ORIGINAL ARTICLE

Role of Early Range of Motion Exercises in Reduction of Scar Formation and Prevention of Contracture in Sub-acute Stage of Burn Patients

Muhammad Asadullah, Asghar Khan, Syed Shakil-ur-Rehman, Khalid Farooq Danish, Fozia Sibtain

ABSTRACT

Objective: To determine the role of early passive range of motion exercises in the reduction in scar formation and prevention of Contracture in sub-acute Burn Patients.

Study Design: Randomized Control Trail (RCT).

Place and Duration of Study: Burn Centre Pakistan Institute of Medical Sciences Islamabad, from January to December, 2010.

Materials and Methods: Thirty patients were selected from the burn center at Pakistan Institute of Medical sciences (PIMS) Islamabad, age ranging from 12-60 years, and were randomly placed into two groups, 15 patients in each group. The anti-contracture positioning program was applied on group A with early passive range of motion (PROM) exercises of the involved areas and in group B only anticontracture positioning program was applied. The Vancouver Scar Scale (VSS) was used as an assessment tool and 4 variables were assessed including vascularity, height/thickness, pliability, and pigmentation. Data was analyzed on SPSS version-20 and independent t-test was applied at 90% level of significance to calculate the p-value for group A and B.

Results: The results show that the anti-contracture positioning with early passive range of motion (PROM) exercises reduced scar formation and prevent contractures more significantly in group A (P-value =0.002) with average VSS score 6, as compare to the anticontracture positioning alone in group B (P-value=0.435) with VSS score 10, as assessed at the completion of physical therapy management program in all the 30 patients of sub-acute stage of burn.

Conclusion: It was concluded that the early passive range of motion exercises with anti-contractures positing can reduce the amount of scar formation, prevent contractures and increase the quality of physical therapy management in sub-acute stage of burn patients.

Key Words: *Anti-contracture Positions, Scar formation, Passive Range of Motion Exercise (PROM)*

Introduction

Burn is very common injury, where necrosis of the human body's tissues occurs, superficially to the skin or deep to the vessels, muscles and vital organs. Burn is commonly caused by the heat electricity, chemical light, radiation or fraction.[1] The first priority of the health professionals is to save life, and secondly the rehabilitation of the patient.[2] The Complications such as shock, infection, multiple organ dysfunction syndrome, electrolyte imbalance and respiratory distress may occur. The commonly used treatment of burns may include the removal of dead tissue (debridement), applying dressings to the wound, fluid resuscitation, administering antibiotics, and skin grafting, and followed by rehabilitation including physical therapy. The physical therapy management includes anticontracture positioning, range of motion exercise, stretching, splinting and pressure garments to prevent contractures, minimize the scar formation and to maintain the soft tissue length.[3]

The physical therapy and rehabilitation is divided into two phases, the acute care at the early stage and advanced care later on. The acute care is very important regarding the prevention of contractures, minimization of scar formation and maintaining normal range of motion. The common physical therapy procedures in the acute or early stage are performing ROM, Splinting and

Correspondence:
Syed Shakil Ur Rehman
Ripah College of Rehabilitation Sciences (RCRS)
Riphah International University
Islamabad

antideformity or anticontracture positioning.[4]

In this study we compared two commonly used physical therapy procedures and techniques in the early sub-acute stage of burn patient's rehabilitation. The anticontracture positioning with passive early range of motion exercise was applied in group A; while the anticontracture positioning was applied alone in group B. The purpose was to determine the efficacy of anticontracture positioning with and without early passive range of motion exercises in rehabilitation of burn patients in early stage.

Materials and Methods

This randomized control trail was conducted on 30 patients of burn patients at their sub-acute stage of condition. The age of patients was 12 to 60, including 18 males and 12 females. (Table-I) All the patients were randomly selected from the burn center at Pakistan institute of Medical sciences Islamabad (PIMS), and were randomly placed into two groups, 15 patients each. The anti-contracture position program and early range of motion exercises were applied in group A, and anti contracture positioning alone in group B. The inclusion criteria was, age between 12 to 60 years, sub-acute stage with less than 40 % burn injury, and ability to follow the instructions for early range of motion exercises.

The treatment program was applied after one week of injury, including anti-contracture positioning with and without early range of motion exercises, and continued for 4 weeks twice a day. The anti-contracture positioning was applied and maintained for 4 weeks with the help of splints, and removed twice a day for range of motion exercises in group-A and to inspect the scar, wound, and dressing. (Table-II) The patients' and their families' motivation and cooperation, was always very important and to achieve this goal a regular patients' and their family education was continuously implemented during the treatment program. The bed mobility and position change were also encouraged as per indication, to prevent the overall deconditioning of the uninvolved segments.

The VSS was used as an assessment tool, which assessed 4 variables including vascularity, height/thickness, pliability, and pigmentation. The VSS has score 0-14, where zero means normal and 14 means thick scar and contracture. The VSS was calculated at the completion 4 weeks treatment program for all patients. The Data was analyzed on SPSS version-20, and independent t-test was applied at 95% level of significance to calculate the p-values for group A and B.

Results

The results show that the anti-contracture positioning with early passive range of motion (PROM) exercises reduced scar formation and prevent contractures more significantly in group A (P-value =0.002) with average VSS score=6, as compare to the anticontracture positioning alone in group B (P-value=0.435) with VSS score=10, as assessed at the completion of physical therapy management program in all the 30 patients of sub-acute stage of burn.

Discussion

Hoffman and colleagues conducted a clinical research trail on 12 burn patients and applied different techniques to reduce pain and prevent contractures in sub-acute stage of rehabilitation. They concluded that the early passive range of motion exercise has significant role in pain management and can manage pain better as compare to the other therapies. This research study shows the significant role and importance of physical therapy management, especially the early

Table I: Base line characteristics of 30 patients

Characteristic		Group-A, anti-contracture positioning with early range of motion exercises (n=15)	Group-B, anti-contracture positioning without early range of motion exercises (n=15)	Total
Gender Distribution	Male patients	11(61%)	7 (38%)	18 (60%)
	Female patients	4 (33%)	8 (66%)	12 (40%)
Area of body involved	Upper extremity involvement	04 (44%)	05 (55%)	09 (30%)
	Lower extremity involvement	08 (57%)	06 (33%)	14 (46.6%)
	Neck, back, and abdominal involvement	03 (42%)	04 (57%)	07 (23.3%)
Occupation	House wife	06 (60%)	04 (40%)	10 (33.3%)
	Factory workers	05 (41.6%)	07 (58.3%)	12 (40%)
	others	04 (50%)	04 (50%)	08 (26.6%)
Cause of burn	Flame	8 (44.4%)	10 (55.5%)	18 (60%)
	hot fluids	2 (33.3%)	4 (66.6%)	6 (20%)
	Chemical	3 (75%)	1 (25%)	4 (13.3%)
	Electrical	2 (100%)	0 (0%)	2 (6.6%)
Extent of burn	Superficial	03 (42.8%)	04 (57.1%)	07 (23.3%)
	Partial thickness	06 (60%)	04 (40%)	10 (33.3%)
	Full thickness	06 (46.1%)	07 (53.8%)	13 (43.3%)

Table II: Anti-contracture positioning applied to all 30 patients

Area burnt	Contracture/ difficulty experienced	Anti- contracture position
Front of neck	Neck flexion. The chin is pulled towards The chest reducing neck movement. Contours of the neck are lost	Neck in extension. No pillow behind head, roll behind neck. Head tilted back in sitting
Posterior neck	Neck extension and other neck Movements	Sitting with head in flexion. Lying with pillows behind the head
Axillas or anterior and Posterior axillary fold	Limited abduction, protraction When Burns also of chest	Lying and sitting-arms abducted to 90 degrees supported by pillows or foam blocks between chest and arms
Front or elbows	Elbow flexion	Elbow extension
Back of hands	Metacarpo-phalangeal (MCP) Hyperextension, Interphalangeal(IP)Flexion, Adduction of thumb Wrist flexed	Wrist- 30 to 40 degrees extended, MCPs 60 to 70 degrees flexion, IP joints in extension, thumb mid-palmar radial abduction
Palm of hand	Fingers adducted and flexed, palm pulled inwards	Wrist extended, minimal MCP flexion, fingers extended and abducted.
Groin (hip)	Hip flexion Hip adduction	Lie in prone with legs extended. Limit sitting and side lying. Supine lying with legs extended, no pillow under knees
Back of knee	Knee flexion	Legs extended in lying and sitting
Feet	Feet are complex structures and can be pulled in different directions by healing tissues preventing normal mobility	Ankles at 90 degrees- use pillows to maintain position. Encourage sitting with feet flat on floor as no edema present
Face	The face can be effected in various different ways including inability to open or closer mouth fully and inability to close eyes fully	Regular change of facial expression and stretching regime required. A well –padded tube can be inserted into the mouth to combat mouth contracture

passive range of motion exercise.[5]

Xie and team published a review article on Evaluation of long term health-related quality of life in extensive burns: a 12-year experience in a burn center. They determined the role of different types of intervention and long term effectiveness. They listed physical therapy one of the effective therapies in the management of burn patients with long term effects. [6]

Casa B. and colleagues conducted a review study on the multidisciplinary approach towards the rehabilitation of burn patients. All the authors concluded that the physical therapy is very effective and important in the rehabilitation of burn patients. They also listed some interventions including early range of motion exercises, anticontracture positioning and aquatic physical therapy, and they also supported the short term and long term effects of physical therapy and rehabilitation in the management of burn patients, both in early and advanced stages of rehabilitation. [7]Cucuzzo and team conducted a research study on the effects of exercise programming vs. traditional outpatient therapy in the rehabilitation of severely burned children. The purpose of the research study was the efficacy of in-patient exercise program versus home program in burn children with less than 40% body surface area. Twenty one patients were enrolled in the study, 10 in group A and 11 in group B. They concluded that supervised in-patient exercise program is safer and significantly increase muscle strength and function as compare to the home exercise program. [8] Oscar E. Suman and colleagues conducted a research study on the Effects of a 12 weeks resistance exercise program on skeletal muscle strength in children with burn injuries. They found that the participation in a resistance exercise program results in a significant improvement in muscle strength, power, and lean body mass relative to a standard rehabilitation program without exercise.[9] Robert L. Sheridan, MD and team conducted a research study on long-term outcome of children surviving massive burns. The purpose of this research study was to investigate the long-term quality of life in children who have survived massive burns. They concluded that physical therapy and rehabilitation is very effective in long term management of burn patients.[10]

Conclusion

It was concluded that the early passive range of motion exercises with anti-contractures positioning can reduce the amount of scar formation, prevent contractures and increase the quality of physical therapy management in sub-acute stage of burn patients.

References

1. Weinstein R A & Mayhall C G. The epidemiology of burn wound infections: then and now. Clinical Infectious Diseases 2003,37: 543-50.
2. Sevitt S. A review of the complications of burns, their origin and importance for illness and death. The Journal of Trauma and Acute Care Surgery 1979, 19, 358-69.
3. Tintinalli J E, Stapczynski J S, Ma O J, Cline D, Cydulka R, & Meckler, G. Tintinalli's emergency medicine: a comprehensive study guide 2011. McGraw-Hill Medical.
4. Perry S & Heidrich G. Management of pain during debridement: a survey of US burn units. Pain 1982, 13:267-80.
5. Hoffman H G, Patterson D R, & Carrougher G J. Use of virtual reality for adjunctive treatment of adult burn pain during physical therapy: A controlled study. The Clinical Journal of Pain 2000,16:244-50.
6. Xie B, Xiao S C, Zhu S H & Xia Z F. Evaluation of long term health-related quality of life in

extensive burns: A 12-year experience in a burn center. Burns 2012, 38:348-55.

7. Casa B, Caleffi E, Bocchi A, Ferraro F, & Del Piano P. Rehabilitation of burned patients. II. Therapeutic exercise. Acta bio-medica de L'Ateneo parmense 1990, 61, 67.
8. Cucuzzo N A, Ferrando A & Herndon D N. The effects of exercise programming vs traditional outpatient therapy in the rehabilitation of severely burned children. Journal of Burn Care & Research 2001, 22:214-20.
9. Suman O E, Spies R J, Celis M M, Mlcak R P & Herndon D N. Effects of a 12-wk resistance exercise program on skeletal muscle strength in children with burn injuries. Journal of applied physiology 2001; 91:1168-75.
10. Sheridan R L, Hinson M I, Liang M H, Nackel A F, Schoenfeld D A, Ryan C M & Tompkins, R G. Long-term outcome of children surviving massive burns. JAMA 2000, 283:69-73.

14