Original Research Article

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

Abstract:

Background

Fracture of the distal radius or Colle's Fracture mainly occurs due to fall on an outstretched hand and Physiotherapy plays an indispensable role in preventing postoperative complication namely hand stiffness. Mulligan concept of mobilization is a specific form of manual therapy technique that embraces skilled movements which is used to mobilize or manipulate soft tissues and joints with the target to improve tissue extensibility, increase in range of motion of joints, foster relaxation and reduce tissue swelling/ inflammation.

Objective

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 as 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.

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 plays a very significant role in explicating the comprehensiveness of dexterity in our daily living. Distal radius fracture is the most frequent type of fracture leading skeletal injuries and is very common in all age groups but more common in individuals with osteoporosis[1]. Abraham Colle's in 1814 first described this fracture; therefore, the name "Colle's Fracture" came into existence[2].

Colle's Fracture is also called "Dinner Fork" or "Bayonet" deformity, due to peculiar appearance of the forearm. It mainly occurs due to fall on an outstretched hand (FOOSH)[3]. Distal radius fracture is one of the most common types of fractures without the involvement of articular surfaces[3,4]. Incidence of Colle's fracture is almost 5 times more in women than that of men. However, the rate rapidly increases above 50 years of age and gets doubled every 10 years until 90 years of age in both men and women[4,5].

Patients with a history of FOOSH injury usually come with a complaint of pain, swelling, and restricted mobility[6]. It is the most common presentation in the emergency department[7]. Patients are mostly treated on an outpatient basis[1]. Initial management includes utilization of various modalities like ultrasound, procedural sedation, Bier's block, hematoma block and immobilization in a back slab or a full cast. Further management for the minimally displaced fractures are done with conservative procedure while the displaced ones are treated either with percutaneous pinning, external fixation, 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]. Hospitalization is required for around 20% of patients especially involving older people following fracture[1].

The main complications include pain, swelling, joint stiffness, reduced joint range of motion and muscle power[6]. 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]. Some of the impediments such as malfunction of median nerve, ulnar nerve, mal-united fracture and post- fracture inflexibility which are reported quite often[3].

Physiotherapy plays an indispensable role in preventing postoperative complications[1]. Aim is to regain the range of motion, minimize pain and ameliorate the functional outcomes followed by the withdrawal of plaster and fixation. This includes appropriate guidance to the patient to safeguard the fracture, manage oedema, maintenance of normal skin condition and a progressive return to a pursuit which can be achieved by active, passive or resisted exercises. 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 (MWM) 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]. MWM also decreases pain and causes excitation of the sympathetic nervous system[13].

Objective

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.

Materials and Methods

Our RCT was registered with the Clinical Trial Registry – India (CTRI/2019/09/021021). The Ethical approval for this study was given by Institutional Ethics Committee, NITTE Institute of Physiotherapy (NIPT/IEC/Min/018/2018-19). The obtained data was evaluated using SPSS software version 16.0.

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.

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

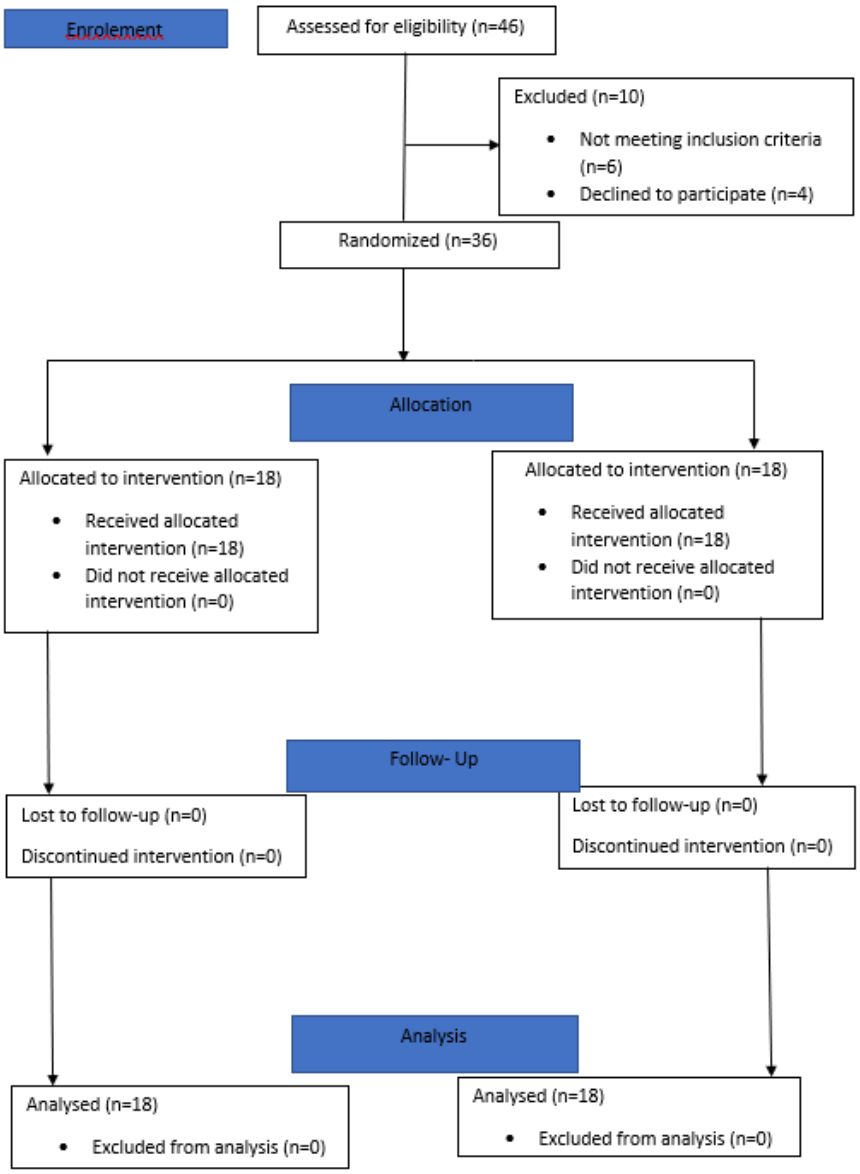

Fig 4: The flow of participants is shown in Figure.

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.

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.

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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	32.92	12.33	49.58	13.855	16.733	< 0.001*

ROM)						
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)