

Comparative effect of PNF (hold relax) VS early Dynamic stretching in improving pain, range of motion and functional status in shoulder joint in post burn patients. A Randomized Controlled Trail

FATIMA KHALID¹, UMAR ABDUL REHMAN KHALID², LAILA NIAZ KHAN³, SUMBAL SALIK⁴, ARSLAN SAEED⁵, ZAINAB ABDULLAH⁶, SANIA MAQBOOL⁷

¹Physiotherapist, King Edward Medical University Lahore,

²MBBS, King Edward Medical University Lahore,

^{3,5}Lecturer, Johar Institute of Professional Studies,

⁴Lecturer, Lahore Medical and Dental College,

⁶Physiotherapist, Central Park Medical College,

⁷Lecturer, University of Management and Technology.

Correspondence to Sania Maqbool, E-mail : saniamaqbool28@gmail.com, Cell : 0332-4164484

ABSTRACT

Background: Burn of shoulder and axillary region are common affecting patient's range of motion and his/her performance in his daily life. Because post burn if treatment is not given, contracture will ultimately form.

Aim: To determine the comparative effectiveness of PNF (hold relax) VS early Dynamic stretching exercises for improving pain, range of motion and functional status in the shoulder joint and quality of functional recovery in burn patients.

Methodology: A single blinded Randomized clinical trial was conducted at Mayo Hospital, Burn ward. Total 74 patients (Male and Female) were included in the study on the basis of inclusion and exclusion criteria. Participants were randomly allocated in two groups, 32 in each group by odd even method. Group 1 received PNF (hold-relax) protocol while group 2 received Dynamic stretching protocol, both the groups received the treatment along with conventional therapy on alternate days for 4 weeks. Pre and post treatment assessment VAS, Q-DASH score and ranges of motion were done. Data was analyzed using SPSS 23 version. Paired sample T-test and independent sample T test was used to assess within and between group analysis with having confidence interval CI 95% and p value 0.05. The purpose of paired T-test and independent t-test was to determine the difference within and between the groups in all clinical parameters (Q-DASH score, VAS score and ROM) during both pre and post treatment.

Results: According to the findings, VAS, Q-DASH scoring and ranges of affected burn shoulder joint were significantly improved in both groups i.e., treated with PNF and Dynamic stretching protocol. However, on group comparison; statistically significant improvement in VAS, Q-DASH scoring and ranges of shoulder were observed in patients treated with PNF as compared to Dynamic stretching with p-value <0.05.

Practical implication: The study provides the opportunity to physiotherapist to get aware of the role of PNF and dynamic stretching in preventing and treating post burn patients. It provides the statistical effectiveness of techniques in increasing the recovery rate of patients by using defined treatment protocol.

Conclusion: This study proved that PNF and Early Dynamic Stretching both are effective in improving pain, range of motions and functional status among burn patients. However; PNF (hold relax) was more beneficial for improving functional status and treating pain and range of motion in shoulder joint of burn patients with p-value <0.05.

Keywords: Axillary burns, Contractures, Early Dynamic Stretching exercises, Functional recovery, Range of motion(ROM).

INTRODUCTION

Burn is the integumentary pathology as an injury to the skin or any other tissue caused by friction, cold, heat, radiations (over exposure to sun), chemicals (acids or alkalis) and electric shock¹. 40% individuals die after burn in Southeast Asia. According to WHO, its incidence in Pakistan is 1388/100,000perannum². Average 1,95,000 people die every year due to burn around the globe³. Changes of burn included inflammatory and metabolic processes⁴. Its manifestations include local and systemic changes. Inflammation produces damage associated molecular patterns which activates immune cells. They decrease tissue repair causing hypercoagulation induced ischemia^{5,6}. Burn injury causes ischemia followed by gangrene, acids cause coagulative necrosis while alkalis cause liquefactive necrosis.

Burns are classified according to degree of skin damage as Superficial and deep burns. Superficial burns involve only an epidermal layer. No blisters present. Partial thickness burns involves epidermis and some part of dermis. Blisters are present. Deep burns involve epidermis and full dermis. These are not painful because nerves are destroyed in it. Burns can also be classified into degrees as 1st, 2nd and 3rd degree burns depending on energy, time and area of body exposure⁷. Percentage total body surface area (%TBSA) determines seriousness of injury. %

TBSA in adults is calculated by rule of nine and in infants, the Lund and Bowder chart is used⁸. Determination of scar% TBSA had 'excellent' reliability (ICC 0.91–0.96).

Burn injury is treated by using advanced trauma life support (ATLS) protocols, and management of pain by analgesics, loss of fluids by fluid transfer by IV route, escharotomy and use of antibiotic dressing like silver sulfadiazine⁹. The primary closure of wound can be done by skin stretching or split skin grafting¹⁰. Treatment of burn involves a multidimensional approach involving surgical debridement of the tissue and tissue grafting for replacement. Replacement of the lost fluid volume and balanced diet chart is the necessary part of the treatment. Contractures develop due to lack of education and poor rehabilitation. To avoid soft tissue shortening early physiotherapy treatment is required. Besides PROM, AAROM, AROM and resistance training early dynamic stretching and PNF training programs also prove to be beneficial.

Previous literatures reported that muscle stretching is highly effective in increasing range of motion and muscle performance. Study showed that PNF stretching was rarely used but it had an effective response on muscle performance. Static stretching and PNF stretching was useful in acute injuries of muscles. All types of stretching either static, dynamic or PNF helped in increasing range of motion⁽¹¹⁾. However, previous literatures focused on describing either the combine effects of stretching and PNF (Hold relax) or individual effects in improving the desired functional outcomes of burned patients. Additionally, there is less literature available that

Received on 19-09-2022

Accepted on 27-03-2023

determine the comparative effect of PNF or stretching with other techniques.

Therefore; the current study was aimed to determine the comparative effectiveness of PNF (Hold relax) and early dynamic stretching in treating pain, ranges and functional status of the shoulder among the post-burn patients that will eventually help in providing the preventive approach along with enhancing the recovery rate of post burn patients through physiotherapy protocol.

MATERIALS AND METHODS

The Mayo Hospital in Lahore's Physiotherapy department conducted the randomised control trial study after receiving approval from the research committee's ethical review board under reference number JIPS-SPT-2020-08. From January 21 to July 31, 2021, 72 patients were evaluated for this study. They underwent a general evaluation that included a look at their demographics, the cause of their burns, and their degree and location. Both genders between the ages of 10 and 50 who have partial and superficial burns meet the inclusion requirements. Participants with a history of anoxic brain injury, deep burn, skin infection, upper limb amputation, or psychological issues were not allowed to participate in the study. The experimental investigation was carried out after data collection. Purposive sampling was used to choose 72 patients in accordance with the predetermined criteria, and 32 patients from each group were randomly assigned to one of two groups for the study's four-week length.

Group A were treated with PNF (hold-relax) protocol along with *Conventional Therapy* including axillary splint, and proper positioning. Whereas **Group —B** were treated with early Dynamic stretching along with *Conventional therapy*. Pain, ranges, and functional status were assessed at the beginning of the study and at the end of the intervention protocol as on the last day of the 4th week. Pain was assessed by and Q-DASH score Test-retest reliability of Q-DASH=0.99, ICC=0.92 and goniometry were used to check the ranges Goniometers have the Pearson co-efficient and ICC = 0.85 in mechanical neck pain with 95% CI which make it a reliable and valid tool for assessing the functional status in MNP.

Intervention protocol: Single blinding method was used in the study. There were two groups in study. Conventional treatment including proper positioning and splinting was given to both groups. Pre and Post Test NPRS, ROM and Q-DASH status was measured.

Table II: Inter Group Analysis of VAS and Q-DASH results

| Outcome Measure | PNF | | | Stretching | | |
|-----------------|------------|------------|---------|-------------|-------------|---------|
| | Pre | Post | p-value | Pre | Post | p-value |
| VAS | 8.63± .97 | 2.31± .859 | 0.00 | 7.2± 1.1 | 4.8± 1.14 | 0.00 |
| Q-DASH | 89.63±4.29 | 55.02±4.62 | 0.00 | 88.62± 4.99 | 65.92± 4.17 | 0.00 |

The inter group analysis of VAS and Q-DASH was done through the Paired T-test. The results of the comparison between pre-treatment and post-treatment VAS score was described in Table I and Figure I. The pretreatment mean VAS score of group PNF was 8.63±0.97 and post treatment score was 2.31 ± 0.859 with p-value of 0.00 that shown a significant difference between pre and post-treatment score PNF. Similarly, the pretreatment mean VAS score of Stretching group was 8.68± 1.029 and post-treatment score was 6.281 ± 0.92with p-value of 0.00 shown that there was significant difference between pre and post-treatment score.

Similarly, Table II and Figure II provide the results of the comparison between pre-treatment and post-treatment Q-DASH. The pre-treatment value of PNF group of Q-DASH was 89.63±4.29 while the post-treatment value was 55.02±4.62 with p-value 0.00. The results of the study showed that there was the significant difference between pre and post treatment score of Q-DASH in PNF group. Similarly, Comparison of Q-DASH of Stretching group shown that there was significant difference between pre and post-

PNF Hold- Relax: For preventing contracture and improving ROM, PNF hold-relax exercise was to be done in all the 6 dimensions, Flexion, Extension, adduction and abduction, internal and external rotation. The protocol was started by passively moving the arm in the required dimension for initial 10-20 degree in the direction to be targeted and then asked the patient to apply force against resistance to opposite direction i.e isometric contraction is done for 10 seconds, and then the arm was moved to initial direction to the available range and held for 20 seconds. Similar procedure would be repeated to all dimensions¹².

Dynamic stretching: Dynamic stretching is a method of muscle elongation with controlled velocity. Muscle elongation is gained by performing 10 repetition of required muscle with slow and measured velocity of 6 sec, out of which 3 sec are used to bring the muscle into possible elongation and 3sec are used to bring it to contraction. Similar procedure was performed in all 6 dimensions¹³.

Statistical Analysis: The sample size was calculated by using G power program by the research center of Johar Institute of Professional studies, Lahore by using the effect size of the past studies. According to the past studies, the estimated size was 72 with 95% confidence interval. The statistical analysis was done by the SPSS version 23. Paired sample t-test and Independent t-test were used to within group and between group analysis. Demographic data were shown by bar chart and other factors such as age, gender, duration with behavior of pain and are analyzed through descriptive statistics and shown by pie and bar charts.

RESULTS

The results of the analysis of the current study were described in the tabulated form. The demographic data of 64 patients were described in Table I. The mean age in PNF group was 41.90±5.42 and the mean age in Stretching group is 41.81±5.95. Similarly, the PNF Group including 14(43.8%) males and 18(56.3%) females while Stretching Group including 17(53.1%) males and 15(46.9%) female.

Table I: Demographic Analysis of Groups:

| Variables | PNF | Stretching |
|-----------|---|---|
| Age:- | 41.91 ±5.42 | 41.81±5.95 |
| Gender:- | Male = 14(43.8%) Female = 18(56.3 %) | Male = 17(53.1%) Female = 15(46.9 %) |

treatment score as pretreatment mean Q-DASH score was 88.62±4.99and post treatment score was 65.92± 4.17 with p value of 0.00.

The Intra-Group analysis of the post-treatment Ranges of shoulder joint was described in Table III. The results of the current study showed that post-treatment flexion of the shoulder joint among PNF group was 101.47±18.43 while among Stretching group was 98.68±19.76 with p-value 0.00. Similarly, the range of shoulder extension 39.68±11.62 while in Stretching group was 35.22±13.4with p-value 0.00. The ranges of shoulder Abduction of PNF group was 104.2±20.36 while in Stretching group was 103.75±22.4 with p-value 0.03, range of external rotation of PNF group was 34.78±13.21while in Stretching group was 31.84±13.89with p-value 0.01. Similarly, range of external rotation of PNF group was 46.78±17.58 while in Stretching group was 56.65±19.17 with p-value 0.01. The results showed that there was a significant improvement of ranges of shoulder was shown among the patients of PNF group as compared to Stretching Group with p-value <0.05.

Table III: Intra-group analysis of post-treatment shoulder ranges of both groups.

| RANGES | PNF | Stretching | p-value |
|-------------------|-------------|-------------|---------|
| Flexion | 101.5±18.43 | 98.68±19.76 | 0.00 |
| Extension | 39.68±11.62 | 35.22±13.41 | 0.00 |
| Abduction | 104.2±20.36 | 103.75±22.4 | 0.03 |
| External Rotation | 34.78±13.21 | 31.84±13.89 | 0.01 |
| Internal Rotation | 46.78±17.58 | 56.65±19.17 | 0.01 |

Figure I: Inter Group Analysis of VAS scoring among groups:

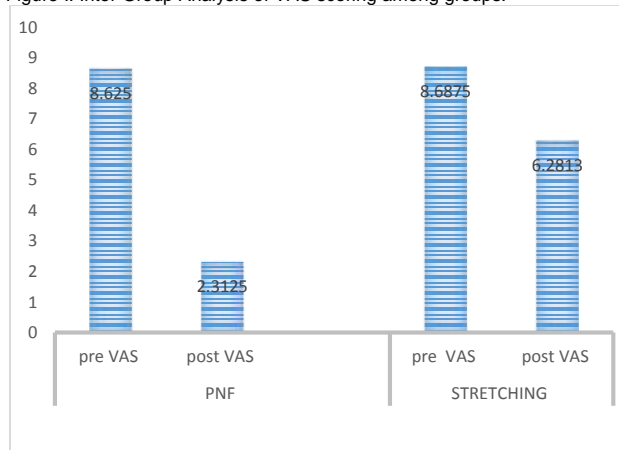
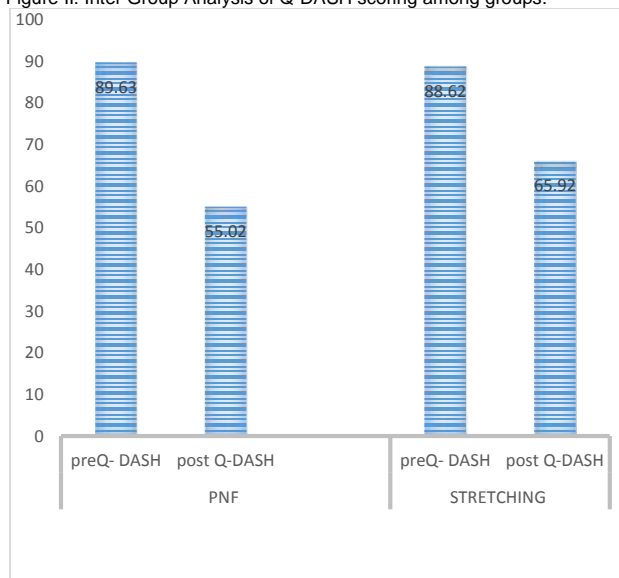


Figure II: Inter Group Analysis of Q-DASH scoring among groups:



DISCUSSION

The aim of this study was to see the effects of PNF (Hold- Relax) VS early Dynamic stretching exercises on pain, range of motion, functional status of shoulder burn patients. The results of the study showed that both groups showed beneficial results but group A, which had PNF Hold-Relax exercise program, showed more effective results than normal Early Dynamic Stretching. Burn injuries are more common in under-developed areas due to lack of knowledge and death rate is also higher in those areas due to less or no facility in those areas or because victim families cannot afford the expenses of treatment. However, in developed countries death rate is reduced due to awareness and more advanced facilities like use of safety smoke alarms in households that start ringing after a certain level of smoke at that place or controlled temperature in hot water bathtubs.

The results of the study showed that PNF (Hold relax) and dynamic stretching both are beneficial in enhancing the ranges of the shoulder joint among burn patients. Furthermore, PNF (Hold Relax) plays significant role in enhancing the ranges of shoulder joint as compared to Stretching. Jung concluded that PNF enhance ranges of shoulder especially external rotation and shoulder flexion. Hold relax cause the elongation of the soft tissues. The elongation is mostly caused by the increased contraction of the efferent muscles that ultimately provide better muscle control and development of the adequate muscles strength¹². This study is supporting our study results, as there is marked increase in the ranges of shoulder especially in flexion and rotations.

Similarly; Nakamura et al concluded that Hold relax is an effective technique in enhancing the ranges of the affected joints by case effective elongation of the muscles and elastic fibers but the duration of the stretch tolerance or marinating the attained range is not significant¹⁴. This supports our study result. However, Hirata K et al concluded that stretching is beneficial in enhancing the ranges of shoulder. Stretching helps in reducing the stiffness that developed in the muscles due to some pathology, traumatic event, or aging effect. During these events; there are hyperplasia of collagen fibers and fibrosis with reduction of elastic fibers that produced stiffness in muscular or non-muscular structures including skin and fascia. This can be managed through the stretching¹⁵. This study is supported current study to some extent as Dynamic Stretching group produce beneficial results in enhancing the ranges but still it does not effective as compared to PNF group.

Ahmed et al. also concluded that stretching and PNF is effective in enhancing the ranges by enhancing the length of muscles through continuous creep and plastic changes in the muscles structure. However, continuous increase in flexibility of muscles is obtained through PNF by producing biomechanical and neuro-physiological changes produced in the muscles¹⁶. This study support current study results.

Similarly; Patsaki et al stated that stretching is beneficial in burn patients. It produce positive results in enhancing the flexibility of the scar, preventing deformities caused by scar that ultimately enhance the ranges of joint and improve the functional level among patients¹⁷. Godleski et al also supported that early stretching is an effective method in preventing the development of scar formation among burn patients. This early protocol not only prevents the formation but it also increases the ranges within the first session¹⁸. Similarly, Tehreem et al reported that static stretching is an effective technique in improving the pain intensity and ranges of affected post burn¹⁹. However, the study did not focus on the dynamic stretching effects that contrast to current study results with defining the literature gap.

According to currents study results; PNF is significantly more effective in enhancing the functional status among the patients. The results are also supported by Chaturvedi P et al stated that PNF is effective in preventing the disability level among patents. PNF focus on the irradiation principle in which strengthening of opposite limb's stronger muscle cause the activation of weakest or effective muscles and develop the tone among muscles. This reduces pain, increasing ranges and functional status among patients²⁰. Additionally, Tedla et al concluded that PNF (Hold relax) is effective technique in reducing pain and disability by increasing ranges of affected upper limb pattern especially shoulder joint. This helps in the activation of Golgi tendon organ, inhibit alpha motor neurons as reciprocal inhibition that ultimately relax and lengthen the tight structures²¹. Therefore, PNF and dynamic stretching are beneficial rehabilitating post-burn patients but PNF is better in enhancing ranges of shoulder joint and functional status among post-burn patients.

Limitations: A number of limitations should be considered in this study. Firstly; this study observed the change in pain intensity but not in pain pressure threshold (PPT). In addition, the patients in this study were obtained solely from the burn and plastic surgery department, Mayo Hospital, Lahore, which limit the generalization

of the study. The sample size was not large enough to generalize our results to their populations. Moreover, the study allowed all movements during daily activities and was therefore unable to control for the diverse motions of each patient. Lastly some shy, hesitant and illiterate people did not give means were to my questions and were less responsive

Recommendations: Further scope of the study is to find out the effects on larger sample population. Further research is required to determine long lasting effects of the treatment by taking follow up assessment of longer duration.

Clinical Funding: None

Conflict of interest: There is no conflict of interest between authors

CONCLUSION

This study concluded that the PNF (Hold- Relax) and Early Dynamic Stretching exercises were effective to improve pain, range of motion and functional status in shoulder joint of burn patients. However, PNF (Hold Relax) produced better and more sustainable results of reducing pain and increasing ranges and functional level of shoulder joint among the post-burn patients.

Conflict of interest: Nil

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