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Post-Operative Management of Metal Implanted Elbow Stiffness with Pulsed Short-Wave Diathermy (SWD) and Joint Mobilization

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ABSTRACT

Background: Stiffness of the elbow after trauma is a well-recognized disabling condition that interferes with daily activities. Restoration of joint motion in the post-traumatic stiff elbow remains difficult and poses a challenge for surgeons. Diathermy is a superb warming modality to be used in deep tissues. Mobilization preceded through warmness frequently produces larger mobility gains. **Objective:** To determine the effect of short-wave diathermy in pain management, elbow range of motion and disability after elbow surgery. **Study Design:** Randomized clinical trial (RCT). **Settings:** Allied hospital, District Headquarter (DHQ) Hospital, Madinah teaching hospital Faisalabad (MTH) Pakistan. **Duration:** The study duration was July to November 2018. **Methods:** A study was conducted on 30 patients that meet inclusion criteria further divided these 30 patients in two groups group A and group B. **Intervention:** The group A receives Mobilization with PSWD on cubital fossa with for 20 minutes and after that crushed ice applied for 30 min. Group B receives only mobilization and ice application for the same time. **Outcome measure:** Data was assessed through the numeric pain rating scale ROM with goniometer and function with Liverpool score of elbows. **Results:** Repeated measures ANOVA was applied to analyze within group variation for pain and ROM. Pre and post comparison of Liverpool scores was made using paired sample t-test. The mean age of group A and group B was 31.60±12.488, 31.666±11.926 respectively. The test results show that there was no statistical difference of elbow flexion and extension ROM in starting but at the last session difference became statistically significant (p-value= <0.05). Significant difference occur in means of pre and post elbow Liverpool score (p-value <0.05). **Conclusion:** Pulsed shortwave diathermy with mobilization was more effective for the treatment of post-surgical elbow pain, stiffness and reduced disability as compared to mobilization alone.

Keywords: Short wave diathermy, Range of motion, Joint mobilization, Elbow stiffness.

INTRODUCTION

Stiffness of the elbow after trauma is a well-recognized disabling condition that interferes with daily activities.[1] There is a greater risk of elbow contracture after traumatic elbow injuries.[2] Loss of motion after elbow injury results from abnormalities of bone, soft tissue, or a combination of both, which may be present intra-articular as well as extra-articular.[3] Proximal humeral fracture higher in females and in geriatric population, mostly occur in winter season. In males, fractures mostly occur due to different traumatic events or accidents.[4] After trauma, loss of mobility occur in 5% cases.[5] It is difficult to generalize the incidence of elbow contracture. The incidence of the post traumatic stiffness is higher.[6] Epidemiology of elbow contracture after operate from 1997-2009 was 1.4%.[6] After injury or surgery, elbow stiffness developed due to myositis ossificans. In 76%-89% cases patients with elbow injury developed myositis ossificans.[7] Elbow stiffness in flexion is more common than extension.[8] However, restoration of joint motion in the posttraumatic stiff elbow remains difficult.[9] Physical therapy and joint mobilizers are the non-surgical methods for treating post- traumatic elbow stiffness. Open procedure and a video arthroscopic technique, are

the surgical treatment for steady elbow joint stiffness.[10] Surgical procedure called open reduction internal fixation used to align the bones after fracture. Immobilization of elbow can cause stiffness and loss of mobility.[11] Stiffness, pain and decreased ROM are common complaint of patients after operate due to immobilization. Patients experience functional limitation from contracture or stiffness.[12] Different therapeutic modalities and manual therapy techniques use to release contracture and gain ROM e.g., therapeutic ultrasound, infrared, diathermy, hot packs, and soft tissue techniques. Heat decrease pain, muscle spasm, increase collagen extensibility and blood flow.[13] Diathermy has been used as a treatment in several injuries such as adhesive capsulitis,[14] chronic pelvic inflammation, low back pain, myofascial trigger points, osteoarthritis and pain. Now days it has been also used for the treatment of post-operative elbow, shoulder and ankle stiffness.[13] Shortwave Diathermy is therapeutic modality in which high frequency electromagnetic currents are used to induce heat for different purposes including relieve pain, improve circulation.[15] Pulsed short wave diathermy is proposed to facilitate the fibroblastic activity in cells and enhances the ATP synthesis and protein in cells.[16] Previous studies suggested that short wave diathermy is contraindicated in metal implants or pacemaker and during pregnancy.[17] While some recent studies suggest that PSWD can be appropriate to increase joint ROM in combination with joint mobilization despite the implant if applied with precaution.[13] Early mobilization is necessary to prevent the post traumatic elbow stiffness. Physiotherapy often routinely prescribed after operate.[18] Joint mobilization refers to the manual therapy techniques which are used to modulate the pain and treat the joint dysfunction which reduces the joint ROM.[19] Different grades and techniques of manual mobilization are effective to manage pain and hypomobility in joints.[20] Pain, muscle guarding and spasm are treated with gentle joint play techniques which have neurophysiologic effects. Reversible joint hypomobility is treated with progressive vigorous joint play stretching techniques which elongate the hypo mobile capsule, ligaments and progressive movement limitations are treated with joint play techniques according to patient threshold.[19] In case series Draper DO., 2014 showed that Pulsed short-wave diathermy and mobilization was effective in improving the range of motion of elbow extension after surgery or injury.[21] A case report declared that thirty-nine years old female teacher after fixation with screws and plates comes and complaining that she would not be able to straighten the elbow completely after conservative treatment. Pulsed short-wave diathermy, traction and Maitland mobilization was given 3 session per week. After completion of six session, she gains full range of motion.[22] A case report showed that a 20 years old male perform full AROM of elbow extension after the 3 session of treatment. AROM, pulsed shorted wave diathermy, joint traction and mobilization were performed followed by application of crushed ice pack for 30 min. After ORIF of elbow patient came with 30-degree lack of elbow extension.[23] In 2006 a case series declared that pulsed short wave diathermy and joint mobilization increase the ankle ROM with metal implant after 8 or13 session.[13]

METHODS

This Randomized clinical trial was done in Single blind study was conducted at Allied hospital, District Headquarter (DHQ) Hospital, Madinah teaching hospital Faisalabad (MTH). The study duration was July to November 2018. Sample size was 30 by using convenient sampling technique to collect data.

Patients were randomly allocated into the groups through the gold fish method. Concealment was done through the sealed opaque envelope.

Participants who were willing to enroll in study, age from15-50 years, both male and female after surgery with implanted metal (after 3to 6 week of surgery) with restricted ROM and stiffness were included in the study.

The persons who have acute stage of fracture, any red flag, integumentary condition on elbow like infection, having psychological condition in which patients are unable to follow the command. Patients having co morbidity in which short wave not applied like high-risk patient, pregnant females and those patients in which ROM not increased after 2nd treatment are excluded.

All participants with elbow pain and stiffness after injury or surgery reported to physiotherapy department. Those who meet the inclusion and exclusion criteria, were requested to participate in the study. Those willing to participate in the study were given brief idea about the nature of the study and intervention. The demographical data include the age, gender, occupation was collected. Initial evaluation was done through the Numeric pain rating scale for pain, range of motion measured through the goniometer and functional status through Liverpool elbow score at base line. Individuals were randomly allocated in two groups.

Group A receive Ice pack as a baseline treatment, Maitland mobilization and pulsed short wave diathermy. Group B received ice pack and Maitland mobilization.

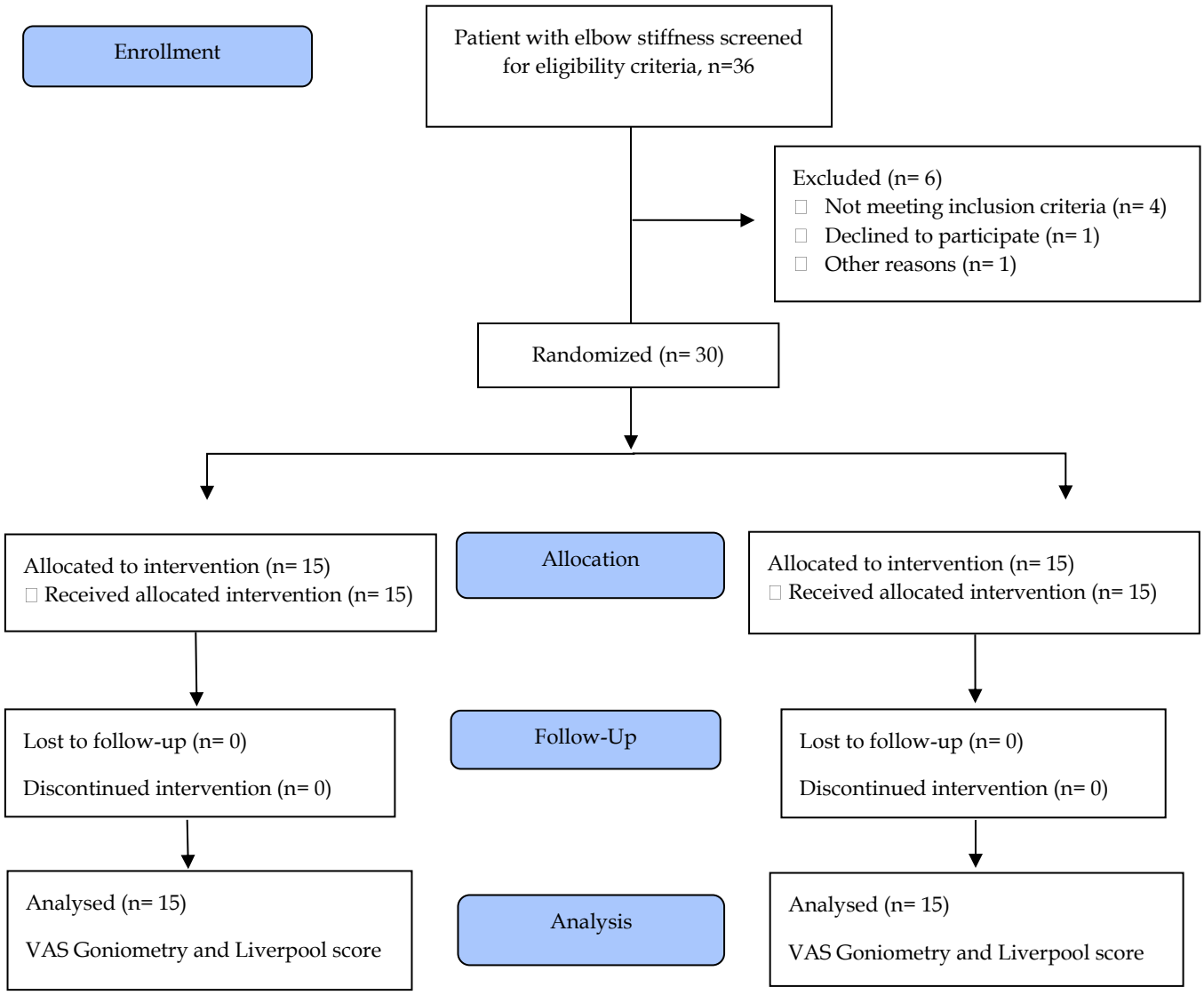
Pulsed shortwave diathermy (CURAPULS 970) applied on the cubital fossa at one-centimeter distance by using foam separator between the electrode and the arm surface, now turned on the machine set the time for 20 minutes set the pulse power at 40-50 W pulse reputation rate or pulse frequency was 300 pulses per second.

Applied distraction then anterior glide of the distal humerus on the ulna after that the radial head glide in both directions volar as well as dorsal most glide was performed on focusing to gain elbow extension the olecranon fossa of the ulna pervade resistance while gliding distal humerus on ulna each grade III oscillatory mobilization was performed for 20 seconds with 6 repetitions. Move from grade III mobilization to grade IV, after that mobilization again, range of motion of the elbow were recorded.

Commercial ice pack applied for 30 minutes in a position of elbow as much as in extended position at the end of treatment. The purpose of application of the ice pack was that its mange the micro trauma occurred during mobilization maintains the gained range of motion by enhancing the plastic priorities of the tissue it also managed the inflammation. Applied treatment 3 times in week for two weeks consisting of 6 sessions and excluded those patients in which the range of motion not improved after 2nd session.

Data analysis was performed through SPSS version 20. Descriptive statistics (Mean ± S.D) and frequency distribution were estimated for age, Gender, affected side of patients type of injury and for the calculation of how many taking the rehabilitation treatment. Repeated measures ANOVA was applied to analyze within group variation for pain and ROM in three follow up visits. Assumptions of normality and sphericity for repeated measures ANOVA were checked through Shapiro Wilck test and Mauchly's test. Post HOC test (Tukey) was used to locate the point of significance for significant results of repeated measures ANOVA. Pre and post comparison of Liverpool scores was made using paired sample t-test. Comparison of all study variables/parameters between treatment and control group was made by the use of unpaired or independent sample t-test.

Figure 1: CONSORT Flow Diagram



RESULTS

The mean age of group A and group B was 31.60 ± 12.488, 31.666 ± 11.926 respectively. Independent sample t-test results show that there was no statistically significant difference between the groups after 2nd session of pain score (p-value< 0.05) but at the last session difference became significant statistically (p-value= <0.05). Pain level was significantly reduced in treatment group as compare to control group. Elbow flexion and extension ROM that was improved in treatment group as compare to control group (p-value= <0.05) at the last session.

Disability of elbow was measured through the Liverpool score, both groups show reduction in disability but greater reduction occur in the treatment group as compared to the control group.

Table 2: Mean age and between group analysis of Numeric pain rating scale and Elbow flexion, extension range of motion

	SWD + Maitland Mobilization + Ice (n=15)	Maitland Mobilization + Ice (n= 15)	P-value (Between group)
Age of the patients	31.60±12.48	31.66±11.92	
NPR Scale			
Baseline	5.46±2.09	3.66±2.31	0.034
Session 2	3.33±2.02	3.93±2.15	0.438
Session 6	0.13±0.51	4.20±2.27	0.00
P-value within group	0.000	0.394	
Elbow Flexion Range (degree)			
Baseline	98.86±14.54	96.73±7.78	0.621
Session 2	105.73±14.06	99.00±7.93	0.118
Session 6	125.26±7.42	103.73±7.97	0.00
P-value within group	0.00	0.00	
Elbow Extension Range (degree)			
Baseline	47.46±16.81	46.60±10.77	0.868
Session 2	42.06±16.63	44.40±10.84	0.652
Session 6	25.26±14.59	39.00±9.94	0.005
P-value within group	0.00	0.00	

Figure 2: Comparison of pain between treatment and control group

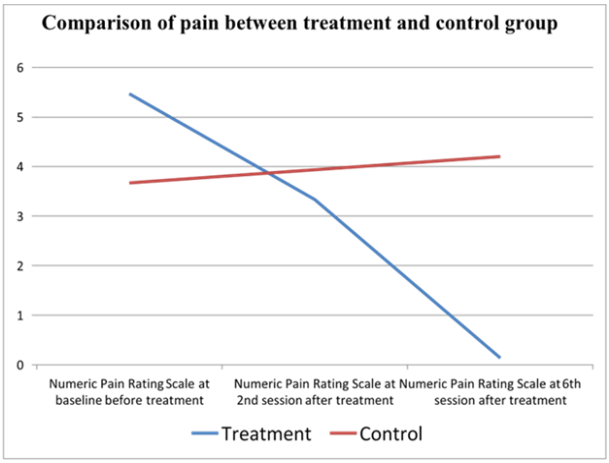


Figure 3: Comparison of elbow flexion range of motion between treatment and control group

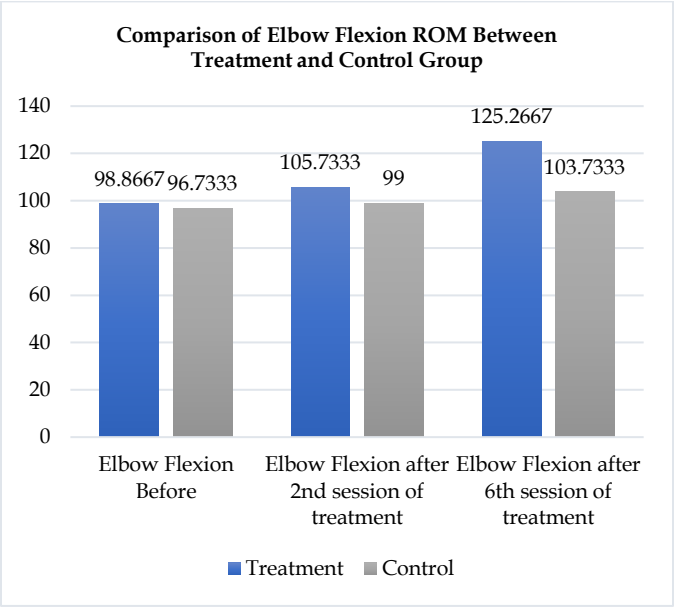


Table 3: Liver pool elbow score between the groups

	Liver pool Elbow Score	
Independent Sample T-test		
	Pre-treatment	Post-treatment
SWD + Maitland Mobilization + Ice (n=15)	9.86 ± 3.06	46.33 ± 5.09
Maitland Mobilization + Ice (n= 15)	10.06 ± 3.45	20.20 ± 2.80
P-value	868	0.00

Table 4: Liver pool elbow score within groups

	Pre-treatment	Post-treatment	P-value
SWD + Maitland Mobilization + Ice (n=15)	9.86 ± 3.06	46.33 ± 5.09	0.00
Maitland Mobilization + Ice (n= 15)	10.06 ± 3.45	20.20 ± 2.80	0.00

DISCUSSION

The result of this study revealed that pulsed shortwave diathermy with mobilization and ice packs showed more improvement in pain and elbow ROM.

Current study shows that there were no harm effects i.e. pain, burning and discomfort reported when pulsed shortwave diathermy applied on surgically all implanted metal. It is safe to used pulsed short-wave diathermy in patient with implant. Patient never reported any type of harm effect other than soothing effect. In current study 27.12MHz pulsed shortwave diathermy used for 20 min with frequency P5= 300Hz, pulsed width= 400µs, the output power was on Dose=2 (50 W).

Many experts presumed that PSWD is contraindicated on the metal implant patients.[21]

Due to high power and non-uniform treatment fields, most of PSWD not safe to use over metal implant patients.

Many short-wave diathermies have high power and non-uniform treatment field, therefore not safe for the metal implant. A preliminary study showed that PSWD did not elevate the temperature of metal and surrounding tissue which enhance the injury.[22]

David O. Draper declared that PSWD with less than 100W power safe to apply over the metal implant. The circular wires absorb high amount of energy and act as an antenna to radio waves which cause tissue burning therefore pulsed short wave diathermy not safer on circular wire implants.[24]

David and Draper, (2014) showing the same result that the patient never reported any type of harm effect i.e pain, burning and discomfort.[21] Another study also showing the same result by David and Draper, (2017) to check that where pulsed shortwave diathermy be used over surgically implant metal in this, they reported that pulsed shortwave diathermy safe for metal implant when it is used at total power of 100W.[23]

After 6th session significant improvement occurs in pain scale but pulsed shortwave diathermy with mobilization group shows significantly improvement in pain as compare to mobilization alone.

PSWD provide the deep heating effect which increase the tissue extensibility, with mobilization reduce the joint stiffness and restore the joint play and accessory movement.[13]

Several case series and case report work on the pulsed short-wave diathermy to improve the elbow ROM with metal implant but no one (RCT) study on the effect of pulsed short-wave diathermy with metal implant in elbow joint to improve pain and ROM.

Leung MS, Cheing GL. 2008 showed that short wave diathermy with stretching is more effective in reducing pain and enhancing function of shoulder than superficial heating effect and stretching alone because short wave diathermy provides deep heating effect.[25]

In this study, PSWD with mobilization declared significant improvement in elbow ROM (flexion, extension) with metal implant. David and Draper, (2017) revealed in a case report that pulsed shortwave diathermy with mobilization is helpful in restoring elbow ROM after immobilization following injury or surgery with metal implant.[23] David and Draper, (2006) showed in case series that PSWD with mobilization increase ankle ROM with metal implant.[13] Restore the ROM after surgery with implant is difficult. Low watt PSWD is better in improving the elbow ROM especially extension with implant. Surgeon observe no side effect of PSWD after implant removal. After one-year patient perform recreational activity.

CONCLUSION

Pulsed shortwave diathermy with mobilization is more effective for the treatment of post- fracture elbow pain, stiffness and reduced disability as compared to only mobilization.

LIMITATIONS

This study was conducted in very short duration (lack of long-term follow-up) on a small sample size and not covered all the parameters like edema tissue response physiological response. Due to time shortage, it was not checked that how many sessions required to gain full ROM it was only limited to six sessions.

SUGGESTIONS / RECOMMENDATIONS

Further new and advance studies must be conducted with different types of mobilization should be compared to find out the most appropriate treatment for the post fractured elbow stiffness. The uses of different modes and frequencies as well as different shortwave modalities to check their effect on implant and stiffness. Long term follow-up sessions required for patient to estimate the

exact number of total sessions needed for complete restoration.

CONFLICT OF INTEREST / DISCLOSURE

None.

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