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PEMF AND Subacromial impingement

1Anuja pasari, 2Prof. BISMAY DAS

1Physiotherapist , 2Assistant professor , 3C.MOHANTY

1B.H.U.,

2Heritage ,

3B.H.U.

ABSTRACT

Background -Subacromial Impingement syndrome (SIS) is a common and disabling condition Pulsed electromagnetic therapy (PEMF) and ultrasonic therapy (US therapy) are proving adjuncts for enhancing fracture healing, reducing inflammation and symptom relief to varied extent in different reports. The benefits of above therapy regimens in SIS are comparatively evaluated in patients of our region.

Method – 162 patients sequentially enrolled following informed consent were administered PEMF, ultrasound therapy or exercise therapy daily for 3 weeks. Parameters examined were pain score, disability score and range of motion at shoulder joint.

Result – PEMF therapy significantly improve in pain score, disability score and range of motion.

Conclusion – PEMF therapy was found to yield significantly superior relief in patients of SIS.

Keywords – Subacromial impingement, ultrasound therapy, PEMF therapy, Exercise therapy.

Introduction –

Subacromial Impingement syndrome (SIS) is the most common cause of shoulder pain. Subacromial Impingement of rotator cuff tendon, the long head of biceps tendon and subacromial bursa between the humeral head, and the structure that make up the coracoacromial arch are among the most frequent problems leading to shoulder pain and consequent functional limitation.[1,2] Patients with SIS suffer from pain, weakness and loss of movement of the effected shoulder. [2]

The occurrence of SIS is associated with highly repetitive work, forceful exertion in work, awkward postures and high psychosocial job demand.[3]

Conservative and surgical strategies are used to treat SIS. Some authors report the effectiveness of surgical and postsurgical interventions for SIS. [4]The goal of non-surgical treatment is to decrease the subacromial inflammation, reduce the pain, allow healing of the compromised rotator cuff and restore satisfactory function of the shoulder.[5]Many treatment modalities including non-steroidal anti-inflammatory drugs (NSAID), physical therapy, activity modification and corticosteroid injections have been advocated to be of benefit in SIS.[6,7]

Pulsed electromagnetic field (PEMF) has been suggested as a treatment method for musculoskeletal system disorders.[8] but literature is non-conclusive about the treatment of shoulder pain. [9]Electromagnetic fields have shown to cause biological changes to the cell environment and restores its integrity and function. In addition to that, it increases membrane potentials of erythrocytes, increases oxygen content of tissue vasodilatation of blood vessels and relieves pain without increasing local temperature.[10]

Subject and Method -This study was conducted in patients referred to the physiotherapy department of S.S. Hospital, Banaras Hindu University during the period September 2018 to November 2019.

Selection Criteria –Patients aged 18 to 62 years complaining of shoulder pain were examined for presence of subacromial impingement syndrome based on positive tests.

1. Neer impingement test
2. Hawkins Kennedy impingement test
3. Copeland impingement test

Patients were grouped as follows

Group 1- Exercise therapy (n=54)

Group 2- Ultrasound +Exercise therapy (n=54)

Group 3- PEMF +Exercise therapy (n=54)

Each intervention will be administered daily for three weeks. Informed written consent was taken from the patients and ethical clearance was obtained from appropriate authority.

Exclusion criteria – Primary scapulothorasic dysfunction due to paresis, Diagnosed instability or previous history of dislocation, Adhesive capsulitis, any history of shoulder surgery, Avascular necrosis, glenoid development defects, degenerative signs affecting inter articular, Space and fractures.

All patients were subjected to detailed history, clinical examinations including pain score disability score and range of motions.

Pain intensity: - was measured on visual analogue scale (VAS) of 10 paints to evaluate intensity of pain where '0' represents no pain and '10' represents unbearable pain.[11]

Shoulder disability index: was measured using shoulder disability index. It was measured in various activities involving shoulder. Score was calculated out of 10. In which worse higher end reflecting "So difficulty required help" and lower score as "no difficulty".[12]

[Table/Fig-1]

Shoulder movement: - was measured with the help of universal goniometer. The axis of goniometer was placed at 2.5cm inferior to the lateral aspect of the acromion process for shoulder flexion extension; at 1.3cm inferior and lateral to the coracoid process for shoulder adduction abduction and at the olecranon process of the ulna for shoulder rotation.[13]

Treatment -

Group 1: Exercise therapy: – In order to restore muscular deficits in strength, mobility and coordination of rotator cuff and shoulder girdle muscle, standard exercise protocol and manual therapy were given. At the beginning of the treatment, all the participants were given a brief explanation on anatomy and biomechanics of shoulder complex and a short description of the etiology and pathology of SIS.

The treatment in the first week aimed at reducing the pain intensity and to prevent further damage and consist of manual therapy techniques such as joint mobilization techniques and transverse friction massage and shoulder pendulum exercise.

The second and third week aimed restoring the functional level by increasing range of motion, muscle strength and flexibility and consists of range of motion exercises with rope and pulley, L-bar exercises, self capsular stretching exercises, joint mobilization techniques and transverse friction massage and shoulder pendulum exercises. Treatment was given for 40 minutes, over a period of 3 consecutive weeks (6 days per week).

Group 2: Ultrasound therapy + Exercise therapy: - Participants of this group received pulsed ultrasound for 5 minutes with a device that was operated at a frequency of 1 MHZ and an intensity of 1 W/cm^2. The treating physiotherapists using the technique of slow circular movements applied the transducer head over the superior and anterior regions of the participant's glenohumeral joint and on the shoulder trigger points. This is in addition to standard exercise and manual therapy as given in group 1. . Treatment was given for 5 minutes, over a period of 3 consecutive weeks (6 days per week).

Group 3: PEMF Therapy +Exercise therapy: - Participants of this group received pulsed electromagnetic field therapy at 26 Hz frequency, 65 microseconds pulse duration and 200 W pulse power. It was placed in closed contact with the area to be treated. . Treatment was given for 15 minutes; over a period of 3 consecutive weeks (6 days per week).The device directs radio frequency waves to the area to be treated.

Result - The findings show that pain and disability have improved best in third group followed by group 2 and group1, respectively. The improvements in individual movements of the joint were also seen and were more prominent in the third group followed by second and first group.

COMPARETIVE IMPROVEMENT AS PERCENTAGE CHANGE IN SYMPTOMS SCORES IN ALL GROUPS (n= 54 in each group)

[Table/Fig-2]

	EXERCISE THERAPY	ULTRASOUND THERAPY	PEMF THERAPY	p-value
PAIN Score VAS	**14.05± 8.58**	**35.22± 20.40**	**35.62 ± 22.15**	**<.001**
Disability Score	**15.07± 10.2**	**36.14 1± 8.83**	**37.42 ± 23.2**	**<.001**
ROM				
Flexion	**9.9± 5.7**	**24.2 ± 25.1**	**30.34 ± 23.97**	**<.001**
Extension	**20.8± 29.4**	**80.3 ± 88.4**	**87.96± 83.15**	**<.001**
Adduction	**42.59 ± 44.9**	**66.98 ± 61.1**	**80.3 ± 88.4**	**0.02**
Abduction	**10.5± 7.4**	**27.7 ± 37.8**	**32.4 ± 37.06**	**0.001**
Internal rotation	**35.6 ± 37.6**	**55.81 ± 74.2**	**66.5±77.4**	**0.05**
External rotation	**30.4± 31.5**	**32.87 ± 34.1**	**58.89 ± 83.6**	**0.015**

[Table/Fig-3]

	EXERCISE THERAPY	ULTRASOUND THERAPY	P-VALUE
PAIN Score VAS	**14.05± 8.58**	**35.22± 20.40**	**<.001**
Disability Score	**15.07± 10.2**	**36.14 1± 8.83**	**<.001**
ROM **Flexion**	**9.9± 5.7**	**24.2 ± 25.1**	**<.001**
Extension	**20.8± 29.4**	**80.3 ± 88.4**	**<.001**
Adduction	**42.59 ± 44.9**	**66.98 ± 61.1**	**<.001**
Abduction	**10.5± 7.4**	**27.7 ± 37.8**	**<.001**
Internal rotation	**35.6 ± 37.6**	**55.81 ± 74.2**	**0.017**
External rotation	**30.4± 31.5**	**32.87 ± 34.1**	**0.008**

[Table/Fig-4]

	ULTRASOUND THERAPY	PEMF THERAPY	P-VALUE
PAIN Score VAS	35.22± 20.40	35.62 ± 22.15	0.90
Disability Score	36.14 1± 8.83	37.42 ± 23.2	0.717
ROM Flexion	24.2 ± 25.1	30.34 ± 23.97	0.123
Extension	80.3 ± 88.4	87.96± 83.15	0.582
Adduction	66.98 ± 61.1	80.3 ± 88.4	0.95
Abduction	27.7 ± 37.8	32.4 ± 37.06	0.42
Internal rotation	55.81 ± 74.2	66.5±77.4	0.41
External rotation	32.87 ± 34.1	58.89 ± 83.6	0.017

[Table/Fig-5]

	EXERCISE THERAPY	PEMF THERAPY	P-VALUE
PAIN Score VAS	14.05± 8.58	35.62 ± 22.15	<.001
Disability Score	15.07± 10.2	37.42 ± 23.2	<.001
ROM Flexion	9.9± 5.7	30.34 ± 23.97	<.001
Extension	20.8± 29.4	87.96± 83.15	<.001
Adduction	42.59 ± 44.9	80.3 ± 88.4	<.001
Abduction	10.5± 7.4	32.4 ± 37.06	<.001
Internal rotation	35.6 ± 37.6	66.5±77.4	<.001
External rotation	30.4± 31.5	58.89 ± 83.6	<.001

Effect of interventions observed in various study parameters in exercise group

[Table/Fig-6]

	EXERCISE THERAPY before treatment	EXERCISE THERAPY after treatment	Mean difference	t-VALUE
PAIN Score VAS	6.67± 1.5	5.7± 1.44	0.92± 0.54	12.5
Disability Score	6.35± 1.56	5.43± 1.51	0.92± 0.54	12.5
ROM Flexion	107.41± 20.67	± 117.59 ±21.36	10.19± 4.5	15.12
Extension	22.59± 8.28	26.9± 10.6	4.3± 4.9	6.27
Adduction	14.0±7 5.0	19.26± 6±.7	5.2 ±5.0	7.6
Abduction	101.48± 26.09	111.30± 26.56	19.58± 5.67	12.74
Internal rotation	31.67± 16.7	38.5±2 16.53	6.85 ±4.69	10.74
External rotation	43.7± 22.13	51.57 ±21.14	7.87 ±4.51	12.81

Effect of interventions observed in various study parameters in ultrasound group

[Table/Fig-7]

	Ultrasound therapy before treatment	Ultrasound therapy after treatment	Mean difference	t-VALUE
PAIN Score VAS	7.3± 1.14	4.7± 1.74	2.6 ±1.74	11.1
Disability Score	7.07± 1.34	4.52± 2.03	2.56 ±1.62	11.6
ROM Flexion	120.74 ±26.34	145.74 ±22.37	25.0 ±18.19	10.09
Extension	25.19± 9.86	40.6 ±13.09	15.37± 11.9	9.5
Adduction	15.19± 5.74	23.52 ±6.5	8.33± 5.74	10.65
Abduction	114.64± 27.25	139.07± 21.30	24.44 ±19.59	9.17
Internal rotation	39.44 ±15.09	54.63± 11.93	15.18 ±10.4	10.71
External rotation	54.26± 16.89	70.56 ±12.8	16.29 ±11.04	10.84

Effect of interventions observed in various study parameters in PEMF group

[Table/Fig-8]

	PEMF Therapy before treatment	PEMF Therapy after treatment	Mean difference	t-VALUE
PAIN Score VAS	7.3± 1.27	4.78± 1.73	2.54 ±1.44	12.97
Disability Score	7.09 ±1.5	4.61 ±1.93	2.5± 1.33	13.7
ROM Flexion	111.11± 26.5	141.11 ±25.3	30.0± 17.38	12.7
Extension	24.26 ±11.1	39.07 ±11.54	14.82± 9.1	12.02
Adduction	15.56 ±6.04	23.89 ±6.27	8.33 ±6.07	10.1
Abduction	108.15± 33.03	135.37± 28.33	27.22 ±18.16	11.01
Internal rotation	34.67 ±17.10	50.09± 15.72	16.11± 8.6	13.83
External rotation	48.15 ±22.4	66.6±7 17.9	18.52± 8.78	15.51

Discussion -

Subacromial Impingement Syndrome (SIS) is a common and disability condition. Among the patients refer for physiotherapy, a quarter of cases show positive results to be labeled as subacromial impingement syndrome.(Morrison DS, Frogameni AD, Woodworth P)Our result showed ultrasound therapy and PEMF therapy in combination to exercise therapy were significantly better in pain relief, disability control, improvement of range of motion and muscle power. Improvements in pain, disability, individual movements of joint and muscle power were best improved in third group (group 3).

Electromagnetic energy of ultrasound therapy device has been reported to cause functional as well as structural changes of potential benefit in traumatic and inflammatory states.[14,15]

There is no sufficient clarity on mechanism how ultrasounds cause therapeutic effect in injured tissue. There is suggestion that thermal effects of ultrasound aid in pain relief as well as resolve the inflammatory reaction.[16] there are many studies that show benefits of manual therapy and exercise therapy in relief of shoulder pain.[17]

However these studies had much longer treatment duration of motor control and strengthening exercises. In general there are conflicting reports on benefits of ultrasound therapy. Studies suggest better assessment of individual patients to monitor outcomes of the interventions.[18]

PEMF therapy was also equally effective in control of pain, disability and improvement in range of motion.[19] PEMF is unique energy therapeutics. This boosts ATP formation and ATP driven cellular functions like proper transmembrane ion kinetics and repair processes of injured cells. In addition, there is inhibitory effect of PEMF on inflammation. It also improves microcirculation, opening of capillaries and stimulating contractile element. This may explain removal of pain causing chemical disturbances from site of inflammation and trauma.[19]

Overall the study reaffirms the utility of either therapeutic modality in subacromial impingement. It is however recommended on the basis of study that PEMF would be preferred more for better improvement in symptoms and functional recovery.

Conclusion -

Both ultrasound and PEMF produce improvement in subjective pain, disability, range of motion and functional recovery. PEMF therapy is significantly effective in yielding symptomatic and functional improvement over the same period of therapy then ultrasound or exercise therapy. PEMF therapy is hence recommended and preferred modality for treatment of SIS.

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