COMPARATIVE STUDY OF THERAPEUTIC EFFECT OF PULSED ELECTROMAGNETIC FIELD & LASER THERAPY IN TREATMENT OF PRIMARY PERIARTHRITIS SHOULDER

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ABSTRACT

Objective: *To compare the therapeutic effect of pulsed electromagnetic field (PEMF), laser and their combination in the treatment of primary periarthritis shoulder.*

Methodology: *Forty five patients with primary periarthritis shoulder were included in this study. They were divided randomly into 3 groups according to the line of treatment (15 patients each). Group I: treated by PEMF with intensity of 3 mT and frequency of 4 Hz for 20 minutes per session. Group II: treated by GaAiAr IR-diode laser therapy of 880 nm wave length with a dose equal to 1 joule/cm^2 for 20 minutes per session. Group III: treated by combination of PEMF and laser in the same time and same parameters of the previous 2 groups. The patients of the 3 groups were subjected to exercise program. The sessions were continued for 2 months, 3 times per week. The follow up period was 2 months during which the patients were instructed to continue their exercise program at home.*

Results: *In the 3 studied groups there was statistically significant improvement in all shoulder parameters (pain, tenderness, range of motion and function) after treatment and in the follow up period compared to before treatment. The comparison of improvement in all shoulder parameters after treatment and follow up revealed statistically significant difference among the 3 studied groups with best improvement was in group III followed by group II, and lastly group I.*

Conclusions: *PEMF therapy, laser therapy and their combination have proved to be efficient physical modalities for treating primary periarthritis shoulder. They lead to improvement in all shoulder parameters. Also, they are safe and have long lasting effects.*

INTRODUCTION

Periarthritis shoulder is a disorder characterized by pain and loss of active and passive motion in the shoulder of middle aged individual *(Ellenbecker et al., 1996).*

It has typically been classified into two forms, primary and secondary. In the primary or idiopathic form, no known precipitating event can be identified. The secondary form is associated with or attributable to other illness or events such a trauma, diabetes mellitus, thyroid disease, cardiac disease & surgery, neurological disease as hemiplegia and pulmonary disease as pulmonary carcinoma *(Warner, 1997).*

Three clinical stages of the disease have been described: freezing, frozen and thawing. The freezing stage lasts from onset up to 10-36 weeks and is characterized by the most severe pain and a gradual diminution of the articular movement. The frozen stage lasts between 4-12 months, pain decreases gradually but without appreciable improvement in motion. The thawing phase is marked by gradual return of motion and may be as short as 12 months but may lasts 4 years *(Binder et al., 1984).*

The study of anatomic, histologic, and surgical specimens from subjects affected by idiopathic periarthritis shoulder have demonstrated that, although the glenohumeral joint synovial capsule often is involved in this disease process most of the significant loss of range of motion (ROM) that result from this pathology comes from disease in structures outside the glenohumeral joint synovial capsule (e.g. coraco-humeral ligament, surrounding soft tissues, subacromial bursa *(Bunker, 1997).*

Several physical therapy methods have been applied including pulsed ultrasound, interferential electrotherapy, short wave, intra-articular corticosteroid injection *(Corbell et al., 1992)*, shoulder manipulation under general anesthesia and joint mobilization technique e.g. Neil Asher Technique *(Winters et al., 1997).*

Pulsed electromagnetic field (PEMF) is a new modality in treating musculoskeletal pain. It tends to accelerate the recovery and minimize the rehabilitation time *(Ramey, 1998).* It has become an important mode of

therapy in alternative medicine sport related injuries and other musculoskeletal disorders *(David & Trock, 2000).* Pulsed electromagnetic field has become recently used to treat many cases of musculoskeletal diseases as osteoarthritis, tendonitis and periarthritis shoulder due to its safety, efficacy and noninvasiveness *(Quittan, 2000).*

There are many physiological effects of PEMF as analgesic and anti-inflammatory effects. It can induce analgesia via suppression of inflammation, removal of irritating toxins by enhancing circulation and induce muscle relaxation by influencing ionic reflux *(Lee et al., 1997).* Also PEMF stimulates opioid receptors, increases encephalon's inhibitor and normalizes the dysfunctioned neurons *(Thomas, 1997).*

As regards the anti-inflammatory effect, PEMF alters the cell membrane potential and influences ionic fluxes. It also enhances microcirculation thus inflammatory edema formation is decreased (Yen-Patton et al., 1988). Also, it decreases the number of circulating neutrophils and increases macrophage cell volume and phagocytic activity *(Mix, 1990).*

Low level laser therapy (LLLT) is also a new modality for the relief of musculoskeletal pain, reducing tissue edema and breaking pain cycle *(Servier and Wilson, 1999).* It has been found to be promising in treating patients with periarthritis shoulder *(Bjordal et al., 2003).*

The aim of this study was to compare the therapeutic effect of pulsed electromagnetic field, laser and their combination in treating cases of primary periarthritis shoulder.

PATIENTS AND METHODS

This study was carried out on 45 patients with primary periarthritis shoulder. They were collected from the outpatient clinic of Physical Medicine & Rehabilitation Department, Tanta University Hospitals. They were diagnosed according *to Waldburger et al., criteria (1992),* which are:

1. Spontaneous onset of pain localized to the shoulder region. The pain is increasing in severity and usually worse at night.
2. Localization of impaired movement to glenohumeral joint exclusively.
3. Limitation of shoulder abduction and external rotation by at least 40%.
4. No clinical or radiological identifiable lesion of the shoulder and no demonstrable cause of shoulder pain.
5. Results of routine laboratory examination are within normal.

Secondary causes as diabetic, post traumatic, cardiac and hemiplegic periarthritis shoulder *(Cuomo, 1999)* were excluded from the study. Also, patients with shoulder pain due to causes other than periarthritis of the shoulder *(Weber & Brown, 2004),* patients with contraindication to electromagnetic field *(Quittan, 2000 and Burkhart et al., 1999),* or laser therapy were excluded from the study *(Bjordal et al., 2003).*

All patients were not allowed to take analgesics or NSAIDs during the study and follow up periods.

Patients were divided into 3 groups according to the line of treatment:

Group I: Included 15 patients treated by a course of PEMF therapy with intensity of 3 mT and a frequency of 4 Hz for 20 minutes per session using the inductive technique the combetron applicator 1cm away from the shoulder surface.

Group II: Included 15 patients treated by a course of GaAIAr IR-diode laser therapy of 880 nm wave length with a dose equal to 1 joule/cm^2 and a frequency of 1000 Hz, pulsed with 1:1 sec. interval for 20 minutes per session using the scanning technique by the combetron applicator 1cm away from the shoulder surface.

Group III: Included 15 patients treated by combination of PEMF therapy and laser therapy in the same time and the same parameters using the combetron applicator 1cm away from the shoulder surface.

Pulsed electromagnetic field therapy, laser therapy and combination therapy of both were done by the same apparatus, magnetic- bio stimulation- mbs system (Biotron/ Combetron).

All patients of the 3 groups were instructed to do active and active assistive exercises for their shoulder joints. Also, stretching of the shoulder joint was done on bed and by instruments (shoulder wheel, over head pulley and stall bar).

The session of the 3 groups continued for 2 months. During the first week, sessions were done daily, then 3 times per week. Follow up period was 2 months during which the patients were instructed to continue doing active and active assistive exercises for their shoulder joints at home.

I- All patients were subjected to:

- Detailed history taking.
- Complete clinical and neurological examination.

- Investigations: x-ray of the cervical spine (antero-posterior and lateral views) and shoulder joint and laboratory tests as ESR, blood sugar tests (fasting & post prandial) were done for all patients to exclude 2ry causes of periarthritis shoulder.

II- Assessment of patients:

1- Assessment of pain at rest and during activity by visual analogue scale (VAS) *(Duncan et al., 1989).*

2- Grades of tenderness *(Hubbard & Berkoff, 1993)* were examined by forceful pressure lateral and inferior to the coracoid process while the arm in zero position of abduction. It was then graded as follow:

- Grade 0: No tenderness.
- Grade I: Tenderness to palpation without grimace.
- Grade II: Tenderness with grimace to palpation.
- Grade III: Tenderness with withdrawal + jump sign.
- Grade IV: Withdrawal + jump sign to non-noxious stimuli (i.e. superficial palpation, pin prick, gentle percussion).

3- Goniometric assessment of active and passive ranges of shoulder movements *(McRae, 1997)* (abduction, flexion, extension, internal rotation in abduction position at 90^{o} and external rotation in abduction position at 90^{o}).

4- The shoulder disability questionnaire (SDQ) *(van der Windt et al., 1998)*: The SDQ is a pain related questionnaire that contains 16 items describing common situations that may induce symptoms in patients with shoulder disorders. Response options are either "yes", "no" or “not applicable". The "not applicable" category should be used when the situation at tissue has not occurred during the preceding 24 hours. A final score is calculated by dividing the number of positively scored items by the total number of applicable items and subsequently multiplying the score by 100, resulting in final score ranging between 0 (no disability) and 100 (all applicable items positive).

All patients were evaluated by VAS, grades of tenderness, goniometric measurements of active and passive shoulder movements and by SDQ before, after treatment and 2months later as follow up.

Statistical analysis:

The analysis of the present study was performed by SPSS windows (version 11) using mean, standard deviation, Student's t test (paired & unpaired) and Chi-Square test.

RESULTS

Table (1): Preliminary data of patients of the three studied groups.

Personal characteristics	Group I (PEMF)	Group II (Laser)	Group III (combination)	Total	p
Number	15	15	15	45	
Age in years: Range Mean ± SD	 35-65 51.0±10.06	 32-72 53.4±10.7	 40-59 49.2± 5.9	 32-72 51.2± 9.1	>0.05
Sex: Male Female	 6 (40%) 9 (60%)	 5 (33.3%) 10 (66.7%)	 6 (40%) 9 (60%)	 17 (37.8%) 28 (62.2%)	>0.05
Duration of complaint in months: Range Mean ± SD	 3.00-7.00 4.4 ± 1.2	 3.00-5.00 3.8 ± 0.9	 2.00-7.00 4.1 ± 1.3	 2.00-7.00 4.1 ± 1.1	>0.05
Affected arm: Non-dominant Dominant	 9 (60%) 6 (40%)	 10 (66.7%) 5 (33.3%)	 9 (60%) 6 (40%)	 28 (62.2%) 17 (37.8%)	>0.05

There were insignificant differences between the three studied groups regarding age, sex, duration of the disease and the affected arm.

Table (2): Clinical parameters of patients of the three studied groups before treatment.

Parameter	Group I		Group II		Group III	
	No.	%	No.	%	No.	%
Grades of tenderness: G 0 G I G II G III G IV	 6 9	 40% 60%	 5 10	 33.33% 66.66%	 6 9	 40% 60%
	Mean ± SD		Mean ± SD		Mean ± SD	
Pain during motion by VAS	9.4 ± 0.63		9.2 ± 0.88		9.1 ± 0.74	
Pain during rest by VAS	5.5 ± 1.7		5.2 ± 1.58		5.4 ± 1.6	
Range of shoulder abduction: active passive	 79.0 ± 6.6 85.2 ± 4.13		 81.6 ± 7.48 90.4 ± 3.21		 86.0 ± 4.14 87.5 ± 3.90	
Range of shoulder flexion: active passive	 84.33 ± 7.52 90.0 ± 3.65		 85.66 ± 5.3 91.8 ± 3.48		 88.0 ± 4.14 95.3 ± 3.1	
Range of shoulder extension: active passive	 29.6 ± 5.49 35.3 ± 4.6		 29.3 ± 3.71 36.9 ± 4.21		 29.3 ± 5.62 35.7 ± 4.54	
Range of shoulder internal rotation: active passive	 46.66 ± 5.56 55.3 ± 3.7		 51.33 ± 6.39 59.7 ± 3.11		 50.33 ± 6.67 58.0 ± 3.23	
Range of shoulder external rotation: active passive	 57.3 ± 7.28 65.3 ± 6.1		 58.8 ± 5.16 67.2 ± 5.75		 56.0 ± 6.60 64.5 ± 6.52	
Shoulder disability questionnaire score (SDQ)	93.6 ± 5.81		94.0 ± 6.12		93.0 ± 5.77	

Table (3): Evaluation of patients of the three studied groups after 2 months of treatment.

Parameter	Group I		Group II		Group III	
	No.	%	No.	%	No.	%
Grades of tenderness: G 0 G I G II G III G IV	10 5	66.66%* 33.33%	11 4	37.33%* 24.66%	10 5	66.66%* 33.33%
	Mean ± SD		Mean ± SD		Mean ± SD	
Pain during motion by VAS	4.73 ± 1.27*		3.0 ± 0.79*		2.4 ± 0.83*	
Pain during rest by VAS	3.33 ± 1.06*		1.4 ± 0.8*		1.0 ± 0.65*	
Range of shoulder abduction: active passive	129.6 ± 9.53* 132 ± 9.12*		152.0 ± 9.78* 156.4± 9.23*		162.0 ±7.03* 168.4 ± 6.86*	
Range of shoulder flexion: active passive	137.33 ± 2.08* 140.5 ± 11.9*		156.33 ± 8.57* 160.3 ± 8.12*		165.66 ± 7.03* 169.89 ± 6.85*	
Range of shoulder extension: active passive	45.0 ± 5.0* 48.9 ± 4.87*		50.6 ± 4.95* 54.9 ± 4.61*		56.3 ± 4.41* 62.5 ±4.02*	
Range of shoulder internal rotation: active passive	58.66 ± 5.81* 61.76 ± 5.43*		70.0 ± 7.55* 74.89 ± 7.1*		80.6 ± 4.57* 85.8 ± 4.1*	
Range of shoulder external rotation: active passive	71.6 ± 4.49* 76.54 ± 4.01*		79.6 ± 4.4* 84.76 ± 3.98*		86.0 ± 3.38* 92.6 ± 3.01*	
Shoulder disability questionnaire score (SDQ)	49.7 ± 7.59*		28.8 ± 7.03*		14.3 ± 4.95*	

*: Highly significant improvement compared to the basal values ($p < 0.001$).
There was highly significant improvement in the three studied groups ($p < 0.001$) after treatment compared to before treatment.

Table (4): Evaluation of patients of the three studied groups 2 months later as follow up.

Parameter	Group I		Group II		Group III	
	NO	%	NO	%	NO	%
Grades of tenderness: G 0 G 1 G II G III G IV	9 6	60%* 40%	10 5	66.66%* 33.33%	9 6	60%* 40%
	Mean ± SD		Mean ± SD		Mean ± SD	
Pain during motion by VAS	3.4 ± 1.4*		1.9 ± 0.9*		1.2 ± 0.6*	
Pain during rest by VAS	1.9 ± 1.1*		0.5 ± 0.3*		0.4 ± 0.3	
Range of shoulder abduction: active passive	 134.6 ± 9.9* 138.4 ± 9.23*		 155.6 ± 9.4* 159.0 ± 9.01*		 166.0 ± 6.9* 173.5 ± 6.2*	
Range of shoulder flexion: active passive	 140.6 ± 12.3* 145.5 ± 11.9*		 159.0 ± 9.2* 165.6 ± 8.78*		 168.3 ± 6.9* 174.0 ± 6.3*	
Range of shoulder extension: active passive	 47.3 ± 5.9* 51.7 ± 5.43*		 52.0 ± 6.7* 58.87± 6.23*		 57.0 ± 3.6* 62.6 ± 3.1*	
Range of shoulder internal rotation: active passive	 61.6 ± 4.8* 66.9 ± 4.34*		 73.3 ± 7.7* 77.6 ± 7.12*		 84.3 ± 3.1* 90.3 ± 2.98*	
Range of shoulder external rotation: active passive	 73.6 ± 6.5* 77.6 ± 6.01*		 80.8 ± 4.9* 86.8 ± 4.2*		 87.1 ± 3.7* 93.8 ± 3.1*	
Shoulder disability questionnaire score (SDQ)	43.8 ± 6.9*		25.1 ± 5.7*		11.4 ± 1.6*	

*: Highly significant improvement compared to the basal values ($p < 0.001$).
There was highly significant improvement in the three studied groups after two months follow up compared to before treatment.

Table (5): Comparison of improvement in shoulder parameters before and after treatment among the 3 studied groups (using the mean of mean difference).

Parameter	Groups		Groups		Groups	
	I	II	II	III	I	III
	Mean ± SD		Mean ± SD		Mean ± SD	
Grades of tenderness:	1.6 ± 0.5	1.7 ± 0.45	1.7 ± 0.45	2.2 ± 0.45	1.6 ± 0.5	2.2 ± 0.45
Pain during motion by VAS	4.6 ± 1.2	6.2 ± 1.2*	6.2 ± 1.2	6.6 ± 1.1*	4.6 ±1.2	6.6 ± 1.1*
Pain during rest by VAS	5.1± 0.9	6.5 ± 1.3*	6.5 ± 1.3	6.9 ± 0.5*	5.1 ± 0.9	6.9 ± 0.5
Range of shoulder abduction: active passive	 50.0 ± 7.3 53.2 ± 7.1	 71.2±13.3* 75.2±12.9*	 71.2 ± 13.3 75.2 ±12.9	 75.5 ± 8.3* 78.4 ± 8.1*	 50.0 ± 7.3 53.2 ± 7.1	 75.5 ± 8.3* 78.4 ± 8.1*
Range of shoulder flexion: active passive	 53.3 ± 12.5 55.4± 12.	 70.6±9.03** 74.1±9.1**	 70.6± 9.03 74.1± 9.1	 77.6 ± 7.2** 80.2± 7.1**	 53.3± 12.5 55.4± 12.1	 77.6±7.2** 80.2±7.1**
Range of shoulder extension: active passive	 15.3 ± 6.3 18.2± 6.1	 21.3 ± 5.4* 25.7± 5.1*	 21.3± 6.3 25.±7 5.1	 27.0 ± 5.2* 30.2 ± 4.9*	 15.3± 6.3 18.2 ± 6.1	 27.0 ± 5.2** 30.2 ± 4.9**
Range of shoulder internal rotation: active passive	 12.0± 5.9 15.3 ± 5.4	 18.6 ± 8.1** 20.6 ± 7.9**	 18.6 ± 8.1 20.6± 7.9	 30.3± 7.1** 33.6± 6.9**	 30.3 ± 7.1** 15.3± 5.4	 12.0± 5.9 33.6± 6.9**
Range of shoulder external rotation: active passive	 14.3 ± 5.6 18.6± 5.1	 21.0±6.03** 25.2± 5.9**	 21.0± 6.03 25.2 ± 5.9**	 30.0 ± 5.6** 33.2 ± 5.2**	 30.0± 5.6** 18.6 ± 5.1	 14.3± 5.6 33.2± 5.2**
Shoulder disability questionnaire score (SDQ)	43.8 ± 10.2	65.1± 9.7**	65.1± 9.7	78.7± 5.9**	43.8 ± 10.2	78.7 ±5.9**

*: Significant improvement ($p < 0.05$).
**: Highly significant improvement ($p < 0.001$).

Table (6): Comparison of improvement in shoulder parameters before treatment and two months later as follow up among the 3 studied groups (using the mean of mean difference).

Parameter	Groups		Groups		Groups	
	I	II	II	III	I	III
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Grades of tenderness:	1.8± 0.63	2.3± 0.61	2.3± 0.61	2.4 ± 0.5	1.8 ± 0.63	2.4 ± 0.5
Pain during motion by VAS	5.9 ± 1.4	7.3 ± 1.5*	7.3 ± 1.5	7.9 ± 1.09*	5.9 ± 1.4	7.9 ± 1.09*
Pain during rest by VAS	6.3 ± 1.1	7.3 ± 1.29	7.3 ± 1.29	7.4 ± 0.9*	6.3 ± 1.1	7.4 ± 0.9*
Range of shoulder abduction: active passive	 54.6 ± 8.2 59.3 ± 7.9	 74.6 ± 2.7* 79.3± 11.9*	 74.6 ± 2.7 79.3 ± 11.9	 79.6 ± 8.6* 82.1 ± 8.2*	 54.6 ± 8.2 59.3 ± 7.9	 79.6 ± 8.6* 82.1± 8.2*
Range of shoulder flexion: active Passive	 56.3 ± 13.6 59.2 ± 13.1	 73.3 ± 8.9** 76.2 ± 8.2**	 73.3 ± 8.9 76.2 ± 8.2	 80.3 ± 7.8** 84.3 ± 7.3**	 56.3 ± 13.6 84.3 ± 7.3**	 80.3 ± 7.8** 59.2 ± 13.1
Range of shoulder extension: active passive	 17.6 ± 5.9 20.3 ± 5.1	 22.6±7.03* 25.9 ± 6.9*	 22.6 ± 7.03 20.3 ± 5.1	 27.6±7.03* 30.2 ± 6.8*	 17.6± 5.9 20.3 ± 5.1	 27.6±7.03** 30.2 ± 6.8**
Range of shoulder internal rotation: active passive	 15.0 ± 5.6 17.4 ± 5.3	 22.0 ± 7.5** 25.2 ± 7.1**	 22.0 ± 7.5 25.2 ± 7.1	 34.0±8.06** 37.3 ± 8.1**	 15.0 ± 5.6 17.4 ± 5.3	 34.0±8.06** 37.3 ± 8.1**
Range of shoulder external rotation: active passive	 18.3 ± 7.7 20.4 ± 7.1	 22.0 ± 7.2* 25.1 ± 6.9*	 22.0 ± 7.2 25.1 ± 6.9	 29.6± 6.6** 32.4± 6.2**	 18.3 ± 7.7 20.4 ± 7.1	 29.6 ± 6.6** 32.4 ± 6.2**
Shoulder disability questionnaire score (SDQ)	49.8 ± 9.6	68.8 ± 8.6**	68.8 ± 8.6	81.6 ± 5.4**	49.8 ± 9.6	81.6 ± 5.4**

*: Significant improvement ($p<0.05$).
**: Highly significant improvement ($p< 0.001$).

There was a statistically significant difference in the improvement of all shoulder parameters on comparing the 3 studied groups after treatment and follow up except grades of tenderness which showed insignificant difference among the 3 groups. The best improvement was in group III, then group II and lastly groups I (Tables 5, 6)**.**

DISCUSSION

Periarthritis shoulder is characterized by an insidious and progressive loss of active and passive mobility in the glenohumeral joint presumably due to capsular contracture *(Bunker & Anthony, 1995).*

There are two categories of adhesive capsulitis: primary and secondary *(Murnaghan, 1990)*. Several physical therapy methods have been applied including pulsed ultrasound, bipolar interferential electrotherapy, laser therapy, short wave, pulsed magnetic field, intra-articular injection, shoulder manipulation under general anesthesia, manipulative treatment and joint mobilization techniques *(Sartucci, 1997)*

Forty five cases with primary periarthritis of the shoulder were included in this study. Their ages ranged between 32 to 72 years, with a mean of 51.2 ± 9.1 years. Twenty seven were females (60%) and 18 were males (40%) (table, 1). This is in agreement with *Dahan & Roy (2005) and Pearsall (2002)* who stated that periarthritis of the shoulder affects patients aged 40-70 years, with males tend to be affected less frequently than females.

In 17patients (37.77%) the dominant arm was affected while the non-dominant arm was affected in 28 (62.22%) patients (table, 1). This is in agreement with *Fareed & Gallivan (1989)* who stated that the non-dominant arm is more likely to be involved in periarthritis shoulder. Non significant difference was found among the three studied groups as regards age, sex, duration of the complaint and the affected arm (table, 1).

As regards shoulder tenderness there was highly significant improvement of degrees of tenderness ($p<0.001$) after treatment (table, 3) and in the follow up period (table 4) when compared to before treatment in the 3 studied groups.

Regarding mean values of pain score by VAS during shoulder rest and motion, there was highly significant improvement ($p<0.001$) after treatment (table, 3) and in the follow up period (table 4) compared to before treatment in the 3 studied groups.

Also, in the 3 studied groups we found highly significant improvement ($p<0.001$) in all active and passive shoulder movements after treatment and in the follow up period compared to before treatment (tables 3, 4).

Regarding shoulder functions measured by the SDQ, the initial mean values in the 3 groups were high denoting severe disability. After therapy and the follow up, the mean values of SDQ markedly decreased and this reduction is statistically significant compared to before treatment (tables 3, 4).

Our results in group I are in agreement with *Rigato et al. (2002)* who compared the analgesic and therapeutic effects of PEMF of 100 Hz with modulated electromagnetic field on patients suffering from periarthritis shoulder. They concluded that PEMF was effective in reducing pain and improving range of motion in periarthritis shoulder.

Paternostro-Sluga & Zoch (2004) stated that PEMF was used as conservative treatment in shoulder problems aiming at improving the local dysfunction of the shoulder joint. Also, *Quittan (2000)* conducted a computer-assisted search to verify the efficacy of PEMF on various diseases including periarthritis shoulder. Clinical trials with at least one control group were selected. The action on pain alleviation of electromagnetic fields was confirmed in most of the trials. Application time varied between 15 -24 minutes per day for three weeks up to eighteen months. Patients were treated with PEMF of 0.2 mT to 10 mT with a frequency between 12 and 100 Hz.

Binder et al. (1984) at their randomized double-blind study which was designed to assess the effect of PEMF stimulation (73 Hz; 2.7mT) on individuals suffering from rotator cuff tendonitis demonstrated the ability of PEMF stimulation to reduce pain and increase activity. They found that more than 70% of the patients in their study improved following PEMF therapy.

Sansverino et al. (1992) at their large 11- year experimental study treated 3014 patients suffering from joint diseases (such as periarthritis shoulder and knee osteoarthritis) with extremely low frequency low intensity magnetic field (0.6 T/s-1.2 T/s). Patients were given one 15-40 minute session daily for 10-15 days to assess the effects of the pulsed magnetic field exposure on healing of the joints and associated pain level. They explained that 78.8% showed good results (i.e. pain disappearance,

40-50% increase in degree of freedom of the sick joint) and that benefits are maintained for at least 3 months.

Markove & Colbert, (2001) reported that the main indication for the use of PEMF was to relieve pain and tenderness of the musculoskeletal system.

The beneficial effects of PEMF on shoulder tenderness, pain score, range of motion and function were attributed to the PEMF which stimulate the cell membrane *(Bassett, 1993 and Vassilenko & Vassilenko, 1997)* resulting in:

Increases the threshold of pain perception. Short term effects are thought to be due to decrease in cortisol and noradrenaline and an increase in serotonin, endorphins and encephalin. Longer term effects may be due to CNS and peripheral nervous system modulation.

Increases electric capacity of muscular fibers which induce muscular relaxation and help to decrease pain and increase the range of motion.

Increases blood flow which is necessary for tissue oxygenation and washing waste products that cause irritation to pain nerve endings.

Dedifferentiation of fibroblast cells and some types of precursor endothelial cell types into embryonic looking cells resulting in decrease the scar tissue formation.

As regards group II, our results agreed with *Taverna et al. (1990)* who used pulsed diode laser GaAr 904 nm for treatment of 40 patients with periarthritis shoulder. They showed that laser therapy is more effective than placebo as it produced improvement in VAS scores and shoulder motion.

Bjordal et al. (2003) investigated the effect of laser therapy on musculoskeletal pain in cases with chronic joint disorders such as periarthritis shoulder and found a significant difference in the pain score (by VAS) and the global health status in favor of the active laser therapy groups. *England et al. (1989)* compared three treatments: low level infrared laser (5 minutes 3 times weekly for 2 weeks), sham laser and naproxen for 20 patients with rotator cuff tendonitis and found that laser significantly reduced pain after 2 weeks compared with sham laser.

The significant improvement in shoulder tenderness, pain score, range of motion and function could be attributed to multiple effects of laser as:

Increased superoxide dehydrogenase enzyme activity in the tissues. This enzyme acts as a scavenger of superoxide radicals resulting in

reduction in the formation of prostaglandin and consequently there is pain reduction *(Tam, 1999).*

Laser therapy changes the potential of nerve cell membranes leading to its hyperpolarization which is a good analgesic mechanism *(Harris & Calvert, 2003).*

Laser increases the level of serotonin and other endogenous neurotransmitters, producing analgesic effects as well as stimulation of the central descending inhibitory system reducing pain sensation *(Tam, 1999).*

Laser leads to relaxation of muscle tension and increase of pressure pain threshold. It activates acupuncture points *(Tam, 1999).*

The role of laser therapy in healing is achieved through accelerating m RNA transcription rate of collagen gene consequently increases the activity of fibroblast resulting in collagen synthesis *(Vargas, 2006).*

Laser improves microcirculation leading to vasodilatation *(Vargas, 2006).*

Laser reduces swelling by enhancing edema and hematoma formation *(Fulga et al., 1994).*

The results we obtained at combination therapy in group III may be due to the augmentation between the effects of both PEMF and laser.

Our results are agreed with *Mwafy et al. (2003)* who found that the combination therapy of PEMF and laser had better and more extended effects, regarding pain, tenderness and functions, when compared to either PEMF or laser in treating patients with tennis elbow.

The comparison of improvement in all shoulder parameters after treatment and in the follow up revealed statistically significant difference among the 3 studied groups except grades of tenderness; there was insignificant difference among the 3 groups (tables5, 6). The best improvement was in group III then group II and lastly group I as shown in (tables 4, 5)

Conclusion:

Pulsed electromagnetic field therapy, laser therapy and their combination had proved to be efficient modalities for the treatment of primary periarthritis shoulder. They led to improvement of tenderness, pain, active and passive ranges of motion and shoulder functions.

The combined therapy of PEMF and laser had better and more extended effects when compared to either of them alone.

Recommendations:

Recent physical modalities as PEMF therapy, laser therapy and their combination are recommended in treating cases of primary periarthritis shoulder as they are more efficient, safe and have lasting effects.

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دراسة مقارنة بين المجال الكهرومغناطيسي المتقطع و الليزر في علاج إلتهاب ما حول الكتف

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الغرض من البحث: الغرض من البحث هو دراسة مقارنه بين تأثير العلاج بالمجال الكهرومغناطيسي المتقطع والليزر وكليهما معاً في علاج حالات إلتهاب ما حول مفصل الكتف الأولي.

المادة وطرق البحث: تضمنت هذه الدراسة45 مريضا يعانون من إلتهاب ما حول مفصل الكتف الأولي و قد تم أخذ التاريخ المرضى بالتفصيل لهؤلاء المرضى وكذلك تم عمل تقييم إكلينيكى كامل مع الانتباه الخاص إلى:

إختبار معدلات الألم أثناء الراحة والحركة وإختبار درجة الإيلام بالضغط وقياس مدى الحركة الحرة والسالبة لإبعاد وثني وفرد ودوران الكتف للداخل والخارج بمقياس الزوايا ودرجة التأثر الوظيفي لمفصل الكتف بإستخدام (استبيان عجز الكتف). وهذا التقييم تم قبل، بعد شهرين من العلاج وبعد شهرين من إنتهاء الجلسات العلاجية كمتابعة.

وقد تم تقسيم المرضى بناءً على طريقة العلاج إلى ثلاث مجموعات كل مجموعة 15 مريض.

المجموعة الأولى: تم علاجها بواسطة المجال الكهرومغناطيسي المتقطع بجرعة 3 مللي تسلا 4هيرتز لمدة 20 دقيقة.

المجموعة الثانية: تم علاجها بواسطة الليزر بجرعة 1 جول/سم2, 1000هيرتز, متقطع1:1 ثانية لمدة 20 دقيقة.

المجموعة الثالثة: تم علاجها بكل من الليزر والمجال الكهرومغناطيسي المتقطع معاً و بنفس الجرعات السابقة لمدة 20 دقيقة.

وقد خضعت المجموعات الثلاث إلى عمل تمرينات حرة وحرة مساعدة لمفصل الكتف وأيضا إلى مط لمفصل الكتف على السرير والأجهزة (عجلة الكتف وبكرة فوق الرأس وسلم الحائط)

وقد إستمرت هذه الجلسات لمدة شهرين وكانت الجلسات يوميا في أثناء الأسبوع الأول تلا ذلك ثلاث جلسات أسبوعيا.

النتائج: وقد أدت الدراسة إلي النتائج الآتية:-

لم توجد فروق ذات دلالة إحصائية في عمر ونوع المريض ومدة المرض والكتف المصاب بين المجموعات الثلاث.

كان التحسن في درجة الإيلام بالضغط و في درجة الألم أثناء الحركة وأثناء الراحة و التحسن في مدى الحركة الحر والسالب للكتف و التحسن في وظائف الكتف تحسنا ملحوظاً وذو

دلالة إحصائية بينة في المجموعات الثلاث بعد العلاج وفي نهاية فترة المتابعة عند مقارنتها بما قبل العلاج. وعند مقارنة هذا التحسن بين المجموعات الثلاث وجد أنه تحسنا ذو دلالة إحصائية.

أفضل النتائج وجدت في المجموعة الثالثة وتليها المجموعة الثانية ثم المجموعة الأولي.

ومن هذا البحث إستنتج الآتي:

العلاج بالمجال الكهرومغناطيسي المتقطع و الليزر وكليهما معاً ثبت أنه من الوسائل الفعالة لعلاج حالات إلتهاب الكتف الأولية مع وجود تحسنا ملحوظا وذو دلالات إحصائية بينة في درجة الألم ونسبة الإيلام و الحركة والوظيفة.

أظهرت النتائج أن إستخدام العلاج المدمج للمجال الكهرومغناطيسي المتقطع والليزر معاً أدت إلى نتائج أفضل في العلاج ذات تأثير ممتد إذا ما قورنت باستخدام كل منهما على حده.

التوصية: يوصى بإستخدام الوسائل العلاجية التحفظية البديلة الحديثة مثل المجال الكهرومغناطيسي المتقطع والليزر والعلاج المدمج لهما معاً في علاج حالات إلتهاب ما حول الكتف الأولي حيث أنهما وسيلتان آمنتان وفعالتان وذاتا تأثير ممتد.