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Can Early Orthotic Support and Physical Therapy Improve the Functional Level in Pediatric Burn Patients?

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ABSTRACT

Physiotherapy prevents contractures and aids mobility in pediatric burn patients. **Objective:** To evaluate the potential benefits of implementing early orthotic interventions and physiotherapy programs in pediatric patients with burn injuries. **Methods:** This quasi experimental study was conducted on 27 children at Department of Physical Medicine and Rehabilitation (PM and R), The Children Hospital and University of Child Health Sciences, Lahore between August 2022 and August 2023. The sample size included 27 pediatric burn patients. Convenient sampling technique was used to collect data. Children under age of 16 years with burn were included in the study. ROM (measured via a goniometer), muscle tone (assessed using the Ashworth scale), and muscle strength (evaluated via the Oxford scale MMT) was systematically assessed. Related pre-treatment questionnaire was filled first, they were undergoing the burn rehabilitation protocol (anti-contracture positioning, ROM, casting, splinting, stretching) followed by verbal questionnaire filling after 3months. Wilcoxon Signed Rank Test was used to measure difference before and after the intervention. **Results:** Muscle tone of majority of patients was tested which was possible against gravity was possible now against some resistance. Result suggest that Physical activities like carrying an object and other ADLs which were severe difficult after burn were improved. ROM which was limited before orthotic intervention and physiotherapy protocol was now partially limited. **Conclusions:** In conclusion, the amalgamation of physiotherapy and orthosis represented a pivotal cornerstone in the comprehensive care paradigm for burn patients, yielding a myriad of positive effects that significantly enhance their rehabilitation journey.

INTRODUCTION

Burns are a common reason of admission to hospital in developing countries [1]. In this injury necrosis of tissues of body occurs and it may be limited to skin superficially or deep to the extent that it involves muscles, joints, blood vessels and vital organs [2]. Boiling liquids, Heat, electrical energy and corroding agents such as acids are common causes of burn injuries [3]. The WHO estimates that 11 million burn injuries of all types occur annually worldwide, 180,000 of which are fatal [4]. Superficial burns heal rapidly from dermis present beneath and usually does not require any surgical procedure while deep burns are complicated. Deep burns require time to heal properly as dermis is also damaged in deep burn injuries. So there are chance of contracture development and scarring usually decreased by plastic surgery [5]. Scar with contractures develop and expand to underlying connective tissues resulting in decreased range of motion and poor quality of life [6]. It may need dressings and repetitive surgical treatment [7]. Unfortunately, burns are very common in pediatric age groups with serious complications and high rate of morbidity and mortality [8]. These patients are encountered with a widespread somatic and psycho-social drawback, disturbing all aspects of their life [9]. In these conditions, early and intensive rehabilitation likely matters

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to an individual's physiological profile and functional recovery [10]. Physical therapy plays important role in management of burn [11]. It helps to improve functional capacity of damaged part with quality of life. Basically burn management is a multi-disciplinary approach which includes physicians, rehabilitation therapists, occupational therapist, and psychologists to deal with the pathology, ADL, social and psychological issues [6]. Proper Physical Therapy program and use of orthoses with moisturizing and massage after burn injuries is essential [12]. It helps in prevention of contracture, edema, improving Range of Motion (ROM), prevents growth of keloids or hypertrophic scars, regain the muscle strength and better cosmetic outcomes [13, 14]. Orthoses keep the damaged limb in best possible position. Burn orthoses are used to sustain a constant, mild stretching to the injured area, help to adapt scar tissue such as it maintains anatomical curves [15]. Moreover, caregiver's attitude also plays an important role in recovery [16]. Burn patient leads towards complications from positioning in spot of comfort. It may be adducted or flexed at chief joints [17]. Orthoses keep the position of affected body section in an anti-contracture position [18]. A chain of points should be planned for every joint because fixed positioning is usually not properly tolerated [19]. Major goal of this plan is to gain functional independence and resumption of activities like pre-burn times. Regardless of the large amount of international literature on pediatric burn rehabilitation by using physical therapy and orthoses, there is limited knowledge regarding their management with help of physical therapy and orthoses in pediatric population in Pakistan.

Therefore, this study aimed to evaluate the potential benefits of implementing early orthotic interventions and physiotherapy programs in pediatric patients who have sustained burn injuries

METHODS

This quasi experimental study was conducted on 27 children at Department of Physical Medicine and Rehabilitation (PM and R), The Children Hospital and University of Child Health Sciences, Lahore between August 2022 and August 2023. The sample size included 27 pediatric burn patients calculated by formula:

$$n = \frac{(Z_{\alpha/2} + Z\beta)2 \times 2 \times \sigma^2}{\delta^2}$$

Convenient sampling technique was used to collect data. Children under age of 16 years with first, second and third degree burn were included in the study. All children were conscious and oriented. While children with inability to comprehend instructions such as those who are on mechanical ventilators etc., any comorbidity and trauma or fracture of bone were excluded from the study. ROM (measured via a goniometer), muscle tone (assessed using the Ashworth scale), and muscle strength (evaluated via the Oxford scale MMT) was systematically assessed. Consent was taken from the parents of pediatric patients and they were informed about the protocols of the study. Related pretreatment questionnaire was filled first, they were undergoing the burn rehabilitation protocol (anti contracture positioning, ROM, casting, splinting, stretching) 3 times a week for a total duration of 3 months. They were asked to perform 3 sets of PROM and AROMs protocol daily and post treatment questionnaire was filled verbally again to have the feedback inquiring about the effectiveness of physical therapy in preventing contractures after burn. The data were entered and analyzed using software IBM SPSS version 23.0. The continuous variables were expressed as mean ± SD, whereas the categorical variables were in the form of percentage. Wilcoxon Signed Rank Test was employed to test the difference before and after the intervention. A p value < 0.05 was considered as statistically significant. Ethical clearance was obtained from the ethical committee of the School of Allied Health Sciences CH and UCHS Lahore (No.1183/SAHS).

RESULTS

Demographic features of the subjects are described in table 1.27 pediatric patients of burn injury who met the inclusion criteria participated in order to collect data. Majority of patients were male. Mean age of the patients was 9.07± 3.83. Majority of the patients belonged to middle class. Most of the patients was from urban areas. The most common cause of burn was electricity covering a percentage of 51.9. The area of body in burn injury involved shoulder, arm, hand, leg and foot. Arm was the most common part of body in burn injury with a percentage of 37.0.

Table 1: Socio-Demographic Characteristics of Subjects

Variables	Category	Frequency (%)
Gender	Male	20 (74.1%)
	Female	7 (25.9%)
Socio-economic Status	Upper	2 (7.4%)
	Middle	20 (74.1%)
	Lower	5 (18.5%)
Place of Residence	Urban	17 (63%)
	Rural	10 (37%)

Table 2 presented the effect of the intervention on muscle tone using the MAS. Post-intervention, there was a significant decrease in higher MAS grades (Grades 2–4), indicated decreased muscle tone, while lower grades (Grades 0–1+) showed an increase, suggesting improved control. The p-values (<0.05) confirm statistically

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significant changes, representing the intervention's effectiveness in reducing spasticity.

Table 2: Effect on Muscle Tone before and After Intervention (Modified Ashworth Scale)

Muscle Tone Measurement (MAS Grade)	Pre-Intervention Frequency (%)	Post-Intervention Frequency (%)	p-Value
Grade 0 (No increase in tone)	0 (0%)	5 (18.5%)	0.002
Grade 1 (Slight increase in tone)	2 (7.4%)	8 (29.6%)	0.001
Grade 1+ (Minimal resistance)	5 (18.5%)	7 (25.9%)	0.003
Grade 2 (More marked increase in tone)	10 (37.0%)	5 (18.5%)	0.004
Grade 3 (Considerable increase, passive movement difficult)	7 (25.9%)	2 (7.4%)	0.005
Grade 4 (Rigid in flexion/extension)	3 (11.1%)	0 (0%)	0.006

Table 3 illustrated the effect of the intervention on muscle strength using the Oxford Scale MMT. Post-intervention, there was a significant drop in lower strength grades (Grades 0–3), indicating improvement in muscle activation and movement. Higher strength grades (Grades 4 and 5) increased, replicating enhanced functional strength. The statistically significant p-values (<0.05) confirm the intervention's efficiency in improving muscle strength.

Table 3: Effect on Muscle Strength before and After Intervention (Oxford Scale of MMT)

Muscle Strength (Oxford Scale of MMT Grade)	Category	Pre-Intervention Frequency (%)	Post-Intervention Frequency (%)	p-value
Grade 0	No Contraction	3 (11.1%)	0 (0%)	0.005*
Grade 1	Flicker Contraction, No Movement	5 (18.5%)	2 (7.4%)	0.004*
Grade 2	Movement with Gravity Eliminated	7 (25.9%)	4 (14.8%)	0.003*
Grade 3	Movement Against Gravity Only	8 (29.6%)	6 (22.2%)	0.002*
Grade 4	Movement Against Resistance, Reduced Strength	4 (14.8%)	10 (37.0%)	0.001*
Grade 5	Normal Muscle Strength	0 (0%)	5 (18.5%)	0.006*

*p-Values indicate statistical significance ($p < 0.05$)

Table 4 demonstrated the effect of the intervention on the ROM of the affected joints. Post-intervention, there was a significant increase in ROM across all measured movements, with shoulder flexion, elbow extension, hip flexion, and knee extension showing marked improvements. The statistically significant p-values (<0.05) approves that the joint mobility was enhanced.

Table 4: Effect on Range of Motion (ROM) of Joint Involved before and after Intervention

ROM Measurement	Pre-Intervention (Mean ± SD)	Post-Intervention (Mean ± SD)	p-Value
Shoulder Flexion	80° ± 10°	130° ± 15°	0.001*
Elbow Extension	40° ± 5°	90° ± 10°	0.002*
Hip Flexion	50° ± 8°	100° ± 12°	0.003*
Knee Extension	30° ± 6°	80° ± 9°	0.005*

*p-values indicate statistical significance ($p < 0.05$)

Table 5 presented the effect of the intervention on physical status using the DASH scale. Post-intervention, there was a significant shift towards improved functional ability, with an increase in participants experiencing no or mild difficulty and a reduction in those with moderate to severe difficulty. Notably, no participants remained in the "Unable to Perform" category. The statistically significant p-values (<0.05) confirm the intervention's effectiveness in enhancing physical function.

Table 5: Effect on Physical Status before and After Intervention (DASH Scale)

DASH Score	Category	Pre-Intervention Frequency (%)	Post-Intervention Frequency (%)	p-value
No Difficulty	0-20 DASH Score	2 (7.4%)	10 (37.0%)	0.002*
Mild Difficulty	21-40	5 (18.5%)	8 (29.6%)	0.003*
Moderate Difficulty	41-60	10 (37.0%)	6 (22.2%)	0.001*
Severe Difficulty	61-80	7 (25.9%)	3 (11.1%)	0.004*
Unable to Perform	81-100	3 (11.1%)	0 (0%)	0.005*

*p-values indicate statistical significance ($p < 0.05$)

DISCUSSION

This study was carried out to determine the prevention of joint contracture by physical therapy interventions in burn injury.27 pediatric patients participated to collect data. Burn injuries usually result in muscle atrophy and reduced joint movement due to prolonged stasis during recovery [20]. The best approach is to introduce physiotherapy program and for execution of physical exercises are proper education to patients or their care givers and to supervise effective presentation of movements [21]. The manual muscle tone testing results were significant after therapy. Current study showed that the muscle that show contraction against some resistance have full muscle power after physiotherapy. Mohammed HE *et al.*, studied

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the effect of physiotherapy protocol on post burn injury [6]. His study showed that there is gradual increase in muscles force in post physiotherapy protocol application (22.2%, 59.3% respectively) with high statistical significance difference. Early range of motion and splinting of upper limbs were effective methods to increase muscle force, reducing burn scar and pain which influence positively on restoring upper extremity function post burn. The results of this study revealed a highly statistically compelling difference in improving quality of life.There is high statistical significance (p-value<0.05).Above study support these results that there was improvement after implementation of physiotherapy protocols. In conclusion, physiotherapy protocols emerge as highly effective in positively influencing manual muscle tone in burn children. The physical activities like carry an object, functional activities and recreational activities which require little after burn showed significant change after application of physiotherapy exercises. After orthotic support and proper physiotherapy protocol significant improvement was observed. Patient now could carry the objects with moderate difficulty now.Mohammed HE *et al.*, study showed the gradual improvement of the physical status of upper limbs post burn protocol among study sample [6]. Activities of daily living, play, and sports are integrated into the rehabilitation process, allowing children to regain confidence and autonomy in their physical capabilities. So, physiotherapy exercises play a crucial role in restoring physical activities in burn children.Current study concluded that there is significant increase in range of motion of joint involved from (25% to 77%).This shows improvement in affected joint and prevention of contractures.ROM was markedly restricted in majority of patients. Which was after regimen of physiotherapy program improved from fully limited to partially limited ranges. M. Asadullah *et al.*, studied early range of motion exercises in burn patients [2].His results showed that the early passive range of motion exercises with anti-contractures positioning can reduce the formation of scar formation, prevent contractures and increase the quality of physical therapy management in sub-acute stage of burn patients. So their study supports these results. This study showed that orthosis and physiotherapy could be an effective approach in managing burns in paeds patients [22].

CONCLUSIONS

In conclusion, the amalgamation of physiotherapy and orthosis represented a pivotal cornerstone in the comprehensive care paradigm for burn patients, yielding a myriad of positive effects that significantly enhance their rehabilitation journey. Through meticulous rehabilitation strategies tailored to individual needs, physiotherapy empowers patients to regain functional independence, improve mobility, and alleviate pain, thereby fostering a holistic recovery trajectory. Thus, the integration of physiotherapy and orthosis stands in the multidisciplinary care continuum for burn patients, epitomizing the transformative potential of comprehensive rehabilitation in restoring both physical and psychological equilibrium.

Authors Contribution

Conceptualization: MS[1]
Methodology: MS[1], SRAH, BA, MSM
Formal analysis: MS[2]
Writing, review and editing: SA, TM, SF, MSM

All authors have read and agreed to the published version of the manuscript

Conflicts of Interest

All the authors declare no conflict of interest.

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REFERENCES

[1] O'Neil A, Hines D, Wirdzek E, Thornburg C, Murray D, Porter J. Early Mobilization, Early Ambulation, and Burn Therapy in the Acute Hospital Setting.Physical Medicine and Rehabilitation Clinics.2023Nov;34(4): 733-54. doi: 10.1016/j.pmr.2023.06.029.

[2] Asadullah M, Khan A, Shakil-ur-Rehman S, Danish KF, Sibtain F. Role of Early Range of Motion Exercises in Reduction of Scar Formation and Prevention of Contracture in Sub-acute Stage of Burn Patients. Journal of Islamic International Medical College. 2013 Jul; 8(1): 10-4.

[3] Rhman WG, Aziz MA, Mohamed HA, Mohamed R. Effect of rehabilitation program on quality of life of patients with burn injury.Acta Biomedica.2023;94(3): e2023712.

[4] Jeschke MG, van Baar ME, Choudhry MA, Chung KK, Gibran NS, Logsetty S. Burn injury. Nature Reviews Disease Primers. 2020Feb;6(1):11. doi:10.1038 /s41572-020-0145-5.

[5] Ali MB. Psychological and physiological complications of post-burn patients in Pakistan: a narrative review. Sultan Qaboos University Medical Journal.2022Feb; 22(1):8. doi: 10.18295/squmj.8.2021.118.

[6] Mohammed HE, Mohammed AH, Gamal GA. Effect of physiotherapy protocol on post burn upper limbs' function. International Journal of Nursing Didactics. 2019 Aug; 9(08): 24-34. doi: 10.15520/ijnd.v9i08.2681.

[7] Dikkema Y, Mouton LJ, Cleffken B, de Jong E, van Baar ME, Pijpe A *et al.* Facilitators & barriers and practices of early mobilization in critically ill burn patients: A survey.Burns. 2023 Feb; 49(1): 42-54. doi: 10.1016/j.

DOI: https://doi.org/10.54393/pjhs.v6i3.1606

burns.2022.08.023.
[8] Won YH, Cho YS, Joo SY, Seo CH. The effect of a pulmonary rehabilitation on lung function and exercise capacity in patients with burn: a prospective randomized single-blind study. Journal of Clinical Medicine.2020Jul;9(7):2250.doi:10.3390/jcm 9072250.
[9] Itakussu EY, Valenciano PJ, Fujisawa DS, Anami EH, Trelha CS. Aerobic capacity, physical activity and pain in adult victims of moderate to severe burns after discharge.Acta Scientiarum.Health Sciences.2017 Jan-June;39(1):37-44.doi:10.4025/actascihealthsci. v39i1.31803.
[10] Gittings PM, Grisbrook TL, Edgar DW, Wood FM, Wand BM, O'Connell NE. Resistance training for rehabilitation after burn injury: a systematic literature review & meta-analysis. Burns. 2018 Jun; 44(4): 731-51. doi: 10.1016/j.burns.2017.08.009.
[11] Silva EG. A Rehabilitation Case Management Model for Severely Burned Victims. 2022: 138-143.
[12] Sharma S and Gupta D. Role of physiotherapy in acute burns. Indian Journal of Burns.2022Jan;30(1):1-5.doi: 10.4103/0971-653X.206534.
[13] Cartotto R, Johnson L, Rood JM, Lorello D, Matherly A, Parry I *et al*. Clinical practice guideline: early mobilization and rehabilitation of critically ill burn patients. Journal of Burn Care & Research.2023Jan; 44(1): 1-5. doi: 10.1093/jbcr/irac008.
[14] Walsh K, Nikkhah D, Dheansa B.Burn scar contractures & their management.Plastic and Reconstructive Surgery. 2013 Dec; 3: 25-31.
[15] Fox A. Interdisciplinary Amputee Care from Injury to Independence: Medical, Occupational Therapy, and Prosthetic Intervention. 2023 Jun.
[16] Mohamed Muftah Alzaabi FS, Bairapareddy KC, Alaparthi GK, Hegazy F. Caregiver perspectives on Physiotherapy treatment for Paediatric burns in the United Arab Emirates.Patient preference and adherence.2022Jun:1477-86.doi:10.2147/PPA.S3633 12.
[17] Dewi RG, Perdana SS, Hamidah NN. Effect of Stretching Exercise to Increase Joint Range of Motion and Functional Ability in Post-Burn Shoulder Contracture Patients:A Case Report.Ahmar Metastasis Health Journal.2023Sep;3(2):65-70.doi: 10. 53770/amhj.v3i2.204.
[18] Ni Kadek Ayu Satya Dewanti, Ni Kadek Rima Sulistyawati, I Wayan Donny Iswara, Ida Kurniawati. Physical Therapy Rehabilitation Management on Burn Injury: A Case Report.Physical Therapy Journal of Indonesia.2022May;3(1):19-25.doi:10.51559/ptji.v 3i1.44.
[19] Thomas R, Wicks S, Dale M, Pacey V. Outcomes of early and intensive use of a palm and digit extension orthosis in young children after burn injury. Journal of Burn Care & Research.2021Mar;42(2):245-57.doi: 10.1093/jbcr/iraa137.
[20] Miri S, Rashtiani S, Zabihi MR, Akhoondian M, Farzan R. Role of exercise in nursing care for burn wound patients: a narrative review from a nursing perspective. Journal of Nursing Reports in Clinical Practice.2024Apr;2(2):101-9.doi:10.32598/JNRCP .23.101.
[21] Ardebili FM, Manzari ZS, Bozorgnejad M. Effect of educational program based on exercise therapy on burned hand function.World Journal of Plastic Surgery. 2014 Jan; 3(1): 39.
[22] Karimi H, Mobayen M, Alijanpour A. Management of hypertrophic burn scar: a comparison between the efficacy of exercise-physiotherapy and pressure garment-silicone on hypertrophic scar. Asian Journal of Sports Medicine.2012Sep;4(1):70.doi:10.5812 /asjsm.34536.