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Shock wave therapy versus phonophoresis in treatment of diabetic frozen shoulder

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Shoulder pain is a common musculoskeletal malady, and one of the most prevalent causes of shoulder pain is frozen shoulder, which may be associated with minor trauma, environmental stresses, autoimmune processes, or disease like diabetes mellitus. *The purpose of this study:* Is to determine the effectiveness of shock wave therapy versus phonophoresis on diabetic frozen shoulder. 30 patients with diabetic frozen shoulder with stage 2 and 3; they all were selected from Agouza police hospital. The ages of all participants ranged from 40 to 60 years, patients were classified into two groups. Group (A) is the shock wave group and was consisted of 15 diabetic frozen shoulder patients received extracorporeal shock waves therapy for 4 sessions between every session one week. Group (B) phonophoresis group received phonophoresis for 12 sessions as 3sessions/week. Both groups performed pendulum exercises (swinging arm forward and back, side to side, and around in circles for 10 times), stretching for 30 seconds/3repetitions include doorway pectoral stretch, cross-body posterior shoulder stretching, shoulder external rotation cane stretch and shoulder internal rotation towel stretch and if the patient was able to tolerate it then followed by wall walking and wall bar. Data measured include, pain and disability by Shoulder Pain And Disability Index (SPADI) and shoulder range of motions by a digital inclinometer. The results of this study demonstrated that application of extracorporeal shock wave versus application of phonophoresis on diabetic frozen shoulder patients with age ranging between 40 and 60 highly significant effect of shock wave as pain improved by (44.97%), disability improved by (24.86%) and patient's range of motion increased by (53.51%) for flexion ,by (34.26%) for extension, by (31.21%) for abduction, by (23.11%) for external rotation and by (23.05%) for internal rotation. It was concluded that the application of shock wave therapy on diabetic frozen shoulder patients showed better results than application of phonophoresis.

Keywords: Frozen shoulder, shock wave, phonophoresis , Diabetes.

INTRODUCTION

Frozen shoulder (FS) or adhesive capsulitis or Shoulder per arthritis affects 2–5% of the population and is most common in the 40–60-year-old age group. FS is characterized by an insidious and progressive loss of active and passive mobility in the glenohumeral joint presumably due to capsular contracture (Wolf and Green, 2002). Adhesive capsulitis has been

classified as primary and secondary. Idiopathic (“primary”) adhesive capsulitis occurs spontaneously without a specific precipitating event. Primary adhesive capsulitis results from a chronic inflammatory response with fibroblastic proliferation, which may actually be an abnormal response from the immune system. Secondary adhesive capsulitis occurs after a shoulder injury or surgery, or may be associated with another

condition such as diabetes, rotator cuff injury, cerebrovascular accident (CVA) or cardiovascular disease, which may prolong recovery and limit outcomes (Hand et al., 2007). Neviasser and Hannaf(2010) identified 4 stages of this condition, which have been correlated with clinical examination and histological features. Intra-articular corticosteroid injections, physical therapy, supraclavicular nerve block, acupuncture, daily activities modification, are traditionally used in this condition (Braddom, 2011). In physical therapy, various modalities such as joint mobilization, heat, transcutaneous electrical nerve stimulation, exercise, are used early in the rehabilitation process; however, passive joint glides and nonpainful passive ROM exercises might be beneficial. Early scapular stability exercises and closed chain rotator cuff exercises can be instituted. As the patient's symptoms improve, active-assisted and active ROM activities can be added, along with open chain and proprioceptive exercises (Yang et al., 2013) (Basford,2005). Mulligan and Maitland end range mobilization are effective in decreasing shoulder pain and dysfunction as well as increasing shoulder mobility in all directions. However, Mulligan mobilization is more effective in treating patients with diabetic frozen shoulder (Youssef et al.,2015)

Shockwave through generating low-energy waves and electromagnetic excitation could be effective in this condition due to increasing the regional blood flow, neovascular changes, enzymes release, reduction of inflammatory cytokines, and increasing the flexibility of the collagen fibers and tendons in that area. Phonophoresis is administered in the same manner as ultrasound, except that medication is used in the coupling agent or applied topically prior to or after ultrasound application (Polat et al., 2011). This procedure is used to administer medication without the pain and discomfort which can accompany injections. Phonophoresis is usually performed with anti-inflammatory medications, such as cortisol, dexamethasone, and salicylates, and with anesthetics, such as lidocaine. The current study aimed to compare clinical outcome of shockwave and phonophoresis in treatment of diabetic frozen shoulder.

MATERIALS AND METHODS

Thirty diabetic patients (13 females and 17 males) referred from orthopaedic department at the Agouza Police Hospital diagnosed as diabetic frozen shoulder represented the sample of the

study. All patients were referred by same orthopaedic surgeon who was responsible for diagnosis of cases based on clinical and radiological examinations. Their age ranged between 40- 60 years old (mean age 51.25 ± 3.25 years). Approval for the study was obtained from the ethical committee of the Faculty of Physical Therapy, Cairo University. Treatment was conducted in the physical therapy department at Agouza Police Hospital and all participants received a comprehensive explanation about the purpose of the study, its benefits, inherent risks, and expected commitments with regard to time and their informed consent was obtained. Patients were excluded if they had the following: history of previous surgery on shoulder, history of shoulder fracture, cancer, bleeding disorders, unwillingness to participate in the study, Steroids injections, mobilization under general anesthesia.

Group assignment:

Subjects were randomly assigned into two groups of equal numbers each containing thirty subjects. Group A ($n = 15$) received shock wave therapy in addition to a program of exercise therapy and Group B ($n = 15$) received the same program of exercise in addition to phonophoresis. Evaluation was conducted for each patient of the two groups before and after treatment. The assessment procedure included the following:

1- Pain and functional disability

This variable was assessed by using the shoulder pain and disability index (SPADI) which is a valid and reliable index for measuring shoulder pain and disability. The SPADI questionnaire's is a self-administered instrument developed to measure pain (five items) and disability (eight items) associated with shoulder complaints. For the five pain items, "no pain" scored zero and the "worst pain" scored 10; for the eight disability items, "no difficulty" received zero score while "difficulty requiring assistance" received 10 scores. Scores were calculated as follow: in part one pain scores in all questions were added, and a mean value was chosen. In part two functional score of all questions were added and a mean value was chosen for the purpose of data analysis. The final scores for each part were statistically analyzed separately.

2- Range of motion assessment:

A digital inclinometer was used to determine the ROM of the shoulder joint. The device was calibrated before treatment at 0 point and

shoulder movements were measured. Shoulder movements including; flexion, abduction, extension, external and internal rotation were determined for each patient from supine lying and sitting positions.

Treatment procedures:

Group A:

The patients received shock wave therapy once a week for 4 weeks. The patients received 2000 Shocks (3 bar and 10Hz) after applying a coupling gel in the anterior and posterior directions of the shoulder from sitting position.

The exercise program was applied as follows: Pendulum exercises (swinging arm forward and backside to side, and around in circles for 10 times). Stretching for 30 seconds/3 repetitions include doorway pectoral stretch, cross-body posterior shoulder stretching, shoulder external rotation cane stretch and shoulder internal rotation towel stretch. If the patient tolerated it progressed by wall walking and wall bar.

Group B:

In addition to the exercise program given to group A, phonophoresis with topical r-hirudin 1120IU (Thrombex DNA Gel) was applied for 12 sessions 3 times/week for 5 minutes, continuous mode with a frequency of 1MHz and intensity of 1.5w/cm² on shoulder joint and shoulder girdle muscles.

Statistical analysis:

The statistical analysis was conducted by using statistical SPSS Package program version 20 for Windows (SPSS, Inc., Chicago, IL). Data was normally distributed by using Shapiro-Wilk test. Additionally, testing for the homogeneity of variance revealed that there was no significant difference ($P > 0.05$). Descriptive statistics included the mean and standard deviation for variables. Paired t-test was used to compare between pre and post-treatment within study group. Unpaired (Independent) t-test was used to compare between shock wave and phonophoresis groups with pre- and post treatment for variables. All statistical analyses were significant level of probability ($P \leq 0.05$).

RESULTS

The results of this study demonstrated that application of extracorporeal shock wave versus application of phonophoresis on diabetic frozen shoulder patients with age ranging between 40 and 60 highly significant effect of shock wave as pain improved by (44.97%), disability improved by (24.86%) and patient's range of motion increased by (53.51%) for flexion, by (34.26%) for extension, by (31.21%) for abduction, by (23.11%) for external rotation and by (23.05%) for internal rotation.

Table (1): Comparison within and between groups for pain and disability in A and B groups.

Variables	Items	Mean \pm SD		t-value	P-value
		Mean \pm SD	Mean \pm SD		
Pain	Pre-treatment	46.00 \pm 3.31	41.33 \pm 4.35	2.451	0.287
	Post-treatment	31.73 \pm 6.99	35.40 \pm 5.31	1.616	0.117
	Improvement %	44.97%	16.75%		
	t-value	10.174	12.048		
	P-value	0.0001	0.0001		
Disability	Pre-treatment	77.00 \pm 7.54	68.60 \pm 4.69	3.679	0.059
	Post-treatment	61.67 \pm 8.16	58.60	0.898	0.377
	Improvement %	24.86%	17.07%		
	t-value	7.554	4.663		
	P-value	0.0001	0.0001		

SD: standard deviation %: percentage

P-value: probability value Significant ($P \leq 0.05$)

Table (2): Comparison within and between groups for ROM in A and B groups.

ROM variables	Items	Group A		t-value	P-value
		Mean ±SD	Mean ±SD		
Flexion	Pre-treatment	89.85 ±25.36	88.24 ±15.77	0.209	0.836
	Post-treatment	137.93 ±29.83	101.67 ±19.73	3.926	0.001
	Improvement %	53.51%	15.22%		
	t-value	21.697	9.663		
	P-value	0.0001	0.0001		
Extension	Pre-treatment	37.89 ±9.37	40.52 ±3.88	1.006	0.323
	Post-treatment	50.87 ±7.38	49.17 ±5.75	0.700	0.489
	Improvement %	34.26%	21.35%		
	t-value	15.667	9.148		
	P-value	0.0001	0.0001		
Abduction	Pre-treatment	87.59 ±15.55	78.28 ±9.85	1.958	0.060
	Post-treatment	114.93 ±19.02	89.35 ±8.74	4.731	0.0001
	Improvement %	31.21%	14.15%		
	t-value	9.115	16.446		
	P-value	0.0001	0.0001		
ER	Pre-treatment	59.33 ±8.96	64.47 ±8.83	0.965	0.343
	Post-treatment	73.04 ±18.66	74.19 ±8.21	0.261	0.796
	Improvement %	23.11%	15.08%		
	t-value	7.924	8.780		
	P-value	0.0001	0.0001		
IR	Pre-treatment	63.38 ±14.46	71.07 ±7.01	1.852	0.075
	Post-treatment	77.99 ±8.96	78.64 ±6.22	0.232	0.818
	Improvement %	23.05%	10.65%		
	t-value	9.204	10.626		
	P-value	0.0001	0.0001		

SD:standarddeviation%;percentage P-value: probabilityvalueSignificant (P ≤ 0.05)

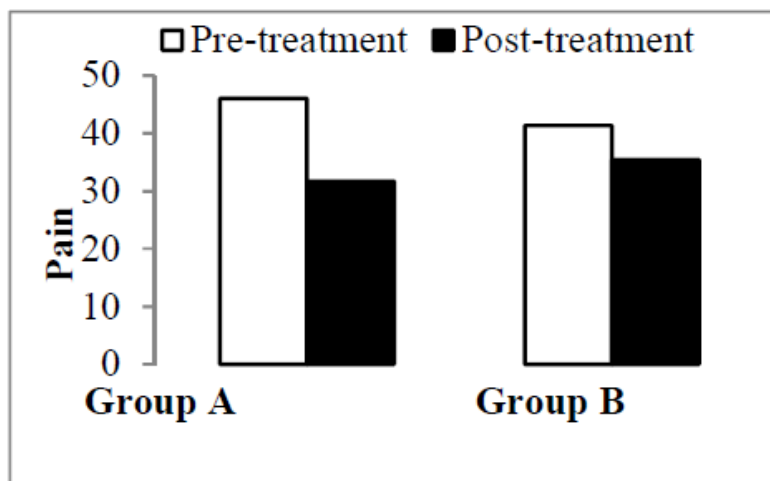


Figure (1): Show mean values of pain.

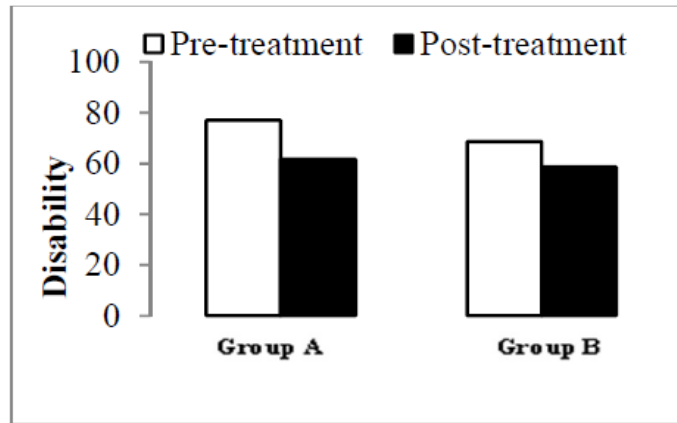


Figure (2): Show mean values of disability.

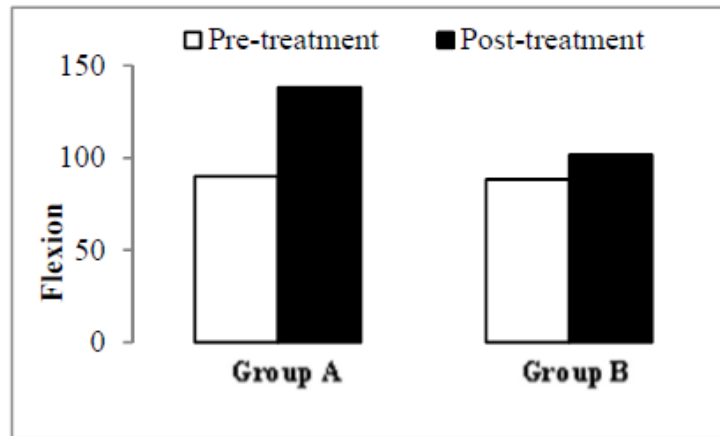


Figure (3): Show mean values of flexion.

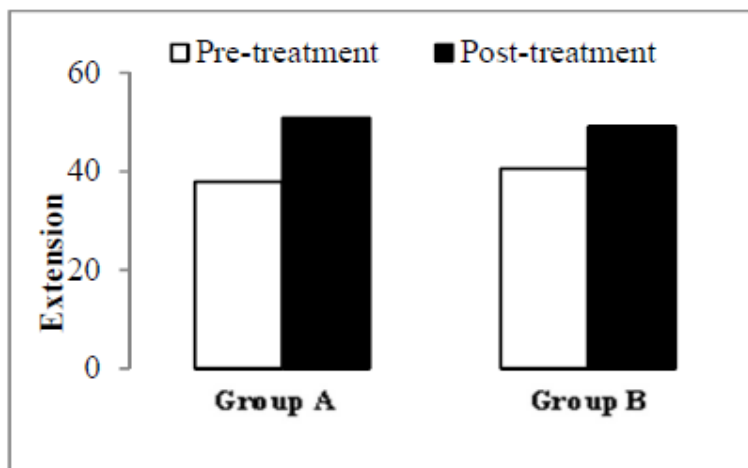


Figure (4): Show mean values of extension

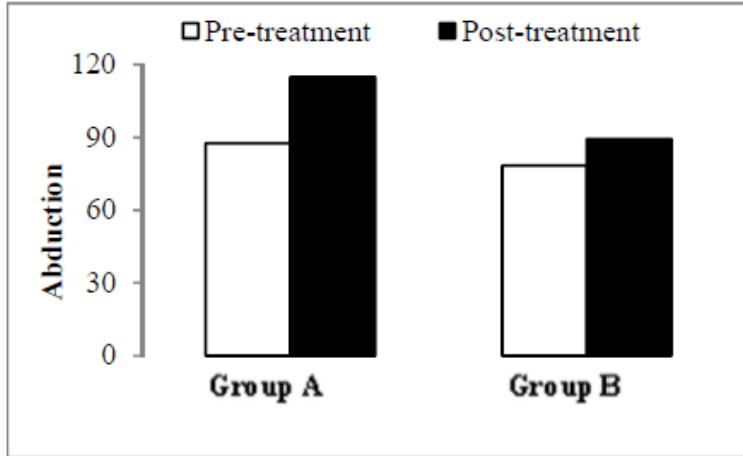
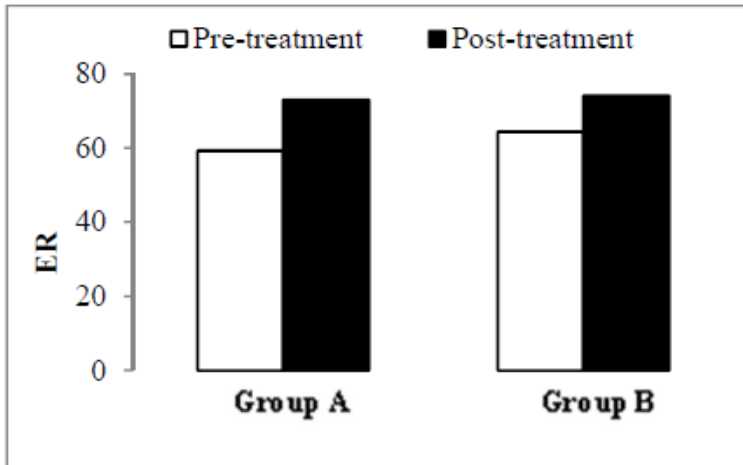


Figure (5): Show mean values of abduction.



Figure(6): Show mean values of ER

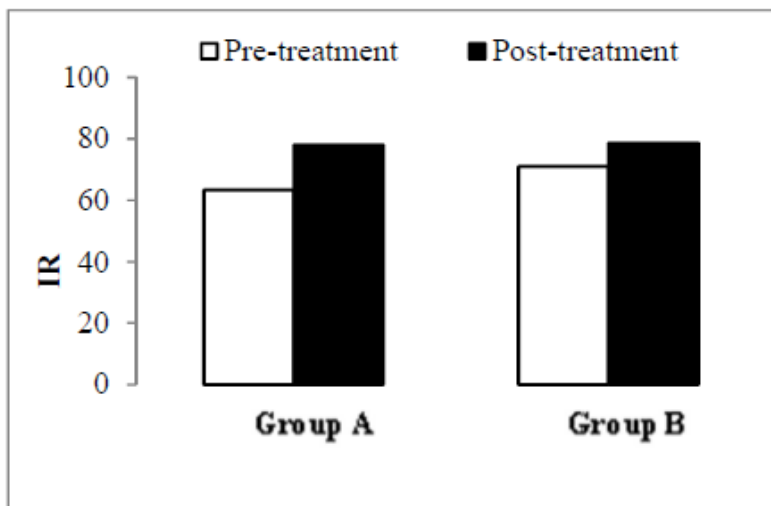


Figure (7): Show mean values of IR.

DISCUSSION

A study performed by Sangho et al., (2017) examined the effects of extracorporeal shock wave therapy on pain and ROM in patients with adhesive capsulitis. An intra-group comparison before and after the treatment showed that both groups experienced a decline in pain and an increase in their ROM that were statistically significant. An inter-group comparison after the treatment showed that the experimental group had a lower level of pain and a higher ROM than the control group that were statistically significant in agreement with results of the current study.

A study done by Adel et al., (2013) to investigate the effects of shock wave therapy versus phonophoresis in treatment of diabetic frozen shoulder. The results revealed that shockwave therapy was more effective in all measured variables of pain, functional disability and ROM than phonophoresis in treatment of patients with diabetic frozen shoulder. These came in agreement with results of the current study.

Mohamed et al., (2018) evaluated the effect of extracorporeal shock wave therapy for patients with diabetic frozen shoulder. Shoulder Pain and Disability Index (SPADI) and Digital Goniometer were used as outcome measures to evaluate the pain and functional activities and degree of movements respectively. Shockwave showed good Improvement in reducing the shoulder pain, increasing the functional activities and range of movements of shoulder joint compare to traditional physical therapy that agree with the results of current study.

A randomized clinical trial study performed by Vahdatpour et al., (2014) on patients suffering from frozen shoulder was allocated into two groups. Intervention group received (ESWT) once a week for 4 weeks. The control group received sham shockwave therapy once a week for 4 weeks. On the follow-up period, changes in individual performance and the amount of pain and disability were assessed by the (SPADI) questionnaire and ROM changes were assessed by a goniometer. This study concluded that the use of ESWT seems to have positive effects on treatment, quicker return to daily activities, and quality-of-life improvement on frozen shoulder which agree with results of the current study.

A pilot study performed by Flavia et al., (2017) assessed the effect of ESWT on functional outcomes in patients with diabetes with adhesive capsulitis. Results indicate that ESWT may be effective, feasible, and well tolerated and can

therefore represent a valid alternative to steroids for adhesive capsulitis treatment in patients with diabetes.

CONCLUSION

From the finding of the current study it concluded that both shockwave and phonophoresis are effective in treatment of diabetic frozen shoulder syndrome. However, the shockwave therapy was more effective in all measured variables (pain severity, shoulder disability index and ROM) than phonophoresis in treatment of patients with diabetic frozen shoulder.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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AUTHOR CONTRIBUTIONS

All authors contributed equally in all parts of this study.

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