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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

***U.Albert Anand MPT,MBA, CSSBB, ** S.Ramesh, MPT, *** Mr. Abdul Khadhar Jailabdeen, BPT**

[*] Professor, K.G College of Physiotherapy, K.G Campus, Saravanampatti, Coimbatore, Tamilnadu, India- 641035.
[**] K.G College of Physiotherapy, K.G Campus, Saravanampatti, Coimbatore, Tamilnadu, India- 641035.
[***] K.G College of Physiotherapy, K.G Campus, Saravanampatti, Coimbatore, Tamilnadu, India- 641035.

***Abstract*- BACKGROUND:** Colle's fracture is a very common extra-articular fracture that occurs as the result of a fall on out stretched hand (FOOSH). Although Colle's fractures are commonly seen in all age groups and demographics, they are particularly common in osteoporotic individuals and as such are more frequently seen in elderly women. Some complications are associated with injury itself. The complications such as persistent neuropathy of median nerve, ulnar nerve or radial nerve, mal-united fracture and post traumatic stiffness have been reported in 1 out of 3 patients. Rehabilitation of fractures is a very important thing because of the limitations produced by improper management can lead to stiffness, deformity and limitation of functions.

OBJECTIVE: The purpose of the study was to find out the effects of Maitland's mobilization with Neuro-Muscular Electrical Stimulation (NMES) on pain and hand grip strength in patients with post Colle's fracture stiffness.

DESIGN: Pre- test and Post- test experimental study design

SETTING: Outpatient Department of Physiotherapy, K.G Hospital, Coimbatore, India.

SAMPLE: Simple random sampling method: Total of 30 patients, 15 in each group

INTERVENTION: Fourteen sessions of Maitland's mobilizations were undergone by the subjects, one session stood for the duration of 30 minutes. Following the mobilization session the Neuro-Muscular Electrical Stimulation (NMES) was given to both flexors and extensors group of muscles. 10 to 15 muscle contractions for both muscle groups were given twice daily and treatment was given 5 days a week for 5 weeks. The studies were conducted over 8 weeks.

MEASUREMENTS: Primary outcomes were pain and Hand grip strength, Pain was assessed using Visual Analogue Scale, where as Hand grip strength was assessed using Hand Grip Dynamometer.

CONCLUSION: Thus the study concluded that Maitland's mobilization technique with Neuromuscular Electrical Stimulation helps in reducing Pain and improves Hand Grip strength in patients with post Colle's fracture stiffness.

***Index Terms*-** Colle's Fracture, Stiffness, Mobilization, NMES, Pain, Hand Grip Strength

I. INTRODUCTION

Hand plays an important role in defining the level of skill in our activities and in our level of social expression and integration. There are many causes which bring about the dysfunction of the hand. The distal radius fracture is one of the leading skeletal injuries[1]. The fracture of distal radius is otherwise known as 'Colle's fracture' which was named after Abraham Colle's in 1814.

Colle's fracture is a very common extra-articular fracture that occurs as the result of a fall on out stretched hand (FOOSH). Although Colle's fractures are commonly seen in all age groups and demographics, they are particularly common in osteoporotic individuals and as such are more frequently seen in elderly women [2]. The relationship between Colle's fractures and osteoporosis is strong enough that, if an elderly male present with this fracture, he should be investigated for osteoporosis, as he is at increased risk of hip fractures[3].

The incidence of Colle's fracture is 7.3 and 1.7 per 1000/year in women and men respectively. In women whose menopause is delayed above the age of 50 years, there is a modest increased risk [HR 1.5 (Range 1.1-2.0)]. Walking regularly in that particular group will also elevate the risk [HR 1.6(1.2-2.2)].[2,4,5]

A recent multi-centre study in the western country of patients aged 35 years and above with Colle's fracture reported an annual incidence of 9/10,000 in men and 37/10,000 in women[2, 3]. Colle's fracture has an increasing prevalence with age. This constitutes 60% of fracture of radius[6]. Fractures of the distal radius may lead to severe pain and functional limitations.

Patients usually presents with history of an injury and localized pain, deformity and swelling also noticed. Numbness of the hand can occur. On examination, deformity, tenderness and also loss of wrist motions are seen. Confirmation is done by X-ray investigation which includes assessment of lateral auricular angle (normal=11˚, tilted to volar aspect), radius length and auricular surface.

"Stiffness" may be due to the soft tissue injury, articular surfaces damage or even prolonged immobilization during the management of fracture. Watson Jones stated that, "Fracture is a soft tissue injury which involves the bone". FRACTURE

DISEASE is defined as the stiffness and weakness following the fracture[7, 8].

Distal radial fracture is mostly treated on outpatient basis. Around 20% 0f patients especially the older people require hospitalization after the fracture[9]. And the medical management of the fracture includes splinting, padding and plaster cast. Fractures that are displaced minimally can be treated with non-operative procedure. But the displaced one are treated with percutaneous pinning or external fixation or closed reduction and manipulation or plaster of Paris but if it is intra-articular fracture, it is treated with open reduction and internal fixation[10,11]. Most important role is played by the Physiotherapy to prevent the post-operative complications. The complications such as persistent neuropathy of median nerve, ulnar nerve or radial nerve and mal-united fracture have been reported in 1 out of 3 patients[12-14].

Some complications are associated with injury itself. If there is a displacement of fracture and soft tissue injuries, it may compromise blood vessels and nerves, along with median nerve dysfunction which is being the most common complication[15-17]. Late complications; such as mid-carpal instability and post-traumatic arthritis, which will occur several months or years after the injury[18-19]. Main complications include stiffness, pain, and reduction in the range of motion and reduced muscle power etc.

Physiotherapy mainly aimed at regaining range of motion, reducing pain and improving functional outcomes which often follow the removal of plaster or fixation. Physiotherapy treatments include proper advice and education to protect fracture, oedema control, preservation of normal skin condition and a gradual increase in activity. In order to improve ROM, strength and stability, passive, active and resisted exercises can be used. Passive joint mobilization techniques help to restore functional range of pain free active motion. Many physiotherapeutic interventions are done which includes Electrotherapy and Exercise therapy programmes which include isometric exercises, active range of motion and intrinsic hand muscle exercises[20].

Maitland's technique includes application of pressure and accessory oscillator movements to treat stiffness of mechanical in nature. The aim is to restore the motion. This technique includes 5 levels of grades. According to Maitland's concept, there will be activation of different mechanoreceptors[21]. Out of this grade I and II are appropriate when there is pain before restriction of movement is experienced where as III and IV are appropriate when resistance to movement is encountered before pain[22-24].

Neuromuscular electrical stimulation (NMES) is one of the effective techniques to strengthen the muscle following musculoskeletal injury or surgery[27]. Neuromuscular electrical stimulation (NMES) were used for many years by physical therapists for the treatment of atrophy in denervated muscle and also to improve or maintain the muscular strength in immobilized muscle followed by surgery[28-29]

II. MATERIALS AND METHODS

The study was conducted in K.G Hospital, Coimbatore, Tamilnadu both inpatient and outpatient Physiotherapy department after approval from the institutional ethical committee. A clear explanation about the study was given to all the patients and they were included following suitable inclusion and exclusion criteria. Subjects who were included in the study had age group between 35 -65 years irrelevant of their side and sex, with radiological diagnosis of post Colle's fractures Stiffness more than 8 weeks duration. Osteopenia, Sundecks' atrophy, Other fracture in ipsilateral limb, Congenital deformity of the hand or forearm, Neuromuscular injuries, Arthritis of the wrist, Previous Colle's fracture, Un co-operative patient, Patient with cardiac and renal dysfunction were excluded from the study. 30 subjects with, Post Colles's fracture Stiffness was selected by simple random sampling method. A computer generated randomized table of numbers were created prior to the beginning of the study and was utilized to determine the randomization scheme. Assessment was done with Hand Dynamometer for hand grip and Visual analogue scale for pain. A consent letter was obtained from each subject and then subjects were divided into 2 groups, with15 subjects in each group.

Group A: They received treatment of Maitland's mobilization with NMES as follows:

15 subjects received Moist Heat Therapy (MHT) for 15 minutes. Then Maitland's mobilization techniques (Grade I and II) in the first week of the treatment followed by (Grade III and IV) for the second week. The mobilization session lasted for three days per week in the first 2 weeks and two days per week in subsequent four week. A total of 14 mobilization sessions were underwent by the subjects, one session stood for the duration of 30 minutes.

Following the mobilization session, the neuromuscular Electrical Stimulation (NMES) was given to both flexors and extensors group of muscles. The following parameters were used in NMES to stimulate the muscles with the Pulse Width of 300µs and Pulse frequency of 30pps.

About the Electrode fixation, one electrode was placed on the proximal 1/3 of the forearm over flexor muscles belly and other electrode was placed centrally over the flexor tendon approximately 7cm proximal to the wrist crease. For the extensor group muscles the proximal electrode was placed on the proximal 1/3 of the forearm over extensor muscles belly and distal electrode was placed 5cm proximally to the wrist crease. 10 to 15 muscle contractions for both muscle groups were given twice daily and treatment was given 5 days a week for 5 weeks.

Group B: They received treatment of Neuro Muscular Electrical Stimulation (NMES) alone as prescribed earlier in Group A.

Subjects in group B received Moist Heat Therapy (MHT) for 15 minutes following MHT the Neuromuscular Electrical Stimulation (NMES) was given to both flexors and extensors group of muscles as prescribed earlier in Group A. Patients were encouraged not to seek any other kind of physical treatment during the 6 week period of this study.

III. DATA ANALYSIS

The Independent variables were Maitland's Mobilization Technique and Neuro Muscular Electrical Stimulation (NMES) and dependent variable were Hand Grip Strength and Pain. Analyses were performed using the SPSS statistical software package. Paired't' test were used for the measurement of pre-test

and post-test values of group A and B. Unpaired 't' test were used to compare the post-test values of Group B. probability values of less than 0.05 were considered significant.

IV. RESULTS

Pain relieved was found better in Group A (Maitland Mobilization Technique and Neuro Muscular Electrical Stimulation) which was considered statistically significant with mean of 2.33 and S.D. of 0.61. Group B mean value is 4.27 with S.D. of 0.88. Paired 't' test for Group A and B was 16.7 and 19.2. Unpaired 't' test was 6.95.

Grip strength in pre-test and post-test treatments of both the groups showed that Grip strength was significantly improved in Group A which was considered statistically significant with mean of 40.3 and S.D. of 0.67. Group B mean value was 18.03 with 0.72. Paired 'T' test for Group A and Group B was 88.2 and 28.4 respectively. Unpaired 'T' test values was 85.9.

V. DISCUSSION AND CONCLUSION

The purpose of this study was to find out the effect of Maitland mobilization technique and Neuromuscular Electrical Stimulation on Pain and Grip strength in patient with Post Colle's Fracture stiffness. A fracture of the distal radius is a common skeletal injury[1] **(Ark J and Jupiter JB et al., 1993)**. There is a steady rise in the incidence of wrist fractures in woman commencing at the age of 40yrs that level of after 65 years of age and the peak is within 10 years post menopause[2,4] **(O Neill et al., 2003).**

The common mode of treatment for low trauma wrist fracture includes closed reduction followed by cast mobilization for up to 6 to 8 weeks, the frequency of management will provide challenge for both the surgeons and the therapist involved in this case, surgical immobilization of these fractures comprised of the use of open reduction with internal or external fixation for more complex injuries. The aim of Physiotherapeutic intervention after immobilization period distal radius fractures includes increasing the range of motion, strength and functional activity by using various modalities like Exercise, Passive mobilization, Electrotherapy, Splinting, soft tissue techniques and intervention to control swelling[24] **(Taylor NF et al., 1994).**

All these interventions were commonly used in the rehabilitation of patients after distal radius fractures, to date there is only a limited number of studies evaluating their effectiveness. From the latest available literature, it is still unclear that the components of Physiotherapeutic intervention are effective for the patients with distal radius fracture after the immobilization period. In our study patients came to the physiotherapy rehabilitation program after the immobilization period, the hand stiffness occurs commonly after the fracture of the distal radius but it is not of great concern. So our study mainly focused on Post Colle's fracture stiffness.

The Maitland mobilization technique was found to be effective for pain relief and there is a positional fault of the joint after an injury or strain which results in movement's restriction or pain[24] **(Taylor N F et al., 1994).** The reduction in joint mobility can often due to a mechanical block from inner structure with in a joint. Maitland concepts will produce a selective activation of different mechanoreceptors. Clinically the resistance due to spasm can be treated under mobilization or manipulation. This may be due to the stimulation of Type I and Type II mechano receptors[25] **(Mcphate M et al., 1997)**

They have dynamic and static response to change in the pressure, and the cutaneous mechanoreceptors, project poly synoptically to fusimotor neuron pools with in the central nervous system which contributes to the continuous modulation of activity following all around the fusimotor muscle spindle loop systems. The exert reflexogenic influences on muscle tone with immediate pain reduction after manipulation owing to a reflex decrease of muscle spasm[26] **(Christopher et al., 1986).**

The neuromuscular electrical stimulation helps to gain the muscle strength and helps in maintenance of muscle mass during prolonged periods of Immobilization[27] **(Synder- mackler L et al., 1997).** The neuromuscular electrical stimulation can improve the strength and functional performance in individual muscle on strength training**.** The neuromuscular electrical stimulation (NMES) helps to prevent the fibrous restriction, joint contractures, decrease the pain to increase the sensory, visual and proprioceptive input[30] **(Singh and sonia et al., 2006).**

Two mechanisms were suggested to explain the training effects with Neuromuscular Electrical Stimulation. The first mechanism suggested that augmentation of muscles strength with neuromuscular electrical stimulation. The second mechanism states that the muscle strengthening seen following neuromuscular electrical stimulation training results from a reversal voluntary recruitment order with selective augmentation of type II muscle fibres. This mechanism will increase the overall strength of muscle[31] **(Lake DA et al 1992).**

This study mainly focused on finding out the combined effects of Maitland's mobilization techniques with Neuromuscular Electrical Stimulation on Pain and Hand grip strength in patient with Colle's Fracture stiffness.

Statistical data were analysed and found that the Maitland mobilization technique with neuromuscular electrical stimulation was very effective in reducing pain as well as improving the grip strength in patient with post colle's fracture stiffness.

Based on these data, this study accepts alternate hypothesis and rejects null hypothesis.

VI. CONCLUSION

Thus the study concluded that the Maitland mobilization technique with neuromuscular electrical stimulation was very effective in reducing pain as well as improving the grip strength in patient with post Colle's fracture stiffness.

VII. CONFLICT OF INTEREST – NIL

VIII. SOURCE OF FUNDING – SELF

IX. ETHICAL CLEARANCE

ETHICAL COMMITEE CHAIRMAN,
K.G HOSPITAL,
COIMATORE,
TAMILNADU, INDIA- 641035.

X. SOURCE OF FUNDING- SELF

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AUTHORS

First Author – U.ALBERT ANAND, MPT, MBA, CSSBB PROFESSOR, K.G COLLEGE OF PHYSIOTHERAPY, K.G CAMPUS, SARAVANAMPATTI, COIMBATORE. TAMILNADU, INDIA- 641035., MOBILE: + 91 9894862003 E-MAIL: albertmpt@gmail.com
Second Author – S.RAMESH, MPT, PROFESSOR, K.G COLLEGE OF PHYSIOTHERAPY, K.G CAMPUS, SARAVANAMPATTI, COIMBATORE. TAMILNADU, INDIA- 641035.
Third Author – Mr. ABDUL KHADHAR JAILABDEEN, BPT MPT II YEAR, K.G COLLEGE OF PHYSIOTHERAPY, K.G CAMPUS, SARAVANAMPATTI, COIMBATORE, TAMILNADU, INDIA- 641035