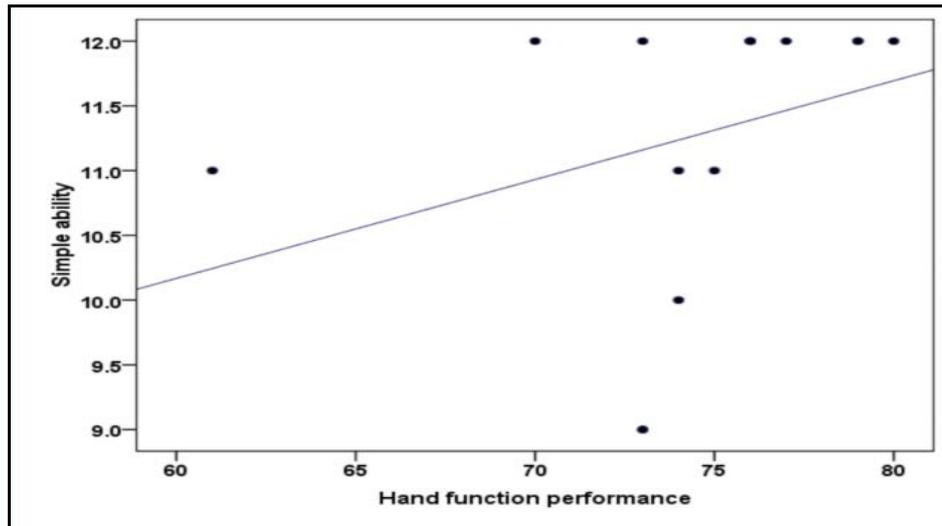


Fig.(8) : Correlation between hand function performance and simple ability measured post-treatment in study group ( $r= 0.568$ ;  $p= 0.027$ ).

## Discussion

This study was conducted to clarify the effect of intensive hand rehabilitation program on hand function and quality of life in post thermal injured children.

Choosing the sample of the current study suffering from thermal burn is supported by **many authors** <sup>4,5</sup> who reported that Flame burns were the most common burn type and that thermal burns covering 20–40% of the total body surface area (TBSA) as assessed by the rule of nine.

QOL is defined as the ability to return to normal life through “satisfactory performance of social roles in the context of family life and the social world. Using BSHS-B in the current study is supported by <sup>6</sup>, who reported that it was one of the most commonly used instruments for the evaluation of quality of life after burn injury. It can be self-administered, and it is useful in evaluating psychopathological symptoms in burn victims.

Affection of the quality of life detected by(BSHS-B) in the current study is supported by the work of <sup>7</sup>, whose study revealed that burns has negative impact on most dimensions of the quality of life of patients with burns

The results in the current study is supported by the work of <sup>8</sup> who used BSHS-B and reported a negative impact on the individuals’ quality of life revealed for the domains of Simple Functional Ability, Work, Affect and Body Image and Interpersonal Relationships.

Positive correlation between hand function abilities and performance after treatment application in both groups may be supported by <sup>9</sup> who reported that clinically relevant comprehensive wellness and exercise program on quality of life of children with severe burns may be beneficial in promoting physical and psychosocial outcome.

Positive correlation between hand grip strength and hand function performance may be attributed to the increased the strength of the intrinsic muscles of the hand which may be supported by the work of <sup>10</sup> who found that the intrinsic muscle strength measures were more strongly correlated with the Sollerman test, which specifically measures fine motor tasks.

Improvement of hand function performance can also be supported by the work of <sup>11</sup> who used resisted exercise program and reported a significant improvements in functional, physical, and psychologic measures and concluded that resisted exercises should be mandatory for all burns patients.

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