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Effect of Physiotherapy Protocol on Post Burn Upper Limbs' Function

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Abstract: Introduction: Burns of the hand have devastating consequences not only for the functional outcome but also for the esthetic appearance. Post burn functional disabilities of the upper extremity are better prevented than treated. ***Aim:*** **this study aimed to** evaluate the effect of physiotherapy protocol on upper limbs' function post burn. ***Design:*** A quasi-experimental (time series) design submitted to meet the aim of the study. ***Subjects:*** A purposive sample of 27 male and female adult patients with 2nd degree burn in hand assigned in the current study which was carried out in Burn Department and its outpatient clinic of General hospital at Minia city. ***Tools:*** Four tools were utilized to collect data of this study; demographic questionnaire, Disabilities of the Arm, Shoulder and Hand Scale (DASH**)**, Manual Muscle testing, and Vancouver Scar Assessment Scale (VSS).
Results: Twenty seven adult 2nd degree burned patients with mean age 36.0 ± 11.22 are included in the study. Gradual improvement of the upper limbs' function measured through DASH scale was observed after application of physiotherapy protocol, this appear through significant decrease in complain from severe dysfunction among 25.9% after 2 months to 0% after 6 months; significant increase in muscle force (22.2%, 59.3%) and prominent improvement of burn scar measured by VSS. ***Conclusions:*** The data suggest that the upper limbs' function post burns can be improved by preventive nursing interventions including early range of motion, anti-contracture positioning and splinting of hand which has positive effects on burn scar. ***Recommendations:*** regular training programs to keep nurses in burn units updated with the evidence-based practices and array interventions for reducing burn scar and improving limbs' function and therefore patients' productivity.

Key Words: Physiotherapy- Post burn Upper Limbs' Function–-splinting-positioning.

INTRODUCTION

Burn, is an injury that causes destruction of skin and underling tissue. Entire soft tissue including nerve endings can all be damaged. It may be caused by a variety of physical agents. Severe burn injury is a medical emergency and complications of the injury are depending on the tissue affected, location, and the degree of burn severity (**Perera et al., 2015).**

According to the World Health Organization (WHO) burns are a huge global health problem resulting in death and devastation to those who survive large burns as they faced with significant functional limitations that prevent purposeful and productive living **(Serghiou et al ., 2016).** Two million burns were reported in USA annually **(Zhang et al., 2017).** Burns also continue to be a significant cause of morbidity and mortality especially in the low- and middle-income countries. The sites of incidence are classified into domestic, industrial or occupational, road traffic accidents, war injuries and criminal or suicidal attempts **(Bataineh et. al., 2018).**

Hands are involved in more than 80% of all severe burns. Although each hand represents less than 3% of the total body surface area, burns of the hand is classified as major injuries. Burns of the hand have devastating consequences not only for the functional outcome but also for the esthetic appearance **(Sridhar & Hariharan, 2017)**. Deep burns may lead to severe scar contracture deformities owing to the unique anatomical structure of the hand. These deformities often have a devastating impact on patients' quality of life. Therefore, effective rehabilitation therapy for hand-burn patients is vital **(Li et al., 2017).**

Burns of the upper extremity may severely limit function by making job performance difficult or sometimes impossible (Dogra, et. Al., 2016). The most common problems include the formation of hypertrophic scars, joint contractures, motor dysfunctions (such as loss of muscle strength, range of motion, coordination, and walking abilities), sensory disturbances (hypersensitivity, pain, itching, and loss of sensation). In addition to, barriers to the activities of daily living (ADL), social problems, and psychological disturbances. Ultimately, the quality of life (QOL) and functional outcomes of burn survivors can be severely affected. Patients may experience negative effects in almost all aspects of their daily functions, physical health, and psychological well-being **(DanTang et al., 2015).**

Hypertrophic scars are severe complications after burn injuries. The concomitant scar contractures will develop and expand to underlying connective tissue and muscles, resulting in limitation in joint range of motion (ROM) and participation of daily activities **(Zhang et al., 2017).** Burns resulting in contractures that have the potential to limit ROM about a joint causing deformation, discomfort, and potentially reducing a patient's ability to carry out activities of daily living especially if the upper limbs is involved **(Ault et al ., 2018).**

Rehabilitation should begin immediately after the burn has occurred. Wound healing, psychosocial support, and restoring maximum functional capacity remain priorities. Maintaining fluid and electrolyte balance and improving nutrition status continue to be important **(Smeltzer and Bare, 2010).** Rehabilitation nurses mainly coordinate between rehabilitation physicians and rehabilitation therapists, educate and promote knowledge of rehabilitation, provide guidance for positioning and ADL training, and facilitate patients to attain rehabilitation goal within limited time. They also provide guidance and supervision for the usage of pressure garments and splints. Moreover, they should recognize patients' psychological changes and discuss them with physicians, rehabilitation therapists, and psychotherapists for further treatment. Rehabilitation nurses play an indispensable connecting role among patients, their families, and the rehabilitation team **(Cen et al., 2015).**

Hand burn injuries often result in limited functionality, flexion and extension of fingers and present a major hindrance in rehabilitation. The aim of physical therapy and splinting after hand burn injury is to maintain mobility, prevent the development of the contracture and to promote the functionality of hand and good cosmetic results **(Rrecaj et.al, 2015).** One major nursing goal is early independence and resumption of pre-burn lifestyle of patient. Early initiation of physical therapy, splinting, passive exercises, topical treatment, early excision, and grafting where indicated and a multidisciplinary approach are the most important treatment principles **(Sridhar, Hariharan, 2017)**.

SIGNIFICANCE OF THE STUDY

Hands are more vulnerable parts of human body. Patient without injury to other joints losses up to 54%function when he loses his hand function **Perera, et.al, (2015)**. Burning not only can physically disable, but also may lead to severely impaired psychological conditions and social relationships **Taheri et al, (2018)**.

Patient with burn injury should be the primary focus of burn rehabilitation efforts throughout positioning; splinting and early ROM exercises which are crucial components of a comprehensive burn rehabilitation program that emphasizes contracture prevention of upper limbs. According to head nurses' reports in Burn unit of General hospital at Minia city, admission of 5-12 cases of burn every month with increased incidence among children and female.

This study will help to highlight the importance of nursing role about immediate positioning, proper splinting, regular ROM to the patients even after discharged from the hospital to decrease hand's disabilities which affect patient's independence and productivity.

Aim of the study:

The aim of the present study is to evaluate the effect of physiotherapy protocol on upper limbs' function post burn.

Research hypothesis:

- The study participants will exhibit reduced degree of disability in the second observation compared to first observation after implementing the physiotherapy protocol.
- The study participants will exhibit more muscle force in the second observation compared to first observation after implementing the physiotherapy protocol.
- The study participants' scar will exhibit improved vascularity, pigmentation, and pliability in the second observation compared to first observation after implementing the physiotherapy protocol.

SUBJECTS AND METHODS

Research Design:

The quasi-experimental (time series) research design is utilized in the current study. This design does not include a control/comparison group; it is a statistical methodology appropriate for longitudinal research designs that involve single subjects or research units that are measured repeatedly at regular intervals over time **Johnson & Christensen (2008).**

Operational definition;

Physiotherapy Protocol; selected nursing interventions include upper limbs splinting, positioning & range of motion exercises used to decrease disabilities & improve upper limbs' function post burn.

Setting:

This study was carried out in burn department and its outpatient clinic at Minia General Hospital. The inpatient burn department is located on the second floor. The burn department consists of three rooms each one has 5 beds, beside one room for nurses and two rooms for burn dressing. The burn outpatient clinic is located on the first floor which is one room for examination and dressing. However this is the only hospital receiving burn injury, flow rate is weak (10-15 cases per months).

Subjects:

A purposive sample of (27) male and female newly admitted with 2^{nd} degree burn assigned in the current study. The researchers select only adult have 2^{nd} degree burn in hands which affects on the number of sample. They were selected according to the following inclusion and exclusion criteria:

Inclusive criteria:

1. Adult (18 – 60 years).
2. Conscious and oriented.
3. Recent admission
4. Have confirmed second degree burn in upper limbs.

Exclusive criteria:

1- Neurological disorder leads to disability in upper limbs.
2- Electrical burn
3- Third degree burn in upper limbs
5- Fracture with burn in upper limbs

Tools of data collection:

Four tools utilized to collect pertinent data for this study.
I- Socio demographic questionnaire and medical data. It was developed by the researchers after revising extensive literature review and was collected once at the first interview. It covers two main parts, first part concerned with assessment of socio-demographic characteristics of the patients under study (including age, sex, educational level, occupation, place of residence, and marital status). The second part concerned with medical data including date of

admission, cause of burn, degree of burn (superficial second, or deep second degree burn).

Disabilities of the Arm, Shoulder and Hand Scale (DASH):

This 5-point scale was used to evaluate patient's upper extremity disabilities post burn. It was adapted from **Hudak, Amadio and Bombardier (1996**). It includes 5 parameters (physical, social, symptoms, work and recreation). The DASH was modified by the researcher excludes recreational parameter

Total items of DASH scale was classified as the following 34- statements. For evaluating of physical functions (item from 1 to 21), the items were scored from 1(none difficult) to 5 (unable) score. Social parameters started from item 22 to 23. The score of social parameters was as following, statement 22 scored as 1(not at all) to 5(extreme) score while statement 23 rank from 1(not limited at all) to 5 (unable) score.

Moreover, symptoms parameters included pain, tingling, weakness and stiffness. The scoring started from statement 24 to 30. The symptoms from 24 to 28 scored as none (1) to extreme (5) score, but item 29 rank from 1 (no difficult) to 5 (so much difficult), while item 30 rank from strongly disagree (1) to strongly agree(5), as it is mainly subjective so it measured through patient's response. Lastly the work parameter (from item 31 to 34), it scored from 1(no difficultly) to 5 (unable) score.

DASH disability/symptom score = ([(sum of n responses / n) - 1] x 25, where n is the number of completed responses.). Overall scoring of DASH scale was estimated as the following: less than 33 has no dysfunction, 33-66 has mild dysfunction, 67-99 has moderate dysfunction, 100-132 has severe and more than 132 unable which reveal that decreased score means patient's improvement.

Manual Muscle Testing (MMT):

This scale evaluates contractile units, including muscles and tendons, and their ability to generate forces. This scale was adapted from **Medical Research Council/Guarantors of Brain (1986)** Scale ranked from 0 (No muscle contraction) to 5 (Full muscle power). Scoring system for this scale when patient assessment indicates five scores this mean there is full muscle power but when have zero scores meant there is no muscle contraction.

Vancouver burn Scar assessment Scale (VSS):

The VSS Adopted from **(Sullivan et al. 1990)** assesses 4 variables: vascularity, height, thickness, pliability, and pigmentation. The sub-scores of the VSS are pigmentation categorized from (0-2 point) while the pliability divided into (0-5 point), otherwise vascularity (0-3 point) and height sub-score are (0-3 point). The VSS set a precedent for the systematic evaluation of scars, taking a semi quantitative approach to organize a collection of subjective assessments. Giving a range of 0–13 in the total score, zero means normal and increased score means grades in abnormality.

Post burn upper limbs ROM exercise, positioning and splinting protocol:

This tool developed by the researchers based on revising extensive literature review **(Lewis et al., 2014 & Smeltzer and Bare 2014)** to improve upper limbs function to burn patients, this protocol consisted of three parts.

Part I: Rang of motion (ROM) exercise start after 48-72 hrs. From burn injury, applied three times daily to all study sample and prescribe frequent active exercises in between sessions.

Part II: **positioning** begins immediately post burn injury and maintained during the entire process. Positioning was carried out together with proper ROM training; otherwise, keeping in normal anatomical position.

Part III: **Splinting** tailored to help maintain the functional or anti-contracture position of the burned body part started after 48 hours from burn injury.

Tools validity:

The developed tools were examined by a panel of three experts in the field of Medical-surgical Nursing. All jury members (100%) agree that current study tools were valid and relevant to the aim of the study.

Tools Reliability:

Cronbach's alpha reliability of the Disabilities of Arm, Shoulder, and Hand (DASH) questionnaire was 0.96, inter-rater reliability agreement of the medical research council. Cohen's kappa coefficient reliability of MMT of 0.50 or higher. Cronbach's alpha reliability of VSS is 0.76.

A pilot study was carried out on 3 patients (10%) of the total sample to test feasibility, objectivity, and applicability of the tools, and the feasibility of research study. Those patients were excluded later from the study.

Ethical considerations:

An official permission to conduct the study was obtained from the ethical committee of faculty of Nursing, dean of Nursing Faculty, Minia General Hospital director. Oral consents were obtained from subjects who were informed about the purpose, procedure, benefits, nature of the study, and follow-up. The participants had the right to withdraw from the study at any time without any rational. Confidentiality and anonymity of each subject were ensured through coding of all data and protecting the obtained data.

Limitations of study:

Weakness of flow rate in burn unit with the inclusion criteria put taxing to increase number of study sample. In other hand, nature of burn injury and its associated pain impair researchers from immediate assessing of certain study tools (2, 3 & 4) among study sample. So, researchers take every patient as a control for himself in two consecutive observations (after 2 and 6 months) from burn injury to examine effectiveness of designing protocol.

Procedure:

The current study began by preparing of different data collection tools, in addition to obtaining formal paper agreement which was taken in duration of one month before

conducting the study. Collection of study data was done on a daily basis (3 to 4 days per week) during morning or evening shift. The total data collection was done over a period of 18 months starting from July 2017 to December 2018.

Selected sample was admitted to burn department so the researcher explain the purpose and nature of the study to all study sample individually, then researcher obtained oral consent from those who accepted to participate in this study. The researcher has started collection of data after 48-72 hrs. From burn patient admission after acute stage by identifying (demographic characteristics). The researchers start the protocol application and teach the patients ROM exercises and instruct them to performs these exercises three times daily, maintain the upper arm in normal anatomical position with splinting the burned hand after performing ROM exercises. The researchers also, teach the expert nurse and family caregiver this protocol to support the patient throughout this work when the researchers doesn't present in hospital.

Educational information and training practices about ROM exercises, compliance of anti-contracture positioning and splinting were applied by the burned patients, expert nurse and family caregiver after that the researchers evaluated the patients and ensure their competence in this practice on the hospitalization period. Also, the researcher has given study sample a pamphlet, and brochures prepared by researcher after extensive literature review **Smeltzer and Bare (2014).** This protocol was done during inpatient period (that ranged from 15 to 21 days) then patients were followed up through outpatient clinic and physiotherapy unit. The three study scales measured two times after 2 and 6 months from burn accident. It included different types of exercises. Also, instructions regarding duration and frequency of exercising was clarified to ensure that the study sample perform these exercises accurately after their hospital discharge and at home.

Follow-up for all study sample were done at (2 and 6 months) post burn through face to face interview to evaluate the extent of upper limbs disabilities, their muscle contractile units, and their ability to generate forces and contracture assessment scale applied. Also, researcher encouraged burned patients of the study sample to attend follow-up.

Statistical analysis of data;

Data were summarized, tabulated, and presented using descriptive statistics in the form of frequency distribution, percentages, means and the standard deviations as a measure of dispersion. A statistical package for the social science (SPSS), version (20) was used for statistical analysis of the data. Numerical data were expressed as mean, SD, fisher exact test and p-value was considered significance.

RESULT

Table (1): Frequency distribution of study sample related to their socio-demographic characteristics (n =27)

Items	No.	%
Age group:		
< 20	3	11.1
20 -< 30	7	25.9
30 -< 40	17	63
Mean ± SD	36.0 ± 11.22	
Gender		
Male	11	40.7
Female	16	59.3
Educational level:		
Cannot read and write	10	37
Basic education	11	40.8
University	6	22.2
Occupation		
Student	6	22.2
Office work	8	29.6
Farmer	13	48.2
Place of residence		
Rural	19	70.4
Urban	8	29.6
Marital status		
Single	6	22.2
Married	16	59.2
Divorced	5	18.6

Table1: shows that about more than half of the studied sample were females, aged between 30 to 40 years, and were married (59.3%, 63 %, and 59.2% respectively). Their educational level revealed that around half of them had basic education and were farmers (40.8%, 48.2.7% respectively). Majority of study sample (70.4%) was living in rural areas.

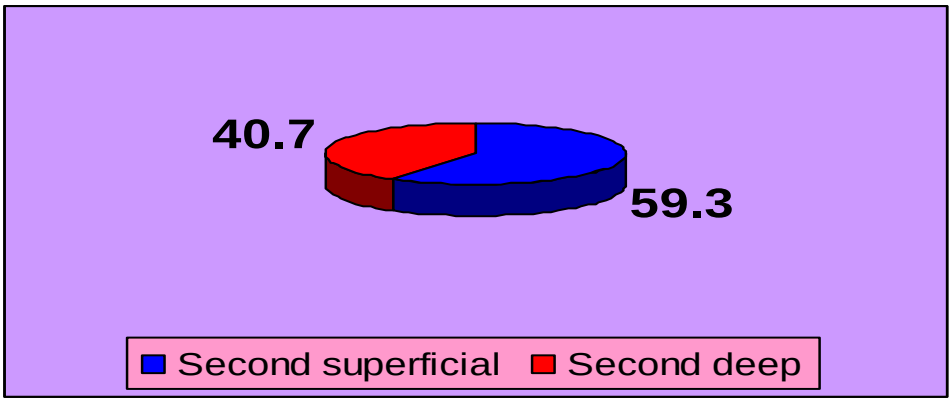

Figure (1): Percentage distribution of study sample related to their degree of burn (n =27)

Shows that 59.3% of the study sample has superficial second degree burn and 40.7% of the patients suffer from deep second degree burn.

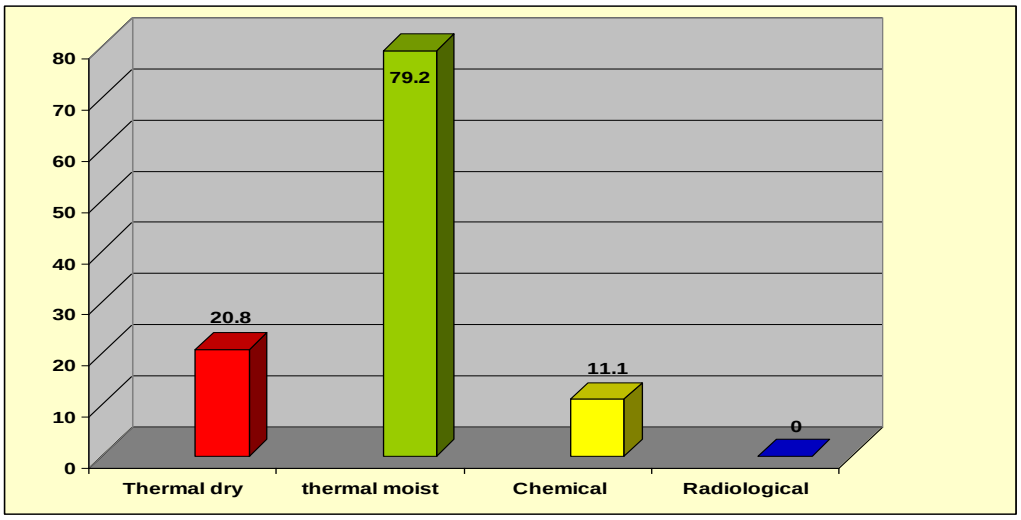

Figure (2): Percentage distribution of study sample regarding their causes of burn (n =27)

Illustrates those most common causes of burn are moist thermal burn followed by dry thermal cause (79.2 %, 20.8 % respectively).

Table (2): Frequency and percentage distribution of muscle tone at first and second observations post implementation of physiotherapy protocol

Muscle tone testing	1st observation after 2 months (n=27)		2nd observation after 6 months (n=27)		Fisher test P. Value
	No.	%	No.	%	
• No muscle contraction	0	00	0	00	Fisher exact =45.6 P. value= 0.001**
• A 'flicker' but no movement	0	00	0	00	
• Contraction is possible on horizontal plane	8	29.6	4	14.8	
• Contraction is possible against gravity	13	48.2	7	25.9	
• Contraction is possible against some resistance	6	22.2	16	59.3	
• Full muscle power	0	00	0	00	

NS= not significant * $p = \leq .05$ (statistical significance) ** $p = \leq .01$ (highly statistical significance)

Table2; Reveals that there is gradual increase in muscles force among study sample after 2 and 6 months post physiotherapy protocol application (22.2%, 59.3% respectively) with high statistical significance difference.

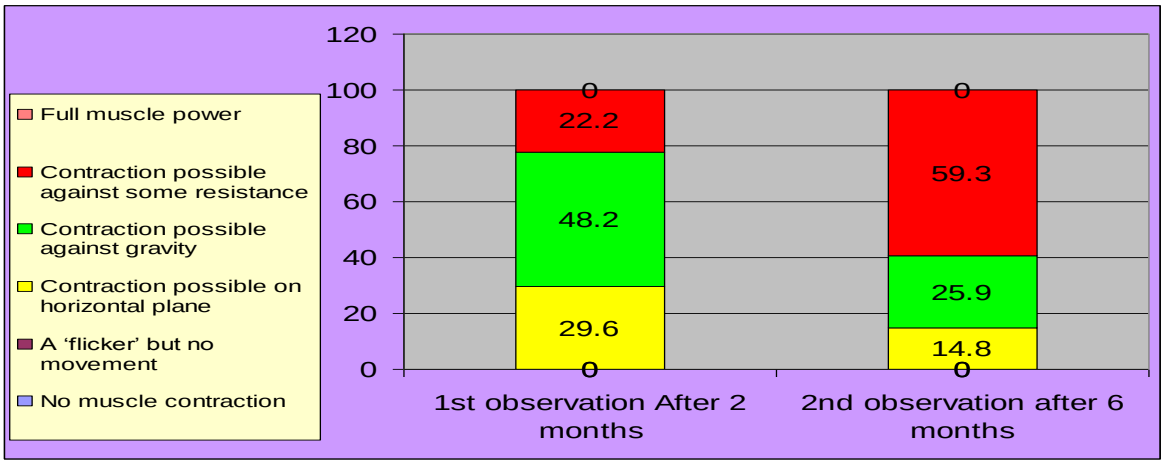

Figure 3. Percentage distribution of muscle tone at first and second observation post implementation of physiotherapy protocol

Reveals that there is gradual increase in muscles tone among study sample after 2 and 6 months post burn protocol application (22.2%, 59.3% respectively) with high statistical significance difference.

Table (3): Frequency and percentage distribution of physical status among study sample post implementation of physiotherapy protocol in the two observations.

Physical status after burn according to DASH scale	1st observation After 2 months (n=27)		2nd observation after 6 months (n=27)		Fisher test P. Value
	No.	%	No.	%	
• No dysfunction	0	0	0.	0	Fisher exact = 68.2 P. value= 0.001**
• Mild dysfunction	11	40.8	18	66.7	
• Moderate dysfunction	9	33.3	9	33.3	
• Sever dysfunction	7	25.9	0	0	
• Unable	0	0	0	0	
Mean ± SD	33.4± 10.2		25.4 ± 7.7		

NS= not significant * *p* = ≤.05 (statistical significance) ** *p* = ≤.01 (highly statistical significance)

Table3. Shows gradual improvement of the physical status of upper limbs post burn protocol among study sample according to DASH scale. Mild, moderate and severe dysfunction represented (40.8%, 33.3, % & 25.9% respectively) during 1st observation compared to (66.7%, 33.3% & 0 %, respectively) in 2nd observation. There is high statistical significance at p-value =0.001. It showed that the mean average of physical status among study participants after performing physiotherapy protocol was constituted (33.4± 10.2 & 25.4 ± 7.7) respectively which also indicate decline in their disabilities.

Table (4): Frequency and percentage distribution of study sample according to presented symptoms post implementation of physiotherapy protocol regarding the two observations.

Symptoms complained after burn according to DASH scale	1st observation After 2 months (n=27)		2nd observation after 6 months (n=27)		Fisher test P. Value
	No.	%	No.	%	
• **No difficult complain**	**0**	**00**	**0**	**00**	**Fisher exact = 30.5** **P .value = 0.000****
• **Mild difficult complain**	**0**	**00**	**0**	**00**	
• **Moderate difficult complain**	**8**	**29.6**	**4**	**14.8**	
• **Severe difficult complain**	**13**	**48.2**	**7**	**25.9**	
Mean ± SD	**11.2 ± 3.2**		**8.4 ± 2.4**		

NS= not significant * *p* = ≤.05 (statistical significance) ** *p* = ≤.01 (highly statistical significance)

Table (4): Illustrates that there is decrease in symptom severity of upper extremity among study sample after physiotherapy protocol application which is better in 2nd observation than 1st one as 77.8% of patient had mild complain in the second observation compared to 66.7% at first one and 7.4% of study sample ended with no suffering from any symptoms after 6 months with highly statistical significance difference p-value =0.000, with average mean 11.2 ± 3.2 & 8.4 ± 2.4

Table (5): Frequency and percentage distribution of the patients according to their social status post physiotherapy protocol implementation at the two observations (n= 27).

Social status after burn according DASH scale	1st observation After 2 months (n=27)		2nd observation after 6 months (n=27)		Fisher test P. Value
	No.	%	No.	%	
• No social change	0	0	2	7.4	Fisher exact = 27.4 P. value = 0.000**
• Slightly social changes	12	44.4	20	74.1	
• Moderately social changes	13	48.2	5	18.5	
• Sever social changes	2	7.4	0	0	
• Extremely social changes	0	0	0	0	
Mean ± SD	8.3 ± 2.3		5.4 ± 3.2		

NS= not significant * p = ≤.05 (statistical significance) ** p = ≤.01 (highly statistical significance)

Table (5): Shows improved social function post implementation of physiotherapy protocol, it appears through 48.2% from them had moderately social changes after 2 months from burn injury while 74.1% had slightly social changes after 6 months with highly statistical significance p-value =0.000,

Table (6): Frequency and percentage distribution of the study sample according to their work status post physiotherapy protocol implementation during the two observations (n= 27).

Work status after burn according to DASH scale	1st observation after 2 months		2nd observation after 6 months		Fisher test P. Value
	No.	%	No.	%	
• No difficult in work status	0	0	0	0.0	Fisher exact = 22.2 P. value = 0.001**
• Mild difficult in work status	13	48.2	16	59.3	
• Moderate difficult in work status	9	33.3	8	29.6	
• Severe difficult in work status	3	11.1	3	11.1	
• Unable	2	7.4	0	0.0	
Mean ± SD	8.5 ± 2.1		7.1± 3.2		

NS= not significant * p = ≤.05 (statistical significance) ** p = ≤.01 (highly statistical significance)

Table (6): Represents increased ability to work among study sample after 6 months compared to after 2 months, with no one 0% unable to work at the end of study with a high statistical significance p-value =0.000.

Table (7): Frequency and percentage distribution of the study sample according to their total disabilities of the arm, shoulder and hand post physiotherapy protocol implementation during the two observations.

Total DASH scale	1st observation (n=27)		2nd observation (n=27)		Fisher test P values
	No.	%	No.	%	
Mild dysfunction	11	40.7	19	70.4	Fisher exact = 42.6 P. value = 0.000**
Moderate dysfunction	14	51.9	8	29.6	
Severe dysfunction	2	7.4	0	0	
Unable	0	0	0	0	
Mean ± SD	58.3 ± 15.3		44.4 ± 13.2		

Table 7; Illustrates gradual improvement of the upper limbs function post physiotherapy protocol implementation during the two observations. It appeared through 40.7% of them had mild dysfunction after 2 months increased to 70.4% after 6 months with highly statistical significance p-value =0.000.

Table (8): Frequency and percentage distribution of the studied patients' according their scars condition post physiotherapy protocol implementation at the two observations (n= 27).

Burn scar assessment by Vancouver scale	1st observation After 2 months (n=27)		2nd observation after 6 months (n=27)		Fisher test
	No.	%	No.	%	P. Value
Vascularity					
1. Normal	**0**	**00**	**2**	**7.4**	
2. Pink	**9**	**33.3**	**16**	**59.3**	
3. Red	**11**	**40.8**	**5**	**18.5**	
4. Purple	**7**	**25.9**	**4**	**14.8**	
Pigmentation					**Fisher exact =26.3**
1. Normal	**1**	**3.7**	**4**	**14.8**	
2. Hypopigmentation	**10**	**37.0**	**18**	**66.7**	**P. value = 0.01***
3. Hyperpigmentation	**16**	**59.3**	**5**	**18.5**	
Pliability					
1. Normal	**0**	**00**	**2**	**7.4**	
2. Supply	**7**	**25.9**	**18**	**66.7**	
3. Yielding	**15**	**55.6**	**5**	**18.5**	
4. Firm	**5**	**18.5**	**2**	**7.4**	
5. Banding	**0**	**00**	**0**	**00**	
6. Contracture	**0**	**00**	**0**	**00**	
Height (mm)					
1. Normal (flat)	**2**	**7.4**	**4**	**14.8**	
2. 0 and 2mm	**8**	**29.6**	**16**	**59.3**	
3. 2 and 5 mm	**12**	**44.5**	**6**	**22.2**	
4. >5 mm	**5**	**18.5**	**1**	**3.7**	

Table 8. Shows gradual improvement of burn scar regarding vascularity, pigmentation, pliability, and height of the scar post physiotherapy protocol implementation at the two observations with a statistically significant difference between the two observations at p= 0.01

Table (9): Relationship between socio-demographic characteristics and the disabilities of the arm, shoulder and hand post implementation of physiotherapy protocol

Items	Disabilities of the arm, shoulder and hand	Muscle force	Burn scar assessment	Fisher test P Value
	Mean ± SD	Mean ± SD	Mean ± SD	
Age:				
< 20	26.2±3.2	3.1±4.2	4.2±5.1	**F=7.55 P=0.02***
21 < 31	33.3±6.1	3.2±2.3	3.3±7.2	
31 < 40	46.6±4.2	4.±6.6	5.2±6.3	
Sex:				
Male	38.4±4.6	3.2±4.3	4.6±4.2	**F=4.22 P=0.05***
Female	44.3±4.2	4.2±3.2	5.4±5.2	
Educational level:				
Illiterate	34.2±4.5	3.4±6.1	4.3±4.2	**F= 5.44 P=0.02***
Basic education	45.4±5.2	4.5±4.2	5.1±6.3	
University	32.2±3.1	3.2±5.2	5.2±5.1	
Occupation:				
Student	26.3±4.2	4.2±5.2	5.2±5.6	**F= 8.44 P= 0.02***
Office work	44.8±5.5	3.1±4.3	4.2±4.6	
Farmer	46.4±5.2	4.2±3.6	5.4±5.2	

Table 9. Illustrate that, there was a significant statistical relation between upper limbs functional status and socio-demographic characteristics among study sample. It was observed that the improvement in DASH and Muscle force was among those aging 31:40 years, farmer, female with basic education. While burn scar according to VSS is improved more among those aging 21 to 30 years old.

Table (10): Correlation between patients' disabilities of the arm, shoulder and hand, muscle force and burn scar condition among study sample n= (27)

Items	Muscle force		Burn scar assessment	
	R	P	R	P
Disabilities of the arm, shoulder and hand	0.827	0.002**	-0.882	0.004**

***Correlation is significant at 0.05** ****Correlation is highly significant at 0.01.**

Table 10. Shows that there are significant correlations between upper limbs' function, muscle force, and burn scar after physiotherapy protocol application. Improvement of upper limbs function (increase in DASH score) positively correlate with increase in muscle force and negatively with formation of hypertrophic scar post burn.

DISCUSSION

Hand function is both uniquely important to daily and work activities and frequently impaired by burn injury and scars. Loss or deformity of digits leads to a variety of deficits **(Johnson & Chung, 2017).** The superficial nature of tendons and joints in the hand places burn patients at great risk for damage to these structures, causing deformities. A review of a large adult sample of severe hand burns showed that 81% of patients had abnormal ROM if the burns involved the tendons or joints. Appropriate splinting and positioning is a critical component of any compressive burn rehabilitation program designed to attain optimal range of motion outcomes **(Dewey et al, 2011).**

The current study reveals that, more than half of the studied sample was females and living in rural areas. Also two thirds of them aged between thirteen to less than fourteen years and about half of them were married. It might be due to females who are living in rural areas spend a lot of time in kitchen and in-fornt of the stove for cooking that lead to increased risk for burn than males. There was an agreement regarding the demographic characteristics of the present study with the results of **Kuiri et al., (2016)**, who cited that 83% of the patients were females. These high females to males' ratio can be explained due to our male dominant society and more engagement of females in kitchen works.

This finding is in congruent with **Adil et al., (2016)** who reported that housewives and children were the groups affected at household environment the most. This happening was common in our population as children easily become victims of scald burns due to low level cooking at most of our homes and housewives become victims of flame burns due to their common engagement in cooking activities. In addition, **Gentian et al., (2018)** who cited that the median age of patients are 25.9 years. About half of them belong to the age group 20-60 years (49.5%) and only 10.2% belong to the age of 60 years. In most cases (73.6%), the burn of hands is associated with the burn of the other anatomical region, mostly forearm.

The result of the current study revealed that, the causes of burn is around four fifths of study sample are moist thermal followed by dry thermal that are represented one fifth. This result was supported by **Khan et al., (2018)** who reported that, flame burns were the commonest type (51.1%) among all age group and both gender, followed by scalds (28.5), electric (7.7%), contact with hot objects (6%), firework and blast (6.5%) and chemical burn (0.2%). **Perera et al., (2015)** reported a contrast result that flame burns were the most common burn type and majority of the victims were females.

The current study showed that there is gradual increase in muscle force among studied sample after application of physiotherapy protocol in 1st (less than half) and 2nd observation (about two-thirds). This finding is in agreement with **Rrecaj et al., (2015)** who reported that, the grip strength were good in 63.8% of cases and bad in 36.2% after 6 months of their intervention.

The finding of current study showed that there is gradual improvement of the physical status of upper limbs according to DASH scale after application of physiotherapy protocol, this appeared through significant improvement among study sample that about two-fifths of them had mild dysfunction after 2 months improved to more than two third after 6 months with highly statistical significance at p-value =0.001. This result was explained by **Perera et al., (2015)** who reported that, the affection on activities of daily living with hand burns is clear in six activities of DASH questionnaire (Opening a jar, Writing, Turning a key, Using a knife to cut food, Preparing meal, Managing transportation needs), and performance of elbow range of motion showed significant negative correlation with activities with right hand score.

Improvement burn patients' social functioning after implementing physiotherapy protocol is evident by about half of them exhibit moderate social functioning at the 2 months observation compared to about three fourths of them displayed a slight social dysfunction at 6 month observation with highly statistical significance p-value = (0.000). This result was supported by **Gauffin et al., (2016)** who stated that, pain severity and interference with daily life were mainly mild to moderate, to be associated with significantly lower health-related quality of life. Chronic pain after burn was associated with both burn- and individual-related factors.

Also this result was explained by **DanTang et.al., (2015)** who stated that, after the intervention, significant improvements were found in all dimensions of quality of life, in the rehabilitation group (all $p < 0.05$). Visual

Analogue Scale (VAS) score of itching (p = 0.009), and the physical health (p =0.002), psychological health (p = 0.021), and social relationships dimensions of quality of life (p < 0.001).

The present study represent that, there is gradual improvement of scar (vascularity, pigmentation, pliability, and height) according to Vancouver Scar Scale post burn physiotherapy protocol in 6 months compared to 2 months with statistical significance p-value =0.01. This result was supported by **Oosterwijk et al., (2017)** who mentioned that, the burn scar contracture prevalence at discharge was 38–54%, but with a longer time after burn, the prevalence was lower. Contractures were more likely to occur in more severe burns, flame burns, children, upper extremity and in female might be have more colloid formation tendency, which could complicate the scar condition and its management. **Rrecaj et al, (2015)** reported that, to manage the keloids scars they used postural alignment, splinting, passive/active mobilization, massage and stretching exercise.

The current study showed that, there was a significant statistical difference between upper limbs' function, force of muscle, scare and demographic characteristic of the studied sample. This result is in agreement with **Shahid, Ismail and Khan, (2018)** who cited that quality of life was compromised in majority of post burn patients. Several demographic characteristics such as young age and female gender, low socioeconomic status and clinical parameters related burns were important risk factors in assessment of quality of life in burn sustained patients.

The current study showed that, there was significant statistical difference between improvements of upper limbs' function (measured by DASH), increase muscle force of upper limbs and improve burn scar (measured by VSS) among study sample. This result was explained by Rrecaj et al, (2015) who mentioned that, the finding of their study have important significant result on muscular strength in the hand after 6 and 9 months, this is due to application of range of motion on the hand. And conclude that the physical therapy and splinting in hand burn injuries play an important role in the hand function.

Also, **Skirven et al, (2011)** stated that**,** the management of keloids scars we occurred when used postural alignment, splinting, passive/active mobilization, massage and stretching exercise. Finally, **Asadullah et. Al., (2010)** who cited that their findings revealed that the anti-contracture position with early passive range of motion exercise reduced scare formation and prevent contractures more significantly in group A (P- value=0.002) with average score 6, as compared to the anti-contracture positioning alone in group B (P- value=0.435) with average score10, as assessed at the completion of physical therapy management program in all patient in sub-acute stage of burn.

CONCLUSION

Early range of motion, anti-contracture positioning and splinting of upper limbs were effective methods to increase muscle force, reducing burn scar, contracture, and pain which influence positively on restoring upper extremity function post burn.

RECOMMENDATIONS

Regular training programs to keep nurses in burn units updated with the evidence based practices and array interventions for reducing burn scar which reflect on reducing patients' upper limbs disabilities.

Educating the patient and family so they have a good understanding as to the benefits of participating in physiotherapy is essential and getting the family on board at this early stage also means that they are more prepared to assist the patient on their return home.

Replication of the current study on a larger probability sample from different geographical areas to achieve generalizable results.

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