Contents lists available at www.innovativejournal.in

INTERNATIONAL JOURNAL OF NURSING DIDACTICS

Homepage: http://innovativejournal.in/index.php/ijnd

ISSN: 2231-5454

Effect of Implementing exercise training program on joints' functioning and perceived self-efficacy of children with upper extremity burn

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DOI: https://doi.org/10.15520/ijnd.v10i08.3068

Abstract: Introduction:Children have a high chance of suffering burn injury regardless of their physiological, psychological, and developmental differences. Burn injuries have short term and long term impacts on children and families. Paediatric burns of the upper extremity have devastating multidimensional consequences especially the capacity and perceived self-efficiency for functioning.It is the pediatric nurses' role to advocate for and ensure proper management of burn related consequences on the child and family. Aim of the present study isto evaluate the effect of Implementing exercise training program on joint functioning and perceived self-efficacy of children with upper extremity burn.***Design:***A quasi-experimental research design was used in the present study. Subjects: convenience sampling of 43 male and female pediatric survivors with deep 2nd and 3rd degree upper extremity burn was carried out at pediatricburn ward at emergency hospital of main Tanta University Hospital.And outpatient clinic of El Mansoura hospital for Dermatology, Venereology & leprosy at El dakahlia governorate.Four tools were used for data collection: Structure questionnaire sheet of children withupper extremity burn**,** Quick Disabilities of the Arm, Shoulder and Hand Scale (Quick DASH), joints function assessment, andSelf-Efficacy Questionnaire for Children (SEQ-C).***Results:***Thirty-six burned children had 3rd degree, with mean age 13.38±1.73 were assigned for this study. Significant cumulative improvement of the upper extremities range of motion and functional ability was observed after application of exercise rehabilitation program, in addition to significant upgrading of academic, emotional and social efficacy. ***Conclusion:***The study concluded that the children's range of motion of burned upper extremities improved after the implementation of the exercise training program. The burned children showed an improvement of their perceived self-efficacy after implementation of the training program.***Recommendations:*** Promoting awareness among pediatric nurses, pediatricians and physiotherapists about the necessity of integrating an exercise program into care plan for burned children is critical. Standardizing parameters, standards and guidelines that allow for adequate tracking of progress in this burn survivors population is also substantial.

Keywords:Burn, Upper Extremity, Training Exercise, Self-Efficacy, Range of motion.

INTRODUCTION

Burn is one of the most traumatic events that may affect children worldwide.As proclaimed by **Alemayehu et al. (2020)**,burn injuries are a global health problem; as a consequence 875,000 children aged 18 years die each year. It accounts for 13 % of the total morbidity among children aged ≤15 years.Childhood burns are a major problem in Egypt, especially in low-socioeconomic families. Such families live in overcrowdedhouses using fire sources that lack proper sanitation and safety measures.**(Hassan Y et al 2010)**.Reports refer thatover the period from 2004-2009 a total number of 1999 burned children presented to the burn unit of Assiut University Hospital. It was cleared that 1440 children were treated as outpatients with a body surface area of less than 10 per cent.The most common site of burn injury in the outpatient group was upper limb (40% of patients). Scalding was the most common cause (75%), followed by flame (25%)**(Hassan Y et al 2010)**.The causes of burn differ according to the child's age and historical clues(**Barrow RE,et al 2004**) .

Scar contracture is among the most well-known severe complications after burn injuriesthat it will expand to underlying connective tissue and muscles. This result in limitation in joint range of motion (ROM) **(Zhang et al., 2017),** which in turn causing deformation, discomfort, and potentially reducing a child's ability to carry out activities of daily living especially if the upper limbs is involved **(Ault et al., 2018, Tan et al., 2019).**Ultimately, the quality of life (QOL) and functional outcomes of burnedchildren can be severely affected. They may experience negative consequences in almost all aspects of their daily functions, mental health, and their overall wellbeing**(DanTang et al., 2015) and (Dogra et al., 2016).**

Self-efficacy is defined as "one's belief in one's ability to succeed in specific situations or accomplish a task."It can play a major role in how one manages goals, obstacles and challenges.**Bandura, A (1977).**Limited literatures surveyed the effect of pediatric burn onchildren's self-efficacy. While, Burn injuries are concomitant with a range of psychosocial difficulties in children and young people aged ≤18 years, such as depression, anxiety, poor academic achievement,in addition to worries about appearance and social situations**(Bakker et al., 2013; Armstrong-James et al., 2018).**

Pediatric nurses are in the front line of the health team responsible for care of burned children. Their role extends from the acute care of burn to the stabilization and the rehabilitative and psychological care of the child and family. The nursing intervention will make a great difference in the overall quality of life of the child and his

family.(S**tephanieScherrer2015**). After burn healing the child will be in need to return back to the nearest pre-injury stat as possible. During the rehabilitation stage nurses are responsible to carry out plans made in collaboration with the physical and occupational therapist to help the child to learn new skills, to ambulate and master the function of the burned upper extremity as close as the pre-burn state. The rehabilitation care can be provided in many settings and nurses working in each place have to understand their roles to achieve the goals of the care plan.Burn patients require comprehensive care that may achieved through cooperation and collaboration with variety of providers**(Ho, W, et al., 2001).**

Right now, attentions in burn care and research is shifting from acute care and reducing mortality towards life quality and optimization ofpaediatric survivors; short and long term post burn out comes. **(Rosenberg et al., 2013, Atiyeh, &Janom 2014)**.The main goal for the plane of care will be restoration of function. Physical rehabilitation is fundamental **(Ebidet al., 2013, Clayton et al.,2017,Hardee et al., 2014)**.Age, depthof burn, extent of the burns, degree of wound healing, presence of infection, and psychosocial status of the child and family all are important factors affecting burn rehabilitation. It requires the participation of the child as well as the caregiver and begins when wound healing is complete **(Omar et al.,2012)**. It may take months to years and requires long-term efforts and follow-up as the child grows to get back into the functioning arena. The main focuses of rehabilitation are scar prevention, hypertrophic scar suppression, management of heterotopic ossification.In additionrestoration of the children's' functional capacity such as maintaining full ranges of motion, muscle strength, and independent mobility and activities of daily living.**(Atiyeh, &Janom, 2014)**

Exercise program is acrucial component of acomprehensive burn management that emphasizes onfunctional ability restoration of upper extremity.Additionally many studies reported that beneficial effects of exerciseon lean mass, muscle strength, and cardiopulmonary capacity, further more promoting psychosocial functioning **(Porter et al, 2015; Mohammed et al., 2019)**. Furthermore, the main goal of therapeutic exercises is returning the injured childinto a fully functioning pain-free state. **(O. P. T. Professionals, 2020)**.

Based on this context the current study highlighted the importance of nursing role regarding collaboration with children'sburn rehabilitation team in designing and implementing therapeutic exercise trainingprogram to the pediatric survivors to decrease upper extremities'disabilities which affect burned children's independence, productivity, self-efficacyand overall wellbeing.

Aim of the study:

The aim of the study is to evaluate the effect of implementing exercise training program onjoints' functioningand perceived self-efficacy of children with upper extremity burn.

Research hypotheses:

- Implementing exercise training program forchildren with upper extremity burn are expected to be improved range of motion and reduced degree of functional disability
- Children perceived self-efficacy are exhibit improvement after implementation of the exercise training program.

SUBJECTS AND METHOD

Research Design:

A quasi-experimental, pre/post-test repeated measures design was employed throughout the current study.

Setting:

The present study was carried outat pediatric burn ward of emergency hospital of main Tanta University andoutpatient clinic of El Mansoura hospital for Dermatology, Venereology & leprosy at El dakahlia governorateaffiliated to ministry of health and population.

Ssubjects:

Convenience sample of (43) children of both genders with completely healed deep 2nd and/or 3rd degree upper extremity post burn injuries were allocated for participation in the current study.

Sample Size Determination:

Considering the time and economic feasibility, sample size calculation was estimated based on power calculation formula in order to detect an effect size of one group (time series) with 5% significance level, 95% confidence interval and 90% power so a sample size of (43) child was included in the study sample **(Two Sample Z-Test Calculator, 2019).**
They were selected according to the following criteria:

Inclusive criteria:

- Children age from 10 – 18 years.
- Conscious and oriented.
- Completely healed deep 2nd and/or 3rd degree.
- Affected upper extremity joints (shoulder, elbow and wrist) with burned injuries

Exclusion criteria:

- Neurological disorder that influence on upper limbs joints functional motion.
- Fracture with burn in upper extremities.
- Electrical burn.
- Free from chronic disease

Tools of data collection

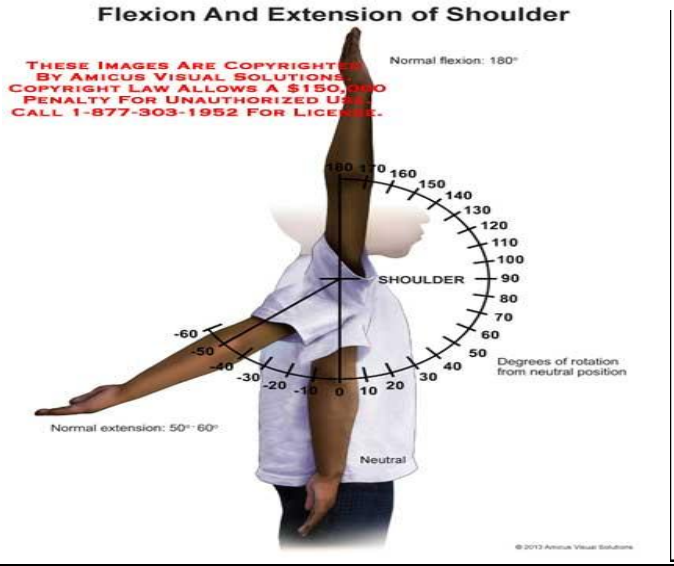
Four tools were used to collect the data for the present study based on the revised extensive literature review.
Tool I: Structure questionnaire sheet of children with upper extremity burn:this tool consisted of two parts.
Part I:Socio-demographic characteristics of the children:It concerned with Scio-demographic characteristics assessment of the children as age, sex, birth order, level of education and residence

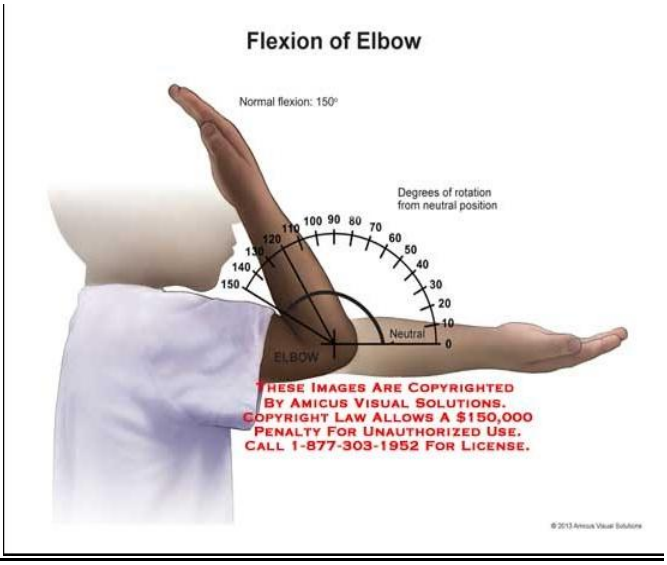
Part II: Children clinical data:It was designed for the burn characteristics evaluation (including cause of burn, degree of burn, presence of post burn contracture, in addition to different post burn complications as stiffness, shortness, distortions, and forming scars & lesions of the upper extremities).

Tool (II): joints function assessment (at three sequential observations):by using Severity rating contracture scale which was developed by the researchers according to Compensation Guidelines for Determining Impairment 2018 andmedical exhibits2020 **(Medical Exhibits, Demonstrative Aids, Illustrations And Models, 2020; New York State, 2020)**. This scale divide contracture into three levels (mild, moderate and severe contracture).

This tool was utilized by the researchers by the assistance of a goniometer instrument with a standardized technique **(Norkin&White, 1958)**. The children' affected joints ROM were measured to obtain baseline data (pre) when the children admitted to outpatient clinic and (post) (6&12) weeks from the children follow up.

Severity rating contracture scale					
Joint	***Muscle action***	***Normal***	***Mild***	***Moderate***	***Sever***
Shoulder	Shoulder flexion	180	120-179	60-119	<60
	Shoulder extension	50-60	32-49	16-31	<16
	Shoulder Abduction	180	120-179	60-119	<60
	Shoulder Adduction	40-50	32-39	16-31	<16
Elbow	Elbow flexion	140-150	93-139	46-92	<46
	Forearm Pronation	90	63-89	36-62	<36
	Forearm Supination	90	63-89	36-62	<36
Wrist	Wrist flexion	80-90	53-79	26-52	<26
	Wrist Extension	70	46-69	20-45	<20
	Wrist radial deviation	20	15	10	<10
	Wrist ulnar deviation	30-50	20-29	10-19	<10





Adapted from :http://www.medicalexhibits.com/

Tool (III): Quick Disabilities of Arm, Shoulder & Hand scale (Quick DASH): This 5-response self-reported disability scale was utilized to evaluate the children with upper extremity burn' disabilities. It was adapted from **Institute for Work & Health 2006**. It constituted from 2 subscales: 11 items (central) that related to severity of symptoms, social, recreational and regular daily living activities, in addition to, 4 items (optional) were belonged to playing your musical instrument or sport or both. This DASH version was extracted from the full length DASH to reduce responder and data entry burden while maintaining a high degree of correlation to the original length DASH. Similar to the DASH, each item was rated on 5 response options ranged from "no difficulty" 1 score to "unable" 5 score and, from the item scores, scale scores are calculated, ranging from 0 "no disability" to 100 "most severe disability".Quick DASH score may not be calculated if there is greater than 1 missing item of total Quick DASH scale (15 items).

Scoring system:

Total Quick DASH disability/symptom score was calculated by Adding up assigned valuesfor each response; divide by 15 (number of items); subtract 1; multiply by 25.Overall scoring levels of Quick DASH scale was estimated as the following:

- **No dysfunction**: ≥ 14 score
- **Mild dysfunction:**15-29 scores
- **Moderate dysfunction:**30:44 scores
- **Sever dysfunction:**45-59 scores

ToolIV: Self-Efficacy Questionnaire for Children (SEQ-C)

The SEQ-C constituted from 24 items that categorized into three 8 items domains of self-efficacy: (1) social self-efficacy included items 2,6,8,11,14,17,20 and 23 concerned with the perceived capability for peer relationships and assertiveness; (2) academic self-efficacy contained items 1,4,7,10,13,16,19 and 22 that concerned with the perceived capability to manage one's own learning behaviour, to master academic subjects, and to fulfil academic

expectations; and (3) emotional self-efficacy incorporated items 3,5,9,12,15,18,21, and 24 that pertains to the perceived capability of coping with negative emotions. This brief questionnaire was developed by**Muris, 2001**. Three domains of this questionnaire were adapted from original self-efficacy questionnaire of **Bandura et al. (1999)**. Each item has to be scored on a 5-point scale with 1 = not at all and 5 = very well.

Scoring system

The total self-efficacy score can be obtained by summing across all items. It was classified into:
Lower self-efficacy score:<50% (60 score)
Higher self-efficacy score: ≥50% (≥60 score)

Procedure:

This study was accomplished throughout three main phases

Phase 1: Preparatory phase

Official, ethical and other technical issues:

- Ethical approval was obtained from the responsible authorities. Oral consents were obtained from children's caregivers to participate in the study after illustrating the purpose, procedure, benefits, nature of the study, and follow-up. The subjects were informed that the participation is voluntary and they could withdraw from the study at any time without any rational. Confidentiality and anonymity of each subject were guaranteed through coding of all data and protecting the received data in close cabinet for 5 years and reached only by the researchers**(World Medical Association, 2011)**.
- An official approval from the responsible authorities for conducting the study was obtained.

Tools development

A Review of local and international pertinent literature of both new and old references using scientific published articles, internet search, and E-books was done. This review was hired as a guide for developing the study tools on various aspects of post burn complication and its effect on the children' physical function and on their self- efficacy, in addition to the technique of designing targeted exercise program and the paediatric nurses" role in implementing children's burn plan of care.

The targeted exercise program development:

This program developed by the researchers based on revising relevant comprehensive literature review **(Ahmed et al., 2019;Mohammed et al., 2019;Flores et al., 2018;Ault et al., 2018;Hardee et al., 2014)** to improve the studied children affected post burn upper extremities' function, this program incorporated two master skills.

Skill I: Therapeutic exercises

Included three main exercise groups: Range of motion exercise, Resistive or strengthening exercise, besides Stretching exercise begins immediately at the first burned child contact after obtaining baseline data and maintained during the entire process. Therapeutic exercise was carried out together with other proper positioning exercise (keeping in normal anatomical position) if the child with burn tailored.

Skill II: Massage technique

- Massage technique was accomplished 5 min on completely healed scar or graft before implementing a therapeutic exercises, a smooth, gentle, tactile massage technique aided by oils or creams for managing the burned child pain, anxiety, distracting his attention, besides it hastened their emotional recovery. Additionally for improving the affected part blood circulation **(O'Flaherty et al., 2012; Ault, Plaza, &Paratz, 2018).**
- The used various massage technique was determined by the burn zone as well as the characteristics and development of the scar **(Atiyeh&Janom, 2014)**.

Tools and the targeted program validity:

- The developed tools and targeted program content validity were examined by a panel of five experts (3) in the field of paediatric nursing, in addition to (2) physical education experts. All jury members (100%) concurred on that current study tools and exercise program content were valid and relevant to the aim of the study.
- Face validity of the developed tools was tested by conducting a pilot study on 10 % of children with upper extremity burn (4 children). The face validity evaluated the clarity, and applicability of the research tools. In addition to estimate the approximate time required for data collection, the exercise session application and identifies the possible obstacles or problems that may hinder the program implementation and overcome measures. According to this pilot study, the required minor corrections were modified. Those piloted children were included into the study.

Tools reliability:

Reliability of the developed and adapted tools were tested by Cronbach's alpha coefficient and interpreted according to **(Tavakol&Dennick2011 ; Glen 2020).** The results revealed excellent internal consistency **(0.98)** of ***Quick DASH scale***, in addition to internal consistency reliability (Cronbach'sα) for ***joints function assessment tool*** emerged as high **(0.7)**. Regarding ***Self-Efficacy Questionnaire for Children,*** it showed excellent level of internal consistency **(0.97).**

Phase II: Operational phase:

- Immediately after obtaining the official permission of the intended study from hospitals' directors, the researchers initiated data collection, name of potential participants who have a follow up card and who met the inclusion criteria were obtained from the hospital records.
- During the first contact with criteria-met children, the researchers granted oral agreement for voluntary participation from those children and their caregivers after illustrating objectives, nature and procedure of the proposed study prior to any data collection.
- The involved participants and their caregivers were interviewed individually for filling **(Tool I)**. Additionally, the researchers obtained the baseline data of the affected upper-extremity' joints function by using **(Tool II)**, this part applied by using the goniometer instrument. Besides, selecting the related responses of **Tool III** (Quick DASH scale) for evaluating their upper

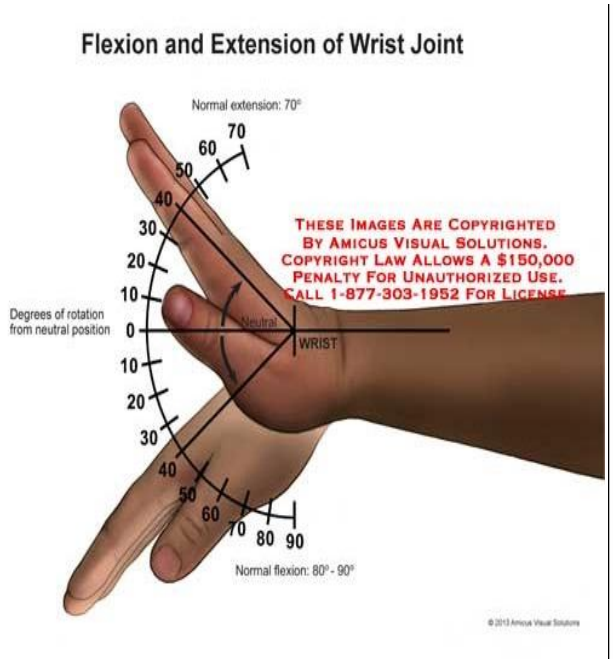
extremity'physical disabilities and **Tool IV** for assessing their self-efficacy at three different dimensions (academic, social and emotional).

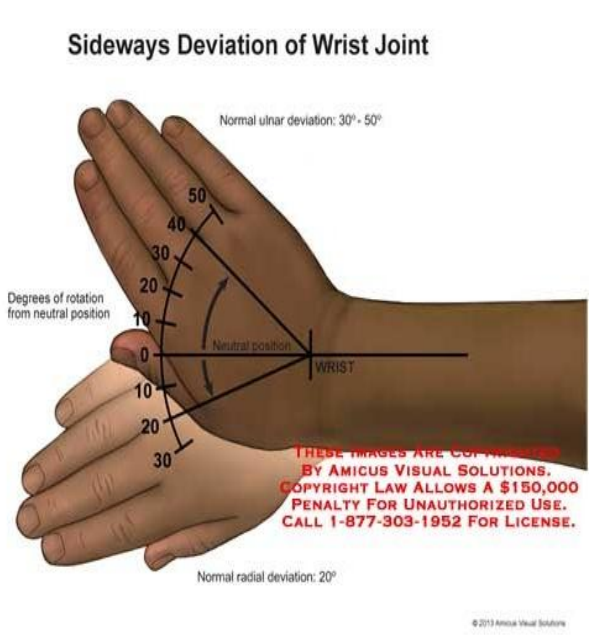
- Collection of the proposed study data was done on a daily basis (3 to 4 days per week) during working hours of the intended settings. The total data collection was completed over a period of 7 months starting from March to September2019.
- At the beginning of the program application, the researchers taught the children and their caregivers therapeutic exercises and appropriate massage technique for child's support and increasing their sense of responsibility
- The therapeutic sessions accomplished on weekly basis (one to three times per week) for 30 min. Depending on the studied child severity and degree of disability, the exercise program period reached for 3 months period.

Description of Exercise workout:

Items	*Description*
Frequency of sessions	One to three non-consecutive days per week, 2 day(s) rest in between (depending on the severity of burn injury and the child tailoring,
Number of sets	2–3 sets.
Rest interval	Approximate 1 minute between sets.
Modalities of therapeutic Exercises	Range of motion exercise, Resistive or strengtheningexercise, and Stretching exercise.
Exercise type	Multi-joint (shoulder, elbow, and wrist), assistance, and core exercises involving the upper extremities.
Order of Exercises	Starting the therapeutic exercise sets with 5 min customized massage followed by sequential range of motion of (starting from shoulder, to elbow and wrist joints), Resistive or strengthening exercises, Stretching exercise then finishing with massage for reliving child anxiety and tension.

- The delivered instructions for the children and their responsible care givers were to perform these exercises three times daily at home by the instructed exercise technique, whereas maintaining the burned upper extremity in normal anatomical position after performing the therapeutic exercises if the child tailored.
- Educational booklet including training practices with illustrated pictures of sequential steps of each therapeutic exercise technique was delivered to the study sample. As it prepared by the researcher after extensive literature review**(Ahmed et al.2019; Mohammed et al., 2019; Flores et al., 2018; Ault et al., 2018;Hardee et al., 2014; Ibrahim et al., 2018).**





Adapted from http://www.medicalexhibits.com/

Phase III- Evaluation phase:

In this phase the researchers re-evaluated main program outcome measure that concerned with the studied participants' upper – extremity joint function using **(Tool II & Tool III)** post six (6) and post twelve (12) weeks from the start of the program. In addition to the 2nd outcome measure that related to the total self-efficacy of children by **Tool IV**.

Statistical analysis:

The collected data were coded, entered, explored for detecting any error by statistical package of social sciences (SPSS) version 24. Then, it was tabulated, and presented using descriptive statistics in the form of frequency distribution, percentages, means, median and the standard deviations as a measure of central tendency and dispersion. Before performing significance statistical tests, the study data were examined for normality by Kolmogorov-Smirnov test. The results revealed non-normally distributed variables. Based on this context, Friedman test was utilized for

comparison between more than two related groups. Spearman correlation (r_s) was performed to measure the strength and direction of relationship between key study variables. It can range from -1 to 1. An r of -1 indicates a perfect negative relationship between variables, an r of 0 indicates no relationship between variables, and an r of 1 indicates a perfect positive relationship between variables. All tests were performed at a level of significance (P-value) equal or less than 0.05 was considered to be statistically significant.

RESULTS

Table (1): Distribution of socio-demographic characteristics of the studied children withupper extremity burn injuries:

Socio-demographic characteristics		n=43	
		No.	%
Age	10-<14	26	60.5
	14-18	17	39.5
	Mean ± SD =	**13.38±1.73**	
Gender	Boy	27	62.8
	Girl	16	37.2
Residence	Rural	32	74.4
	Urban	11	25.6
Education	Preparatory school	27	62.8
	Secondary school	16	37.2

Table(1)revealed that,around two thirdsof the studied children were boys, aged between 10 to less than 14 years with a mean age 13.38±1.73 years old, besides they were studying in preparatory school(62.8%, and 37.2% respectively). Regarding their residence, about three quarter of them (74.4%) wereresiding in rural areas.

Table (2): Distribution of the studied children with burn' clinical data:

The clinical data		n.=43	
		No.	%
Causes of burn injuries	Fire	9	20.9
	Boiling water	26	60.5
	Boiling oil	8	18.6
Degree of burn	Deep second degree	7	16.3
	Third degree	36	83.7
Presence of the contracture	Yes	35	81.4
	No	8	18.6
Treatment	Reservation	26	60.5
	Surgical skin grafting	17	39.5
Presence of upper extremity burns complications	Yes	39	90.7
	No	4	9.3

Table (2)clarifiedthat,less than two third of most common causes of burn were boiling water (60.5%), followed by fire (20.9%), and boiling oil (18.6%).As regard to degree of burn, majority of the studied children (83.7%) were represented by third degree burn which matched with large percentageof existence of post burn contracture and complications (81.4% and 90.7% respectively). In according to the used burn treatment modality, 60.5 % of the studied children were treated by reservation modality.

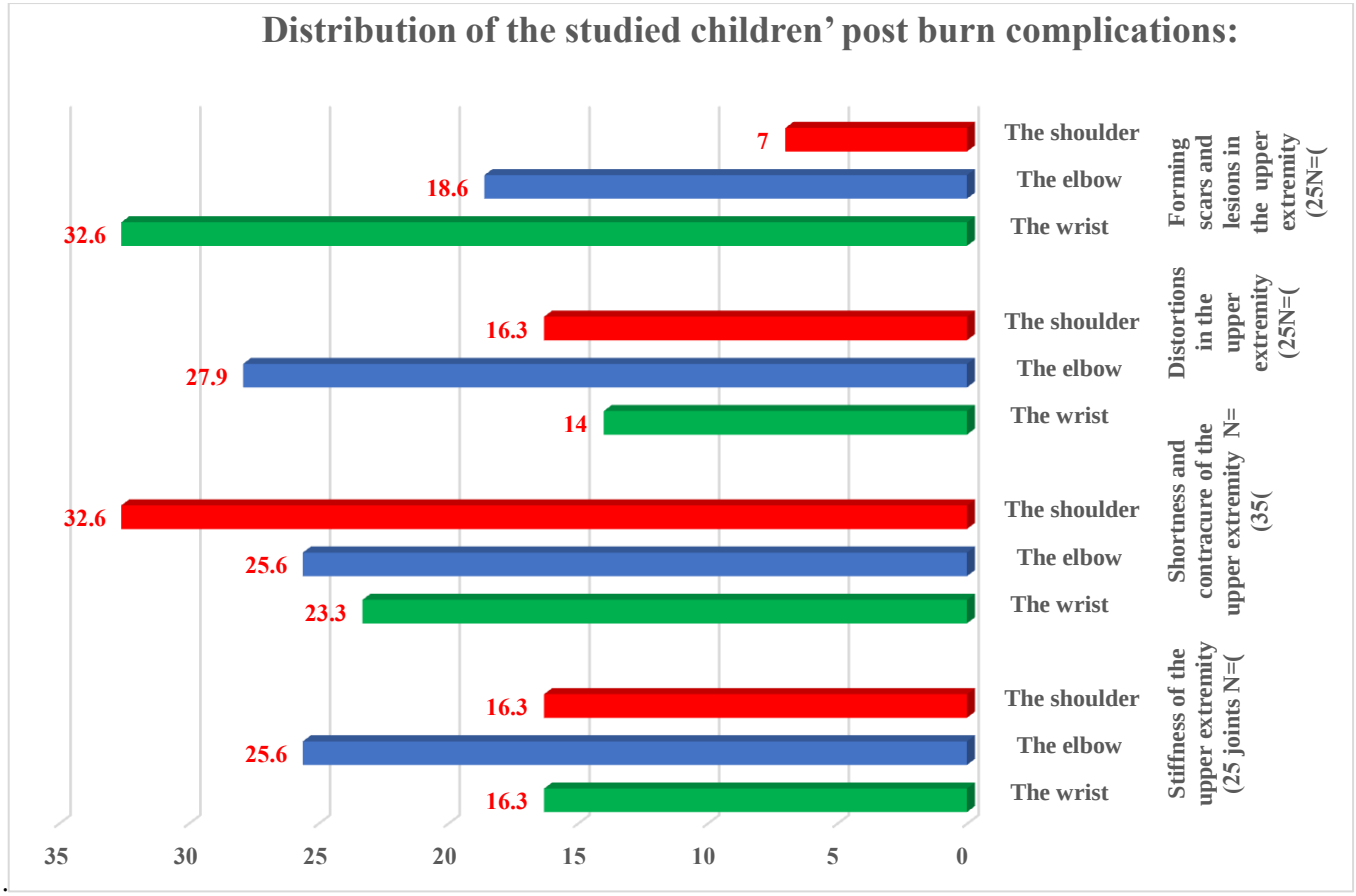


Figure (2): Percentage distribution of the studied children' post burn complications (N=43)

Figure (2) Illustrated that the studied post burn complication were categiezed into stiffness, shortness, distortions & forming scars and lesions of the upper extremities. Regarding stiffness category, 25.6% of the study sample suffered from elbow stiffness followed by shoulder and wrist stiffness (16.3%). Concerning the second category, shoulder shortness and contracture was the major affected joint among 32.6% of the study sample. In relation to upper extremities distortion, elbow distortion was occurred among 27.9% of the study sample. Lastly wrist scares and lesions were developed among 32.6% of the studied children.

Table (3): Percentage distribution of studied children's total disabilities of the upper extrimities mean scores before and after the targeted exercise program implementation:

Items	Baseline observation (n = 43)	2 nd observation (n = 43)	3 rd observation (n = 43)	Test of significance (Friedman test)		
				$\chi 2$	P-value	EF
Central subscale score median (range)	51(44)	40(33)	25(22)	81.33	≤0 .0001	0.95
Mean ± SD	43.88±12.73	33.44±11.53	23.58±7.94			
Optional subscale score median (range)	12(16)	8(12)	4(8)	84.00	≤0 .0001	0.98
Mean ± SD	14.27±3.93	10.46±3.62	6.65±3.42			
Total Dash scale Median (Range)	64(60)	49(45)	34(30)	84.00	≤0 .0001	0.98
Mean ± SD	58.16±15.24	43.9±13.58	30.23±9.92			

NS= not significant *** p** = ≤.05 (statistical significance) **** p** = ≤0.01 (highly statistical significance)

Table (3)presented Friedman test results that shows highly statistical differences from baseline observation to the second successive observations**(P-value≤0.0001)**with a huge effect size **(0.95, and 0.98)** of central, optional and total Quick DASH itemsin terms of reducing the studied children'total disabilities with gradual improvement of the upper extremity function post exercise program implementation. It appeared through decreasing mean difference 20 points through three observation of central subscale. While mean difference of optional scale reduced only 8 points across three measurements. Totally Quick DASH revealed cumulative improvement of upper extremities' disabilities post burn from baseline mean score (**58.16±15.24**) compared to the second two observations mean score (**43.9±13.58, and30.23±9.92** respectively).

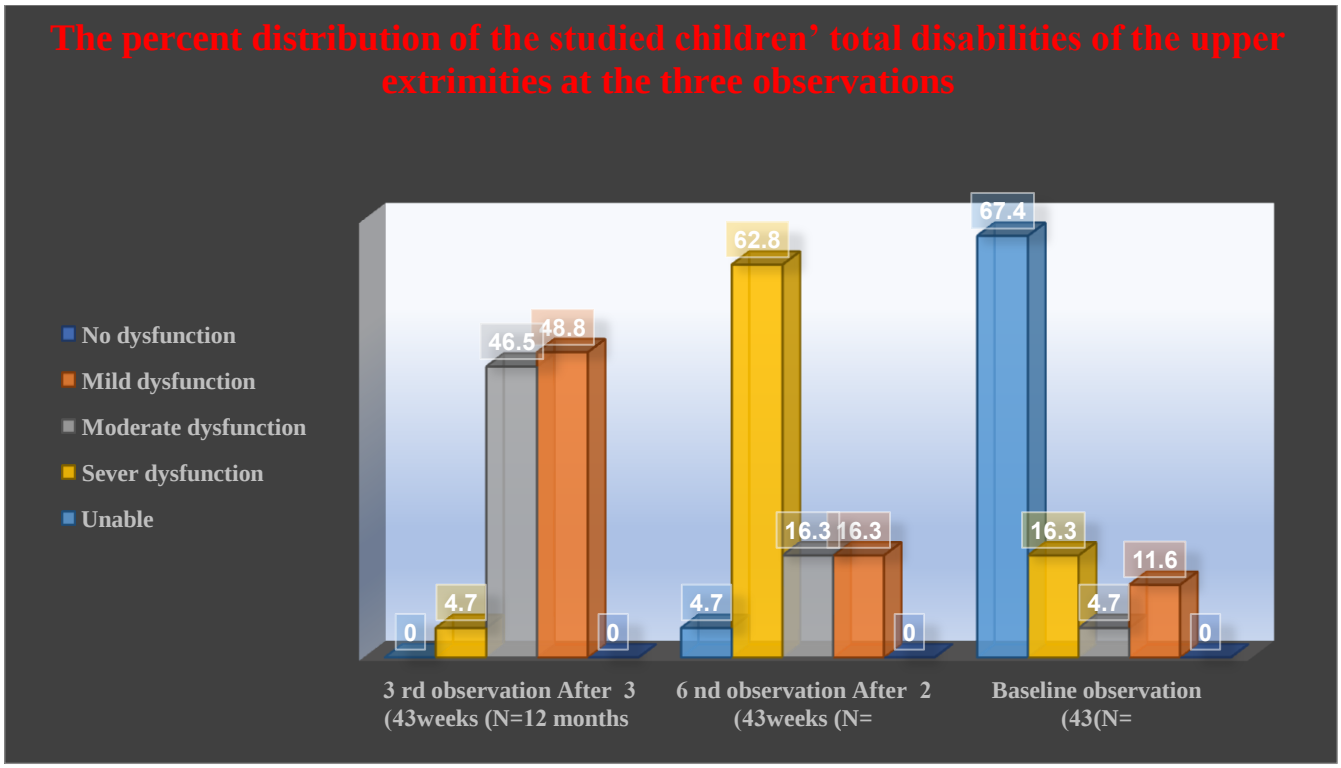


Figure (2): Percent distribution of the studied children' total disabilities of the upper extrimities at the three observations (N=43).

Figure (2) representedprogressive improvement of the physical ability of upper extremities post burn among the studied children according to Quick DASH scale. Mild, moderate, severe dysfunction, and unable level represented (11.6%, 4.7%, 16.3%, and 67.4%respectively) during 1st observation compared to (16.3%, 16.3%, 62.8 %, and 4.7%respectively) in 2nd observation. As regard to the third observation, a cumulative refinement was observed for the physical ability of the affected upper extremities and changing mild, moderate, severe dysfunction levels to (48.8%, 46.5%, and 4.7%respectively).

Table (4): Percentage distribution of studied children' self-efficacy mean scores before and after the targeted exercise program implementation:

	Baseline observation (n = 43)		**2 nd observation (n = 43)**		**3 rd observation (n = 43)**		**Test of significance (Friedman test)**		
Self-efficacy subscales	**Lower** efficacy %	**Higher** efficacy %	**Lower** efficacy %	**Higher** efficacy %	**Lower** efficacy %	**Higher** efficacy %	**χ^2**	**P-value**	**EF**
Academic self-efficacy	**76.7**	**23.3**	**58.1**	**41.9**	**9.3**	**90.7**	**30.8**	**≤0 .0001**	**0.36**
Median (Range)	**8(24)**		**16(26)**		**25(16)**				
Social self-efficacy	**81.4**	**18.6**	**60.5**	**39.5**	**16.3**	**83.7**	**26.9**	**≤0 .0001**	**0.31**
Median (Range)	**8(24)**		**14(21)**		**21(21)**				
Emotional self-efficacy	**81.4**	**18.6**	**60.5**	**39.5**	**48.8**	**51.2**	**11.8**	**≤0 .0001**	**0.137**
Median (Range)	**8(24)**		**15(28)**		**20(20)**				
Total self-efficacy scale	**81.4**	**18.6**	**60.5**	**39.5**	**14**	**86**	**18.0**	**≤0 .0001**	**0.21**
Median (Range)	**25(72)**		**44(75)**		**65(57)**				

NS= not significant *** p** = ≤.05 (statistical significance) **** p** = ≤0.01 (highly statistical significance)

Table (4) illustratesthat;the three dimensions of self-efficacy (academic,social and emotional) were tested during the current study. There is a significant statistically improvement in academic and social self-efficacy ***(P-value≤ 0.0001)*** amongthe study sample after exercise program application with moderate effect size ***(0.36, and 0.31 respectively)***, more ever,the studied children verbalized higher efficacy level in 3rdobservation than 1st and 2ndone (90.5%, and 83.7% respectively). While,there is a small effect size (0.13) of exercise program implementation on the studied children'emotional efficacy with highly statistically significance ***(P-value≤ 0.0001)*** through the three sequential observations. In conclusion, total self-efficacy increased from baseline observation (18.6%) compared to 2nd and 3rdone (39.5% and 86% respectively) with higher statistically improvement ***(P-value≤0.0001 and EF=0.21)***.

Table (5): Comparison of the mean difference between the studied children's measured ROM score at three observation before and after the targeted exercise program implementation (n= 43)

The affected upper extremity joints ROM	Baseline observation (n = 43)			2 nd observation (n = 43)			3 rd observation (n = 43)			Test of significance (Friedman test)		
	Mean	SD	Median	Mean	SD	Median	Mean	SD	Median	$\chi 2$	P-value	EF
Shoulder flexion	146	53.25	180	167	24.37	180	176	10.2	180	**27.11**	**≤0 .0001**	**0.31**
Shoulder Extension	41	15.5	50	47.58	10.59	53	53.7	6.25	56	**83.32**	**≤0 .0001**	**0.96**
Shoulder Abduction	147.2	52.17	180	166.3	26.43	180	176	10.39	180	**27.11**	**≤0 .0001**	**0.31**
Shoulder Adduction	34.74	11	40	40	7.25	43	46	4.48	47	**84.58**	**≤0 .0001**	**0.98**
Elbow Flexion	115.72	34.86	140	135.8	15.08	142	146.14	5.37	147	**82.15**	**≤0 .0001**	**0.955**
Forearm Pronation	75	20.48	90	85.49	8.33	90	89.42	2.71	90	**35.77**	**≤0 .0001**	**0.42**
Forearm Supination	75.7	18.99	90	85.4	9.24	90	89.35	2.99	90	**37.33**	**≤0 .0001**	**0.43**
Wrist Flexion	67.56	22.49	81	77.63	11.68	83	84.07	6.56	87	**84.14**	**≤0 .0001**	**0.98**
Wrist Extension	61.14	17.43	70	66.42	8.68	70	69.12	3.16	70	**19.15**	**≤0 .0001**	**0.23**
Wrist Radial Deviation	17.16	5.04	20	18.6	2.95	20	19.65	1.28	20	**22.8**	**≤0 .0001**	**0.30**
Wrist Ulnar Deviation	27.86	9.63	31	34	7.09	37	41.16	6.15	43	**83.00**	**≤0 .0001**	**0.96**

Table (5)reflects the gradual improvement of the most common central tendency measures of the studied affected upper extremities joints ROM. There was a highly statistical significance difference (***P-value≤0 .0001***) as regard the study sample' joint function on different upper-extremities joints at the three successive observations before and after exercise program application. The targeted exercise program demonstrated different effect sizes ranged from moderate to massive effect. As it presented modest effect on the shoulder flexion, abduction, forearm pronation, supination, and wrist radial deviation ***(0.31, 0.31, 0.42, 0.43 &0.30 respectively)***.Additionally to the huge size of effect on shoulder extension, adduction, elbow and wrist flexion, besides wrist ulnar deviation ***(0.96, 0.98, 0.95, 0.98 &0.96 respectively).***

Table (6): Correlation of the studied children'sScio-demographic characteristics and clinical datawith key study variables (n= 43).

Items	*Total Dash score*						*Total self-efficacy score*					
	Baseline Observation		2 nd observation		3 rd Observation		Baseline observation		2 nd observation		3 rd observation	
	r	P	r	P	r	P	r	P	r	P	r	P
The children' Scio-demographic characteristics												
Age	0.467	0.002**	0.582	0.000**	0.787	0.000**	0.142	0.363	0.222	0.153	0.086	0.583
Gender	0.150	0.338	0.160	0.307	0.054	0.730	0.244	0.114	0.263	0.088	0.107	0.496
Residence	0.345	0.024*	0.308	0.044*	0.308	0.044*	0.003	0.985	0.066	0.672	0.171	0.273
Education	0.524	0.000**	0.562	0.000**	0.707	0.000**	0.268	0.083	0.038	0.809	0.236	0.127
The children' Clinical data												
Causes of burn injuries	0.198	0.202	0.092	0.559	0.108	0.49	0.019	0.902	0.178	0.254	0.229	0.140
Degree of burn	0.496	0.001**	0.374	0.014*	0.308	0.044*	-0.437	0.003**	-0.357	0.019*	-0.178	0.225
Presence of contracture	0.691	0.000**	0.677	0.000**	0.345*	0.024*	-0.386	0.011*	-0.387	0.01*	-0.193	0.216
Treatment	0.217	0.162	0.291	0.058	0.009	0.956	-0.142	0.363	0.416	0.005	0.188	0.226
Presence of post burn complication	0.591	0.000**	0.539	0.000**	0.303	0.048*	-0.670	0.000**	-0.259	0.094	-0.129	0.410

*Correlation is significant at **≤0.05**

Correlation is highly significant at **≤0.01.

Table(6) presents measure of the strength and direction of association that exists between two main table sections (total DASH and total self-efficacy) with the studied children' Scio-demographic characteristics and clinical data. As regards tothe first section, there was a modest, positive correlation between Scio-demographics (age, residence and education),besides burn characteristics as (degree of burn, existence of post burn contracture and complications) with level of the studied children**'** physical function of the upper extremities, which was statistically significant at ***P-value≤0.01*** Concerning self-efficacy section, there was no statistical correlation was noticed between the studied children**'** Scio-demographics and their total efficacy level.While, negative moderate to strong correlation was observed between the studied children**'** efficacy level and their burn characteristics (degree of burn, existence of post burn contracture and complications) at ***P-value≤0.001***

Table (7): Correlation between the studied children' total disabilities of the upper extrimities and their total efficacy at three observation before and after the targeted exercise program implementation

Items	n= (43)					
	Baseline observation		2 nd observation		3 rd observation	
	r_s	P	r_s	P	r_s	P
Total self-efficacy score	-0.488	0.001**	-0.453	0.002**	-0.345	0.024*

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

Table (7) showsimprovement of the self-efficacy score negatively correlate with the increase in DASH scoreat significance level at P≤0.05 as it means improvement of upper limbs function (decrease in DASH score) affects positively on the studied children**'**academic, social and emotional efficacy at the three sequential observations.

DISCUSSION

The current study examines the outcome of a comprehensive, structured exercise training program on the joint functioning and perceived self-efficacy of paediatric burns. For many years researchers have focused separately on examination of physical, psychological, social outcomes of burn survivors. Revision of related literatures revealed that**(Mohammed et al., 2019;Disseldorp et al., 2012;Stubbs et al., 2011;Corner et al., 2014)**the majority of children with burn attained optimal outcomes, while others continue to experience difficulties with physical function as revealed by **Baker et al.,2007** and/or psychosocial functioning as reported by **Stubbs et al.,2011.** physical rehabilitation replenished with range of motion and/or resistive strengthenexercises has achievedhighly favourableeffects on the recovery of children with burn injuries (**Rivas et al.,2018 ; Disseldorp et al., 2012 ; Porter et al., 2015; Atiyeh&Janom, 2014).** However little or may be no study in Egypt focused on the effectiveness of the rehabilitation exercise programs on children's self-efficacy which is a highly valuable determinant of normal developmental tasks achievement for the paediatric population**.**

Regarding demographic characteristics of the children; the current study revealed that; the more than half of the studiedchildren were male. These findings was congruent with **Ahmedet al., 2019; Daffue et al., 2018; Faisal et al., 2016; Faris& Al Naser, 2019).**Also supported by **Gupta et al., (2011)** who found that more than half of the burned children in his study were males and less than half were female. This may be explained due to the active and curious nature of the male children.Concerning the studied children' age,**Rosenberg etal., 2013 and Clayton et al., 2017**reported the same mean age of the study sample were 13.9±3.1. As regard to residence, large percentage of the study sample live in rural areas which is in agreement with findings of**Mohammed et al., 2019 andKuiri etal.,2016** who cited that less than three quarter of their participants were living in rural areas. This finding may be attributed to the nature of life in rural areas and the use of unsafe fire sources and storage of flammable subjects within the reach of children and low income criteria of most families in the rural communities.

In accordance with clinical data; the finding of the current study indicated that the majority of burn causeswereboiling water **(60.5%)** among the study sample, followed by fire **(20.9%)**. These findings are in agreement with **Tripathee&Basnet, 2017;Ahmedet al., 2019 and Hosseini et al., 2017**who declared that the flame and scald burns were among the most common causes of burn injuries in children.This may be related to lack of awareness about child-precautions from burn hazardous at homes.Also agreed with a study conducted by **Faris& Al Naser, 2019** which mentioned that more than 71.6% of the subjects were burned by flame and less than 23.4%were burned by hot fluid.

Furthermore, study results represented that majority of the studied children (83.7%) suffered from third degree burn and the lowest percentage haddeep second degree burn which is consistent with **Clayton et al., 2017**. This finding conflicted with **Ahmed et al., 2019; Hassan et al., (2008)**who declared that more than half of their participants had second-degree than third degree burns. Besides, reporting that "all the cases had history of burns in the upper extremities, with more than half presenting burns only in the hands and/or wrists and less than quarter only in the forearm" which is consistent with the current study finding toward the presence of post burn upper extremities' complication and contracture. Likewise **Tan et al., (2019)** was agreed with the present study as they pointed that 93.5% of burnt patient suffered from at least one joint contracture especially upper extremities' contracture.

With regards to the study finding of upper extremity burn' disabilities according to Quick DASH scale after application of exercise program, it demonstrated significant improvement among study sample that about 11.6 % of them had mild dysfunction at baseline assessment improved to 48.8% after 3months with highly statistical significance at p-value≤0.001and great size of effect (0.98). This result was confirmed by**Perera et al., 2017 ;DanTang et al., 2015;Hardee et al., 2014; Clayton et al., 2017; Mohammed et al., 2019** who reported that, significant improvement at all Full length DASH scale dimensions (work status, severity of symptoms, physical and social functioning).

In accordance with range of motion results that assessed by goniometer instrument, there was significant improvements regarding the affected upper extremities' joints ROMpost implementation of program. This is compatible with**Ardebili et al., 2014; Rrecaj et al, 2015; Ahmed et al., 2019**whoillustrated that there was a statistical significance difference towardparticipants' joint function on different upper- arm joints in pre / post implementation of range of motion exercise program.

Similarly,**Neugebauer& colleagues (2008)** reported that the participated children who engaged in a 12-week rehabilitation program that was augmented with music and exercise significantly experienced improved range of motion.

Regarding the correlations of the current study, the results demonstrated improvement of the self-efficacy score negatively correlate with the increase in DASH score (decline in upper extremities' disabilities) at significance level at P≤0.05. This finding is in same line of **Mohammed et al., 2019** and **Rosenberg et al., 2013** who concluded that improving in physical functioning (measured by Quick DASH scale) was positively affected on psychosocial functioning measured by self-efficacy.

In conclusion, we hypothesized that participation in the proposed exercise program would positively recover the physical function by reducing post burn disabilities, which in turn improving emotional, social and academic efficacy. This hypothesis was completely proven in those children who participated in this program as they perceived massive improvements in their overall physical functioning, additionallyraising their total –self efficacy. As the results of physical functioning revealed highly statistical differences from baseline data to the second successive observations **(P-value≤0.0001)** with a huge program'effect size **(0.95, and 0.98),** besides acceptable effect size on the study sample' total self-efficacy **(0.21).**These results are clinically relevant in that exercising and good support systems may facilitate physical, psychological, social & emotional recovery and well-being after burn injury as cited by **(Rosenberg et al., 2013; Ahmed et al., 2019; Hardee et al., 2014; Clayton et al.,2017; Landoltet al.,2009; Stubbs et al.,2011).**

CONCLUSION

Regarding the findings of the current study, it is concluded that there was an improvement in children's joint functioning after implementation of the exercises training program. In addition exercise training program improved children perceived self-efficacy.

RECOMMENDATIONS

- Promoting awareness among pediatric burn health care team regarding the importance of integrating an exercise program into outpatient burn care plan.
- Standardizing parameters, standards and guidelines that allow for adequate tracking of progress in this burn survivors population is also substantial.
- Developing regular training sessions to keep pediatric nurses in burn units knowledgeable and qualified with the updated evidence-based practices and array interventions for lessening burn contracture and improving extremities" function and therefore children's' independence and productivity.
- Developing subspecialties of pediatric nursing concerned with providing focused nursing care for children with special needs andtheir families.

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