

EFFECT OF DESENSITIZATION METHODS DURING THE EARLY MOBILIZATION PHASE IN POST-FRACTURE CONDITIONS OF UPPER EXTREMITY

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ABSTRACT

Objectives: The objectives of the present study were to determine the effect of desensitization methods during early phase of mobilization in post-fracture conditions of upper extremity and to compare the effects of conventional physiotherapy methods and desensitization methods.

Methods: A total of 30 subjects having fractures of upper extremity were assigned into two groups. Subjects included in Group A received conventional treatment (hot moist fomentation, mobilization, free exercises, resisted exercises, and strength training exercises). Group B received desensitization methods. The pre- and post-assessment is taken using visual analog scale, range of motion (ROM), manual muscle testing, and disabilities of the arm, shoulder and hand.

Result: Desensitization showed significant improvement in ROM for elbow flexion ($p=0.0427$) ($t=2.124$) and in strength for shoulder flexion ($p=0.0246$) ($t=2.376$), shoulder extension ($p=0.0246$) ($t=2.376$), shoulder abduction ($p=0.0246$) ($t=2.376$), shoulder adduction ($p=0.0246$) ($t=2.376$), and elbow extension ($p=0.0472$) ($t=2.075$) when compared to the conventional treatment, but the conventional treatment showed overall improvement in all outcome variables.

Conclusion: Desensitization methods showed a significant effect on reducing pain and improving functional outcome.

Keywords: Upper extremity fracture, Pain, Early Mobilization, Desensitization.

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INTRODUCTION

The upper extremity is an integral part of our body for physical functioning. The upper extremity is performing various activities of daily living such as eating, combing, bathing, writing, picking up objects, carrying things from one place to other, and many activities [1].

The incidence of proximal humerus fracture is more common in women than men above the age of 60 years. In all the fractures of proximal humerus, 48% occurred at home, 43% at street, and remaining circumstances were not recorded. 89% of fractures are caused by moderate trauma. The convulsive seizures are also a cause in rare cases [2]. Supracondylar fracture of humerus is a common childhood injury accounting for 3–7% of all fractures. Supracondylar fracture occurs on playground includes fall from a monkey bar, fall from swing, slide, teeter-totter, and other. 70% of supracondylar fractures occur due to fall from height [3]. Distal radius fracture occurs 25% of all fractures of all fractures in pediatric population and 18% of all fractures in elderly age group. This fracture has a significant impact on health and well-being of young adults. In the age group of 19–49 years, men and women have a risk of equal incidence; while in the age group of 19–65 years, women have doubles the risk of incidence of distal radius fractures (it may be because of osteoporotic changes in women after the age of 50 years) [4]. The fractures most commonly occur due to increased level of physical activity reduced physical fitness and trauma [5,6]. The fractures of hand complex most commonly occur in men between the age of 15 and 35 years.

The fractures are having various complications which include hypovolemic shock, adult respiratory distress syndrome, compartment syndrome, injury to nerves, injury to vessels, injury to muscles, malunion, non-union, delayed union, muscle stiffness, avascular necrosis, and reflex

sympathetic dystrophy. Along with these complications, paresthesia and hyperesthesia are most important sensory impairments in post-fracture conditions. Hypersensitivity is also most commonly seen [7]. Paresthesia is numbness and tingling sensations, and hyperesthesia is increased sensitivity to mild painful stimuli [8]. Hypersensitivity leads to referred pain, deep aching, and steady pain [9]. The transmission of pain signals toward brain occurs due to the stimulation of nociceptors [10].

Prevalence of sensory impairments after fractures of upper extremity is 46%. Those increased sensory perceptions lead to difficulty in performing range of motion (ROM) activities in early post-immobilization phase after fractures [11]. To overcome such sensory impairments in early phase of mobilization, the technique called desensitization is used. Desensitization techniques are implemented to assist with normalizing sensations to the affected area. Desensitization includes the sensitization of peripheral nociceptors which helps in pain reduction [12]. The sensation of pain is carried out by nociceptors present over the nerve endings. During the process of desensitization when we stimulate them repeatedly, the temporal summation of these impulses takes place and the threshold level is increased. The temporal summation occurs when one presynaptic terminal is stimulated repeatedly. It plays an important role in facilitation of responses. Hence, the pain gets reduced [13,14]. Thus, in this study, the attempt is made to study the effects of desensitization methods for reducing pain, improving the ROM and maintaining the activities of daily living, and improving the quality of life of the patient.

METHODS

This study was a randomized, prospective, comparative study conducted at our institution from June 2017 to February 2018, after obtaining the approval from the institutional scientific and ethics committee.

Sample size was calculated using the following formula:

$$n = (2(Z\alpha + Z\beta)^2 \sigma^2) / d^2$$

Power of the study:

Zα=1.96 at 95% confidence level.

Zβ=1.28 at 90% power.

σ=Combination of standard deviation.

d=Mean difference between groups.

The criteria for inclusion were both male and female of every age group having fractures of one or both upper extremity. Subjects having sensory loss, diabetic neuropathy, arterial involvement, and pain with radiculopathy were excluded. 30 subjects with the mean age for Group A 38.8666±18.201 and for Group B 43.1333±20.66 (range 5–84 years, 19/30 women) participated in the study; written consent form was taken. Subjects were divided into two groups.

Group A: 15 subjects received conventional treatment (hot moist fomentation, mobilization, free exercises, resisted exercises, and strength training exercises).

Group B: 15 received desensitization methods (general shaking movements, gentle rub, light touch, warm and cold test tubes, joint compression, osteopressure, mirror therapy, tapping, quick icing, stretch resistance, and tendinous pressure). All the subjects were informed about the experimental protocol and gave written consent before their participation.

Measurement procedure

The pre-treatment and post-treatment assessment was done by outcome measures such as visual analog scale (VAS), ROM, manual muscle testing (MMT), and disability of the arm, shoulder and hand (DASH) questioner.

VAS score was taken before and after the treatment. ROM of upper extremity is calculated before and after the treatment using universal goniometer. MMT of all muscle groups of upper extremity is noted.

Statistical analysis

The data were entered into Microsoft Office Excel 2007. The data were analyzed using Instat software. Descriptive statistics were used

to analyze baseline data for demographic data. Paired t-test was used to find the significance of parameters between pre- and post-test, and p<0.05 was considered to be statistically significant. The unpaired t-test was used to find out the significance of parameters between pre-pre and post-post.

RESULTS AND DISCUSSION

In this study, 30 subjects had participated who were undergone surgery for the fractures of an upper extremity based on inclusion and exclusion criteria. Of these 30 subjects, 11 were male and 19 were female. The subjects were evaluated and divided into two groups. Group A was included 15 subjects and was given the conventional treatment of the hot fomentation, joint mobilization, free exercises, resisted exercises, and strengthening exercises of upper extremity. The Group B was included 15 subjects and had given the methods of desensitization along with the conventional treatment of Group A (Table 1).

Intragroup comparison (within the group) was analyzed statistically using paired t-test for VAS, ROM, MMT, and DASH score. This showed that there was a significant difference of Group A VAS score with p≤0.0001, ROM score with p≤0.0001, MMT score with p≤0.0001, and DASH score with p≤0.0001.

Similarly, there was extremely significant difference of Group B, VAS score with p≤0.0001, ROM score with p≤0.0001, MMT score with p≤0.0001, and DASH score with p≤0.0001 (Table 2).

Intragroup comparison (within the group) was analyzed statistically using paired t-test for VAS, ROM, MMT, and DASH score, and intergroup comparison (between the group) was analyzed statistically using unpaired t-test.

Intergroup comparison (between groups) was analyzed statistically using unpaired t-test. This showed that pre-intervention there was no statistically significant difference seen for VAS score with p≤0.3727. The pre-intervention ROM score showed no significant difference for shoulder flexion (p≤0.4630), shoulder extension (p≤0.2896), shoulder adduction (p≤0.7852), elbow extension (p≤0.6656), wrist flexion (p≤0.6759), and wrist extension (p≤0.7391). Pre-intervention ROM scored significance for shoulder abduction (p≤0.0435) and

Table 1: Pre-post data analysis in Group A

Group A	VAS	ROM		MMT		DASH		
		Flexion		Abduction				
		Shoulder	Elbow	Shoulder	Shoulder			
Pre:	6.733±2.549	119.2±33.616	102.86±40.010	104±37.154	3.6±0.5071	3.266±3.266	3.6±0.5071	58.044±21.800
Mean±SD								
Post:	4.86±2.346	133.73±33.82	115.8±38.059	119.66±33.698	3.866±0.3519	3.866±0.3519	3.866±0.3519	39.054±17.692
Mean±SD								
p value	0.0001	0.0001	0.0001	0.0001	0.0406	0.0004	0.0406	0.0001
T value	8.671	18.077	9.008	7.562	2.256	4.583	2.256	11.597

VAS: Visual analog scale, ROM: Range of motion, MMT: Manual muscle testing, DASH: Disability of the arm, shoulder and hand, SD: Standard deviation

Table 2: Pre-post data analysis in group B

Group B	VAS	ROM		MMT		DASH		
		Flexion		Abduction				
		Shoulder	Elbow	Shoulder	Shoulder			
Pre:	5.733±3.432	112.866±8.280	74.33±22.723	29.866±5.449	3.733±0.4577	3.2666±0.4577	3.7333±0.457	59.428
Mean±SD								
Post:	3.533±2.100	127.066±5.873	91.266±23.526	37.2±3.840	4.2±0.4140	4.1333±0.3519	4.2±0.4140	37.684
Mean±SD								
p value	0.0003	0.0001	0.0001	0.0001	0.0035	0.0001	0.0035	0.0001
T value	4.785	10.551	6.745	9.648	3.500	9.539	3.500	5.928

VAS: Visual analog scale, ROM: Range of motion, MMT: Manual muscle testing, DASH: Disability of the arm, shoulder and hand, SD: Standard deviation

elbow flexion ($p \leq 0.0234$). Pre-intervention MMT showed statistically no significant difference for shoulder flexion ($p \leq 0.4560$), shoulder extension ($p \leq 0.4560$), shoulder abduction ($p \leq 0.4560$), shoulder adduction ($p \leq 0.4560$), elbow flexion ($p \leq 0.7025$), elbow extension ($p \leq 0.9999$), wrist flexion ($p \leq 0.4605$), and wrist extension ($p \leq 0.2849$). Pre-intervention DASH score showed no significance with $p \leq 0.8588$ (Table 3).

The exercises are having a great importance during the early mobilization phase in post-fracture conditions of upper extremity. The desensitization methods are also been used along with these exercises to control the pain and in improving the strength and ROM of an affected area. The purpose of this study was to find out the effect of desensitization methods during the early mobilization phase in post-fracture conditions of upper extremity. Reviewing the various studies, it was analyzed that conservative management, surgical management, and post-operative rehabilitation were the routine guidelines for treating the subjects with an upper extremity fractures. This study was undertaken considering all the mentioned points and sole aim of this study was to evaluate the effect of desensitization methods during early mobilization phase in early mobilization phase in post-fracture conditions of upper extremity.

Harden *et al.* in complex regional pain syndrome studied that the desensitization methods are an effective as a treatment protocol for the complex regional pain syndrome [11]. They studied about the various aspects of desensitization methods and this was combined with the psychotherapy. This study showed that desensitization is important to improve ROM and aerobic capacity of the individual. Norman Harden *et al.* in article complex regional pain syndrome: Practical diagnostic and treatment guidelines 4th edition studied that the gradual desensitization improves the functions of the joint and reduces the pain. This improves the functional capability of the individuals [11].

Jeanine Yip Menck, Susan Mais Requejo, and Kornelia Kulig in thoracic spine dysfunction in upper extremity complex regional pain syndrome Type 1 studied that the patient having wrist and hand trauma with an allodynia had undergone the desensitization treatment, and the intensity of pain was decreased, was able to perform all the activities of daily living, and the ROM was improved [12]. Osteoporosis is a disease characterized by an enhanced risk of sudden fractures due to reduced bone mass, structural deterioration of bone tissue, and weakness of skeletal strength [15]. Patients with osteoporosis respond poorly to the post-immobilization physiotherapy interventions. Early activity motion is recommended for patients after fixation of distal radius fracture, surgical repair of flexor or extensor tendon injuries, and surgical tendon transfer [16].

Various recent approaches are used in treating subjects of post-operative upper extremity fractures, but this study concluded that the combination of desensitization along with conventional physiotherapy rehabilitation was effective in decreasing pain and improving quality of life than providing post-operative rehabilitation alone. The advantage of desensitization methods is that it normalizes the sensations of an affected area. This reduces the pain and ultimately it helps in improving the ROM and strength of an affected part. This was results in the lessening the duration of rehabilitation process. Hence, it improves the quality of life of patients.

CONCLUSION

We conclude that the combination of desensitization along with conventional physiotherapy was effective in decreasing pain, improving ROM, and muscle strength than the conventional physiotherapy alone. Desensitization showed significant improvement in ROM for elbow flexion and in strength for all the components except wrist flexion and extension when compared to the conventional treatment, but the

Table 3: Pre-pre and post-post data analysis between Group A and Group B

Outcome measures	Mean±SD		p value	T value
	Group A	Group B		
VAS				
Pre	6.733±2.549	5.733±3.432	0.3727	0.9059
Post	4.866±2.356	3.533±2.100	0.1130	1.636
ROM				
Flexion				
Shoulder				
Pre	119.6±34.054	112.86±8.280	0.4630	0.7441
Post	153.66±92.122	127.46±5.553	0.2809	1.099
Elbow				
Pre	103.533±40.574	74.733±22.723	0.0234	2.399
Post	115.8±38.059	91.26±23.526	0.0427	2.124
Abduction				
Shoulder				
Pre	104±37.154	126.4±17.422	0.0435	2.114
Post	119.533±33.619	139.6±18.791	0.0533	2.018
MMT				
Flexion				
Shoulder				
Pre	3.6±0.5071	3.733±0.4577	0.4560	0.7559
Post	3.866±0.3519	4.2±0.4140	0.0246	2.376
Elbow				
Pre	3.266±0.4577	3.33±0.4880	0.7025	0.3854
Post	3.866±0.3519	4.066±0.4577	0.1905	1.342
Abduction				
Shoulder				
Pre	3.6±0.5071	3.733±0.4577	0.4560	0.7559
Post	3.866±0.3519	4.2±0.4140	0.0246	2.376
DASH				
Pre-intervention	58.177±21.649	59.428±16.127	0.8588	0.1795
Post-intervention	39.054±17.692	37.684±19.261	0.8407	0.2029

VAS: Visual analog scale, ROM: Range of motion, MMT: Manual muscle testing, DASH: Disability of the arm, shoulder and hand, SD: Standard deviation

conventional treatment showed overall improvement in all outcome variables.

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AUTHOR'S CONTRIBUTION

Poonam S. Shah conducted literature review for this manuscript, developed introduction section of the manuscript together with the discussion of the study findings, collected data, and analyzed the data. Dr. Sandeep B. Shinde provided a description of the background information and participated in preparation of the manuscript. All the authors read and approved the final manuscript.

CONFLICTS OF INTEREST

The authors declare that there are no conflicts of interest concerning the content of the present study.

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