Original Research Article

EFFICACY OF MOBILIZATION WITH MOVEMENT IN PATIENTS WITH COLLE'S FRACTURE: A RANDOMIZED CLINICAL TRIAL

Abstract :

Study Design

A randomized clinical trial.

Introduction

The fracture of the distal radius also known as "Colle's Fracture" is one of the most common leading skeletal injuries. It mainly occurs due to the fall on an outstretched hand (FOOSH). Hand stiffness is a very common complication of the hand after an injury. Physiotherapy plays an indispensable role in preventing the postoperative complications after Colle's fracture. Mulligan concept of mobilization with movement is a specific form of manual therapy technique that embraces skilled hands-on movements which is used to mobilize or manipulate soft tissues and joints with the target to improve tissue extensibility, increase in joint range of motion, foster relaxation and reduce tissue swelling, inflammation or restriction.

Purpose of the Study

To compare the effectiveness of Mulligan concept of mobilization with movement technique and conventional physiotherapy treatment following postsurgical Colle's Fracture in terms of range of motion and functional activities.

Methods :

A total number of 36 patients was recruited for the study. They were divided into two groups: group I and group II. Group I (n= 18) was given MWM along with wax bath and group II (n=18) was given conventional physiotherapy along with wax bath. The interventions were given for 7 days. The value of

goniometer and Michigan hand outcome questionnaire (MHOQ)s were taken both at baseline and after 7 days of interventions.

Results :

After intervention, there were no significant differences between the groups.

Discussion :

This study showed consistent with the previous studies as there was a significant improvement in the range of motion and hand functions between and within the groups.

Conclusion :

It can be concluded that both the treatments are equally effective.

Introduction

Hand is an essential component of every human body. It plays a very significant function in explicating the comprehensiveness of dexterity in our daily living pursuits and also in our societal conveyance and unification. Dysfunction of a hand can occur from many causes. Colle's fracture another name of distal radius fracture is the most frequent type of fracture leading skeletal injuries[1]. Abraham Colle's in 1814, was the first to describe the fracture of the distal radius, hence the name "Colle's Fracture" came into existence[2].

Colle's fracture is also called "Dinner Fork" deformity or "Bayonet" deformity, due to the appearance of the forearm. It mainly occurs due to the fall on an outstretched hand (FOOSH)[3]. Distal radius fracture is one of the most common types of fracture, without the involvement of the articular surface[3,4]. Colle's fracture is very common in all the age groups, but is more common in individuals with osteoporosis[1].

The incidence rate of Colle's fracture is almost 5 times higher in women with osteoporosis than that of men, which has rapidly increased from 50 years of age and above, and are getting doubled every 10 years until 90 years of age, per 10,000 people in men and women[4,5].

Patients with a history of FOOSH injury usually come with a complaint of pain, swelling, and restricted mobility[6]. Sometimes numbness of the hand also may occur[1]. On examination of the patient, swelling of the hand is due to the accumulation of edema, restricted joint range of motion due to the immobility of the hand and tenderness associated with both swelling and immobility of the hand[6].

Colle's fracture patients are mostly treated on an outpatient basis[1]. It is the most common presentation in the emergency department[7]. Hospitalization is required for around 20% of patients especially older people following fracture[1]. The emergency department provides the initial management which includes the utilization of various modalities like ultrasound, procedural sedation, Bier's block, hematoma block and immobilization in a back slab or a full cast. medical management which is provided by the team of orthopaedics including the physiotherapists[7]. Further management for the minimally displaced fractures are cured with conservative procedure while the displaced ones are cured with percutaneous pinning, or external fixation or close reduction and manipulation or plaster of paris and if the fracture is intra-articular in nature then it is cured with open reduction and internal fixation[1].

Hand stiffness is a very common complication of the hand after an injury[8]. Stiffness usually results from an injury to the soft tissue, articular surfaces or an extended immobilization period in the course of the fracture phase of management[9]. Stiff joint thus refers to a restricted joint range of motion and a stiff end feel[8]. "FRACTURE DISEASE" refers, when there is a weakness and stiffness following any fracture[9].

Physiotherapy plays an indispensable role in preventing postoperative complications[1]. Some of the impediments such as malfunction of median nerve, ulnar nerve, mal-united fracture and post- fracture inflexibility which was reported quite often[3]. The main complications include pain, swelling, joint stiffness, reduced joint range of motion and muscle power[6].

The main aim of physiotherapy is to regain the range of motion, minimize the pain and ameliorate the functional outcomes followed by the withdrawal of plaster and fixation. This includes appropriate guidance and edification of the patient to safeguard the fracture, manage the edema, maintenance of normal skin condition and a progressive return to a pursuit which can be achieved by active, passive or resisted exercises. Passive joint mobilization techniques are utilized to put back the functional achieved by active, passive or resisted exercises. Passive joint mobilization techniques are utilized to put back the functional pain-free active range of motion. Many treatments such as Electrotherapy and Exercise therapy programs are utilized in physiotherapy, which further include paraffin wax bath, soft tissue stretches, isometric exercises, active movements and exercises of hand muscles[3].

Mulligan concept of mobilization with movement is a specific form of manual therapy technique that embraces skilled hands-on movements which are used to mobilize or manipulate soft tissues and joints with the target to improve tissue extensibility, increase in joint range of motion, modulate pain, foster relaxation and reduce tissue swelling, inflammation or restriction[10,11]. Techniques of this concept were introduced by Brain R. Mulligan in the 1970s in New Zealand[12]. In this technique, an accessory glide is given while the patient performs movement that is usually painful. It rectifies the positional fault of a joint followed by trauma. MWM also decreases pain and causes excitation of sympathetic nervous system[13].

Purpose of the Study

The purpose of this study was to compare the effectiveness of Mulligan concept of mobilization with movement technique and conventional physiotherapy treatment following postsurgical Colle's Fracture in terms of range of motion, functional activities.

Methods

Design and sample size

Our RCT was registered with the Clinical Trial Registry – India (CTRI/2019/09/021021). The obtained data was evaluated using SPSS software version 16.0. The collected information was summarized by using frequency percentage, for qualitative data; and mean, the standard deviation, Median and Inter Quartile Range (IQR) for quantitative data. To compare the difference in proportion Chi square test was used. To compare the ROM and Michigan Hand Outcome Questionnaire between two groups Independent sample t-test was used. Within the group comparison was analysed by using paired t-test. The p-value less than 0.05 considered significant for the study.

Participants

Patients were eligible to participate if they met the following inclusion criteria: (i) participants with Colle's fracture having conservative or internal fixator, (ii) participants with or without deformity, (iii) participants consenting to take part in the study, (iv) physiotherapy treatment will be given to the patients with Colle's fracture after 6 weeks of healing. Exclusion criteria include: (i) any other fracture in ipsilateral limb, (ii) osteopenia, (iii) previous Colle's fracture, (iv) pre-existing inflammatory joint condition, (v) Sudeck's dystrophy.

Procedures

Ethical approval for this study was given by Institutional Ethics Committee, NITTE Institute of Physiotherapy (NIPT/IEC/Min/018/2018-19). Participants were recruited to this study from both inpatient and outpatient department of Orthopaedics of Justice K S Hedge charitable hospital, Mangalore, from September 2019 to January 2020. Potential participants were assessed for eligibility, and written consent was obtained from all participants. Participants were randomized immediately after baseline assessment. Randomized sequence was generated using a computer random number generator, and allocation concealment was achieved using sequentially numbered opaque sealed envelopes.

Intervention

After baseline assessment, participants were randomly allocated to 1 of 2 study groups. Group I received Mulligan mobilization along with paraffin wax bath and Group II received Conventional physiotherapy treatment along with paraffin wax bath for 1 week.

THE SUBJECTS INCLUDED IN **GROUP I** (MULLIGAN MOBILIZATION) WERE INSTRUCTED AS FOLLOWS:

- The patient was in a sitting/ supine position.
- Paraffin wax bath was given for 15 mins.

For loss or pain with flexion or extension. (Figure 1)

- The therapist stood proximal to and grasped the lower ends of the radius and ulna with one hand so that the web between the therapist's index finger and thumb lies over the distal end of the radius.
- The web between the thumb and the index finger of the therapist's other hand lied medially over the proximal row of carpal bones keeping the rest of the therapist's fingers and thumb from making contact with the patient.

- The therapist then glided the carpels laterally.
- The therapist had to maintain the mobilization and asked the patient to actively move in the restricted direction (Flexion or Extension).

For loss or pain with radial and ulnar deviation. (Figure 2)

- The therapist stood proximal to the affected wrist.
- The patient's hand is stabilized to attain 3-point pressure for gliding.
- Patient's hand is stabilized at the distal end of the radius and at ulna using web space on the dorsal or ventral aspect, based on the glide.
- The therapist glided the carpels and maintained it while asking the patient to perform the painful movements. This glide makes the movement pain-free.

For loss or pain with supination or pronation. (Figure 3)

- The therapist stood proximal to the affected wrist.
- The therapist placed the fingers of his other hand anteriorly along the ulnar border of the radius for an accurate stabilization.
- The therapist placed his right thumb over the lower end of the ulna and places the left thumb over the right one and pushed the ulna down on the radius.
- The fingers of the therapist's right hand lied over those of his left. With the ulna, it was repositioned on the radius asked the patient to supinate or pronate with overpressure provided there is no pain.

THE SUBJECTS INCLUDED IN **GROUP II** (CONVENTIONAL PHYSIOTHERAPY) WERE INSTRUCTED AS FOLLOWS:

- The patient was in a seated/ supine position.
- Paraffin wax bath was given for 15 mins.

- Patients were asked to do active exercises, soft tissue stretches, isometric stabilizing exercises and gentle grip strengthening exercises.

Outcome Measures

Outcome measures were taken on 2 occasions: (1) at baseline and (2) at the end of 1-week treatment.

Statistical Analysis

The obtained data was evaluated using SPSS software version 16.0. The collected information was summarized by using frequency percentage, for qualitative data; and mean, the standard deviation (S.D) for quantitative data. To compare the ROM and Michigan Hand Outcome Questionnaire between two groups Independent sample t-test was used. Within the group comparison was analysed by using paired t-test. The p-value less than 0.05 considered significant for the study.

Results

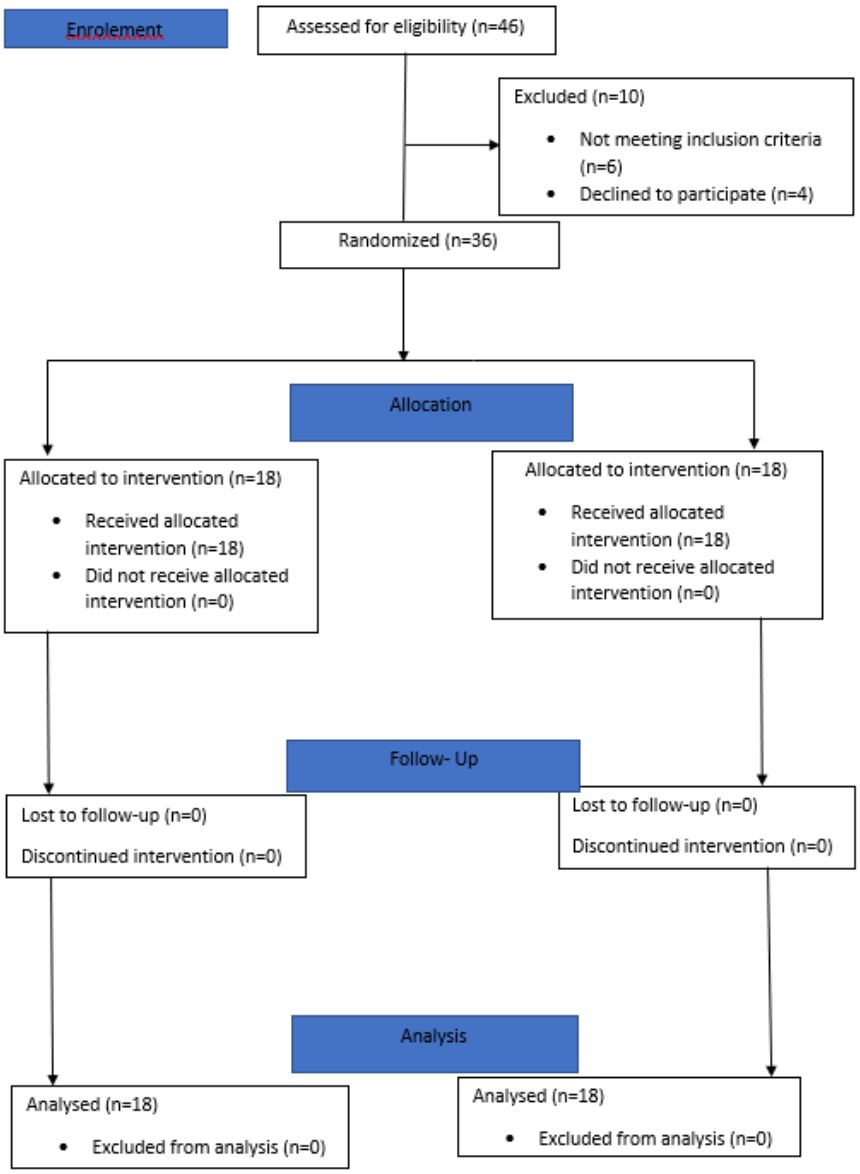

Fig 4: The flow of participants is shown in Figure.

CONSORT flow of participants through trial.

Independent sample "t" test was used to test the homogeneity of baseline sample characteristics according to groups. The obtained p values are more than 0.05, except for hand outcome - I ($p = 0.008$), II ($p = 0.021$) and VI ($p = 0.028$). Hence the baseline sample characteristics are homogeneous according two groups, except for hand outcome – I, II, and VI. (Table 1)

Paired “t” test was used to compare the outcome measures before and after interventions. The obtained p values are less than 0.05 for all the comparison except for Hand outcome - V (p value = 1). It indicates that there was a difference in the outcome measures before and after the interventions irrespective of groups. (Table 2)

The Independent sample “t” test was used to compare the effectiveness (pre – post) between the groups. Obtained p values are more than 0.05 except for hand outcome – II and hence there was no difference in effectiveness ($p > 0.05$) between the groups except for hand outcome – II. (Table 3)

Discussion

The purpose of this study was to compare the efficacy of Mulligan's concept of mobilization with movement (MWM) technique and conventional physiotherapy treatment following postsurgical Colle's fracture. Range of motion and functional activities were compared within the groups and between the groups.

This study confirms that the range of motion and functional activities are significantly improved with the Mulligan concept of mobilization with movement and also after conventional physiotherapy.

Varsha C. Naik et al (2007), conducted a comparative study on the efficacy of the Maitland and Mulligan mobilization in patients with Colle’s fracture post-surgery. The study concluded that there was decrease in pain and improvement in functional tasks on thumb motion scale with the Mulligan mobilization technique. However, there was no improvement on functional assessment tool in both groups[9]. According to present study, a significant difference is present between and within the groups pre and post measures, except for the comparison of Hand outcome – IV and VI in the conventional group. Thus, Mulligan mobilization with movement is more effective than conventional physiotherapy.

Dr. Sue Reid conducted a study to evaluate the effect of Mulligan mobilization with movement (MWM) plus self-MWMs on non-surgically treated patients with distal radius fracture. It was concluded that adding MWM to exercise and advice gives a faster and greater improvement in motion impairments for non-operative management of distal radius fracture[14]. This study also shows consistent with the study above as there is a significant improvement in the range of motion and hand functions between and within the groups.

Eva Santacreu et al (2016) did a case report for evaluating the effect of paraffin, manual therapy, pegboard and splinting in distal radius fracture patient with stiffness. She was given paraffin wax bath followed by mobilization, active and passive stretching on a pegboard. Later splinting of the hand was done. Tremendous improvements were noted in the outcome measures after the therapy[8]. The present study is consistent with the previous study as a paraffin wax bath for both the groups are found to be effective in terms of hand range of motion and hand functions in patients with postoperative hand stiffness.

Sandra Kay et al (2008), conducted a randomised trial to compare the effect of advice and exercise program over natural healing in post distal radius fracture. Range of motion, grip strength of wrist, activity limitations were assessed using goniometer, hand dynamometer and questionnaires on day one and after 6 weeks. It was found that the group which received physiotherapy treatment showed better improvements[15]. This study shows, both the groups shows an improvement in relation to range of motion and hand functions. Thus, Mulligan mobilization with movement and conventional physiotherapy is significantly effective.

Tomruk M et.al.(2020) conducted a study evaluating the benefits of early manual therapy in distal radius fracture patients who were treated with volar plating. Hand functions, pain, range of motion, grip strength and the level of disability were assessed. Patients were randomly divided into two groups where Group A received Early Manual Therapy and Group

B received Standard Physiotherapy. Group A was given standard physiotherapy along with the Mulligan's Mobilization with Movement technique whereas Group B was given standard physiotherapy only. The study concluded that manual therapy along with standard PT is effective in these patients[16]. The present study findings are consistent with this study as there is an improvement in the outcome measures pre and post-treated with Mulligan mobilization than conventional physiotherapy.

Nilima Bedekar (2018) conducted an interventional study to evaluate the benefits of Mobilization with Movement and Muscle Energy Technique in Distal Radius Fracture patients. Sixty patients were divided into three groups. Group A received conventional exercises, group B received Mulligan's mobilization with movement along with conventional exercises while group C received with Muscle Energy Technique and Conventional Exercises. Contrast bath and home strengthening exercise program were advised. Pain, ROM, functions, grip strength were assessed in which all the 3 groups improvement. However, MET with conventional Exercises showed better results when compared to others[17]. In this present study, Mulligan mobilization with movement along with paraffin wax bath therapy showed more improvement in relation with ROM and hand function activities than conventional physiotherapy.

Limitations

This was a small but adequately powered study. The period of intervention was for 1 week.

No long term follow up was taken.

Conclusion :

The present study concluded that Mulligan concept of mobilization with movement and conventional physiotherapy are equally effective in terms of range of motion and functional activities as the mean difference was effectively significant.

References :

1. Anand U. A Study to Analyze the Efficacy of Maitland's Mobilization Technique and Neuromuscular Electrical Stimulation on Pain and Hand Grip Strength in Patients with Post Colle's Fracture Stiffness. *International Journal of Scientific and Research Publications.* 2014;4(4):2250-3153.
2. Millet P. Early mobilization in the treatment of Colles' fracture: a 3 year prospective study. *Injury*. 1995;26(10):671-675.
3. Mahakul B. Effectiveness of Maitland mobilisation technique on pain and hand functions in the postoperative management of Colles fracture. *International Journal of Orthopaedics Sciences.* 2017;3(3):397-399.
4. Nellans K. Epidemiology of Distal Radius Fractures. *Hand Clin*. 2012;28(1):113-125.
5. Silman A. Risk factors for Colles' fracture in men and women: results from the European Prospective Osteoporosis Study. *Osteoporosis International.* 2003;14(3):213-218.
6. Morey K, Watson A. Team Approach to Treatment of the Posttraumatic Stiff Hand. *Physical Therapy.* 1986;66(2):225-228.
7. Barai A, Lambie B, Cosgrave C, Baxter J. Management of distal radius fractures in the emergency department: A long-term functional outcome measure study with the Disabilities of Arm, Shoulder and Hand (DASH) scores. *Emergency Medicine Australasia.* 2018;30(4):530-537.
8. Santacreu E, Cabezas N, Graupera A. Combined treatment with paraffin, manual therapy, pegboard and splinting in a patient with post-traumatic stiff hand. *Archives of Physiotherapy.* 2016;6(1).
9. Naik V, Chitra J. Effectiveness of Maitland versus Mulligan Mobilization Technique following Post Surgical Management of Colles - Fracture - RCT. *Indian Journal of Physiotherapy and Occupational Therapy.* 2012;1(4):0973-5674.
10. Taylor A, Wilken J, Deyle G, Gill N. Knee Extension and Stiffness in Osteoarthritic and Normal Knees: A Videofluoroscopic Analysis of the Effect of a Single Session of Manual Therapy. *Journal of Orthopaedic & Sports Physical Therapy*. 2014;44(4):273-282.
11. Pourahmadi M, Mohsenifar H, Dariush M, Aftabi A, Amiri A. Effectiveness of mobilization with movement (Mulligan concept techniques) on low back pain: a systematic review. *Clinical Rehabilitation.* 2018;32(10):1289-1298.
12. Exelby L. The Mulligan concept: Its application in the management of spinal conditions. *Manual Therapy*. 2002;7(2):64-70.
13. Heiser R, O'Brien V, Schwartz D. The use of joint mobilization to improve clinical outcomes in hand therapy: A systematic review of the literature. *Journal of Hand Therapy*. 2013;26(4):297-311.
14. Reid S. Effects of mobilisation with movement in participants with distal radius fracture: a randomised controlled trial. *Journal of Manual and Manupulative Therapy*. 2018 December 9;(1).
15. Kay S, McMahon M, Stiller K. An advice and exercise program has some benefits over natural recovery after distal radius fracture: a randomised trial. *Australian Journal of Physiotherapy.* 2008;54(4):253-259.
16. Tomruk M, Gelecek N, Basçi O, Özkan M. Effects of early manual therapy on functional outcomes after volar plating of distal radius fractures: A randomized controlled trial. *Hand Surgery and Rehabilitation.* 2020;39(3):178-185.Mullaney M, McHugh M, Johnson C, Tyler T.

Reliability of shoulder range of motion comparing a goniometer to a digital level. *Physiotherapy Theory and Practice*. 2010;26(5):327-333.

17. Badekar N. Comparing Two Methods of Treatments for improving hand function after Wrist Fractures. *Journal of Manual and Manipulative Therapy*. 2018 April 4;(1).

Fig 1. For loss or pain with flexion or extension

Fig 2. For loss or pain with radial and ulnar deviation

Fig 3. For loss or pain with supination or pronation

Table 1: - Test of homogeneity of baseline characteristics according to groups.

	Intervention group	Conventional group	"t"	p Value

	Mean	S.D	Mean	S.D		
Age	42.78	19.68	44.28	14.03	0.263	0.794
Flex (Active ROM)	26.39	10.55	23.06	10.02	0.972	0.338
Ext (Active ROM)	21.39	12.81	18.89	12.78	0.586	0.562
Ul Dev (Active ROM)	10	3.43	9.72	4.01	0.223	0.825
Ra Dev (Active ROM)	9.44	4.50	9.72	6.52	0.149	0.883
Sup (Active ROM)	17.5	14.48	16.11	7.78	0.359	0.722
Pro (Active ROM)	23.06	17.08	18.61	11.73	0.91	0.369
Flex (Passive ROM)	34.44	12.82	31.39	11.98	0.739	0.465
Ext (Passive ROM)	27.78	12.63	28.33	14.65	0.122	0.904
Ul Dev (Passive ROM)	15.83	4.29	15.56	4.82	0.183	0.856
Ra Dev (Passive ROM)	15.83	6.24	15.56	7.25	0.123	0.903
Sup (Passive ROM	23.89	15.20	22.5	8.45	0.339	0.737
Pro (Passive ROM)	28.33	17.74	25	12.13	0.658	0.515
I	54.72	5.55	47.5	9.43	2.8	0.008*
II	48.67	11.79	37.17	16.26	2.49	0.021*
III	55	13.61	48.89	17.45	1.171	0.25
IV	45.83	9.74	48.89	14.71	0.735	0.467
V	60.94	14.86	57.44	14.42	0.717	0.478
VI	61.22	11.93	49.06	19.03	2.298	0.028*

(* Indicates significant)

Table 2: - Comparison of the sample characteristics irrespective of the groups.

	Pre Test		Post Test		"t"	p Value
	Mean	S.D.	Mean	S.D.		

Flex (Active ROM)	24.72	10.28	38.89	12.712	12.877	< 0.001*
Ext (Active ROM)	20.14	12.68	31.25	13.168	15.404	< 0.001*
Ul Dev (Active ROM)	9.86	3.68	17.22	4.543	15.777	< 0.001*
Ra Dev (Active ROM)	9.58	5.53	17.92	4.982	14.79	< 0.001*
Sup (Active ROM)	16.81	11.47	26.81	15.953	8.039	< 0.001*
Pro (Active ROM)	20.83	14.61	31.11	17.284	6.609	< 0.001*
Flex (Passive ROM)	32.92	12.33	49.58	13.855	16.733	< 0.001*
Ext (Passive ROM)	28.06	13.48	40.83	15.142	12.244	< 0.001*
Ul Dev (Passive ROM)	15.69	4.50	23.89	5.989	14.407	< 0.001*
Ra Dev (Passive ROM)	15.69	6.67	24.03	6.304	10.146	< 0.001*
Sup (Passive ROM)	23.19	12.14	33.61	15.974	9.19	< 0.001*
Pro (Passive ROM)	26.67	15.07	37.22	17.746	8.009	< 0.001*
I	51.11	8.46	73.47	8.849	21.032	< 0.001*

II	42.92	15.17	71.75	9.749	21.747	< 0.001*
III	51.94	15.73	62.08	16.535	3.296	0.002*
IV	47.36	12.39	40.14	10.521	3.565	0.001*
V	59.19	14.54	59.19	14.312	< 0.001	1
VI	55.14	16.83	79.58	8.686	10.916	< 0.001*

(* Indicates significant)

Table 3: Comparison of effectiveness (Pre – Post) according to groups

	Intervention		Conventional		"t"	p Value
	Mean	S.D	Mean	S.D		
Flex (Active ROM)	13.06	5.18	16.39	4.79	2.003	0.053
Ext (Active ROM)	10.28	4.01	11.94	4.58	1.161	0.254
Ul Dev (Active ROM)	7.50	2.57	7.22	3.08	0.294	0.771
Ra Dev (Active ROM)	8.33	3.43	8.33	3.43	< 0.001	1.000
Sup (Active ROM)	10.00	4.20	10.00	9.85	< 0.001	1.000
Pro (Active ROM)	10.00	4.20	10.56	12.71	0.176	0.861
Flex (Passive ROM)	15.28	5.55	18.06	6.22	1.414	0.166
Ext (Passive ROM)	13.61	6.82	11.94	5.72	0.794	0.433

Ul Dev (Passive ROM)	8.61	3.35	7.78	3.52	0.728	0.472
Ra Dev (Passive ROM)	8.06	5.18	8.61	4.79	0.334	0.741
Sup (Passive ROM)	10.56	4.82	10.28	8.48	0.121	0.905
Pro (Passive ROM)	10.56	4.16	10.56	10.56	< 0.001	1.000
I	23.06	6.67	21.67	6.18	0.648	0.522
II	76.06	9.16	67.44	8.51	2.921	0.006*
III	12.22	16.02	15.83	15.46	0.688	0.496
IV	10.00	8.04	11.67	10.00	0.551	0.585
V	0.00	0.00	0.67	1.94	1.458	0.154
VI	20.22	7.86	28.67	16.50	1.961	0.058

(*Indicates significant)