FUTURE OF TREATMENT OF TEMPROMANDIBULAR JOINT DYSFUNCTIONS IN PARKINSONIAN PATIENTS.

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ABSTRACT

The purpose of the study was designed to clarify the modern trends of physical therapy in treatment of tempromandibular dysfunctions in Parkinsonian patients . In this respect, the degree of disabilities, pain, the muscles power of both masseter and temporalis, the angle of mouth opening and their effect on electromyography study in both sexes. Subjects, thirty males and females were the same degree of disabilities according to modified Hoehn and Yahr scales (grade 3) of Parkinsonian patients , their age ranged from 50-77 years old and their weight ranged from 60-88Kg. They were randomly divided into two equal groups (G1and G2). G1 (control)consists of 15 patients of both sexes and was treated by exercises therapy program and G2(experimental) consists of 15 Parkinsonian patients of both sexes and was treated by the same exercises therapy program and low level pulsed electromagnetic therapy . Vital signs as blood pressure, body temperature, pulse rate and respiratory rate were measured before and after the treatment sessions. Assessments, visual analogue scale was used to measure degree of pain, Tensiometer was used to measure the muscle power of masseter and pterygoid, the digital mouth caliper was used to investigate the angle of TMJ opening. Moreover, by the use of standard electromyography test (EMG) to measure the compound muscle action potentials. Statistically the results for all groups were analyzed by t-test to compare the differences between the two groups. The statistical package of social sciences (SPSS, version10) was used for data processing using the p-value 0.05 as a level of significance. Results, showed that there was significant improvements in all variables in G2 only. However, there was a little improvement but not significant in both G1. Therefore, it could be concluded that the use of low level pulsed electromagnetic therapy combined with exercises program were the good method to control pain of TMJ, increase muscle power and the angle of mouth opening together with determination of electromyography. Our results open a new link to manage the TMJ dysfunctions in Parkinsonian patients via the use of low frequency of electromagnetic therapy combined with exercises program.

Keywords: Electromagnetic, Parkinsonian patients, electromyography, Tensiometer, Pain and Tempromandibular Dysfunctions .

INTRODUCTION

Parkinson's disease is a chronic illness with major problems requiring personal and social adjustments. The incidence of Parkinson's disease is thought to be 1% of the general population, and has been estimated to reach 10% among the population of over 65 years of age. The progressive nature of Parkinson's disease often causes disruption in the daily function, roles and activities of the affected individuals [1].

Parkinson's disease is associated with a tendency to assume and maintain fixed postures. All aspects of movements are affected including initiation, alteration in direction and the ability to stop movement at once it has begun. Also, spontaneous or associated movements as arm swinging in gait or smiling at a funny story are affected. Moreover, the Orofacial functions are affected especially the tempromandibular joint movement [2].

The flexed postures of the head, neck lead to disorders of the Orofacial functions as TMJ range of motion, power of mastication and pain that have been produced in Parkinson's disease by the ablation of the globus pallidus bilaterally[3]. Tempromandibular joint dysfunction (TMD) is very common; more than 10 million people in the United States have it. Jaw pain is one of the symptoms of TMD. It's important to know that jaw pain also can be a symptom of heart attack. Seek medical care immediately if jaw pain is accompanied by chest pain, shortness of breath ,dizziness, left arm pain , numbness in left arm and nausea[4].

Bad posture habits in Parkinsonian patients are one common reasons of TMD because of long time of flexion position of head and neck. Also, trismus ("lockjaw"), where the jaw muscles spasm(rigidity) and the jaw cannot be fully opened . Rigidity involves all muscle groups of the face, tongue and even those of the larynx are often affected[5].

Electromyography (EMG) can be used to assess amplitude and timing of onset of the supporting muscle groups activity in order to describe pattern of movement[6]. EMG can be useful to assess muscle activity during gait simultaneous and coordinated movement[7]. So, the EMG is used very effectively in evaluation of musculoskeletal disorders and neurological deficits[8].

Nowadays, the use of pulsed low frequency electromagnetic as an adjuvant and supportive treatment in management of Parkinsonian cases are widely spread and of increasing interest, they play an important role in controlling the Orofacial complication. Moreover, the electromagnetic therapy can delay or prevent the TMD and widely used in the hope to improve Orofacial dysfunctions[9].

The Kinesiologic studies have significantly high-lighted the muscle function under both normal and pathological conditions. Electro-myography (EMG) is the most important method used in kinesiological and biomechanical studies, which is used to determine muscle function or to relate EMG output to developed tension. In addition, EMG technique may have the advantage of providing muscle specific motivation compared with a technique that is based entirely on mechanical measurements of force and endurance [10].

A relatively powerful magnetic field set up in large coil into which the part can be placed is provided by some machines. This field is oscillated, changing direction at various frequencies up to 50 Hz. Other pulsed devices use higher pulsing frequencies but much weaker magnetic fields and are placed in contact with the part to be treated [11] found that the field settings of a pulsed magnetic fields machine is specified as producing vasodilatation. There is good evidence of the effectiveness of low-frequency pulses applied to the tissues by electromagnetic induction in the treatment of un-united fractures [12] and Perthe's disease [13]. Similar 0.38 m/s pulses at around 0.72 Hz have been used successfully in the treatment of rotator cuff tendinitis.

Numerous experiments demonstrated the low frequency effects of electric and magnetic fields on cells, tissues, organs, systems and even behaviour in animals and humans. There is an evidence of their effects on the central nervous system, on fat and calcium metabolism and on circadian rhythm in humans and animals with various strengths and frequencies[14]. There is no certain evidence of significant health damage from artificial electromagnetic field [15].

A number of devices are available which generate pulses at a tiny fraction of the power. They produce pulses of 27.12 MHz oscillations at various repeated rates but with power about 0.5w to peak 15w. There are some reports of their effectiveness in treating variety of conditions as muscle spasm[16] and ligament sprains[17].

EMG has been used effectively in evaluating and following up most musculoskeletal and neurological disorders. EMG can be used to assess amplitude and onset of the supporting muscle group's activity in order to describe pattern of movement Moreover, EMG is of great helpful in study muscle activity. during gait with simultaneous and coordinated movement [5].

It is apparent that, EMG activity of the muscles performing the task before arrival of sensory feedback information from the muscles, joints and skin could modify the centrally generated movement program. These changes in neuronal activity occurred 50 to 200 m/sec before EMG activity changes and there were enough overlap of the onset of these changes [4].

Oedema and bruising were found to be less on the treated side during a controlled study of recovery after bilateral blepharopalsy[18]. All these sources apply energy for the tissues by means of an induction coil aerial placed on the surface of the skin. It has been claimed that the proximity of the tissues compensated for their low output, low-power pulses used successfully to encourage healing of skin wounds.[19]applied low-power pulsed electro-magnetic energy via a cervical collar for persistent neck pain and found an increase in range of movement and a decrease in pain.

compromised if you have diabetes

Therefore, new strategies with classic as well as new electromagnetic therapy should be implemented in the treatment of parkinsonism.

In this respect, we design our study in trial to find out a synergistic effect between electromagnetic and regular exercises regime incorporating the muscles of TMJ to limit and control the rigid muscles complications of TMJ in Parkinsonian patients.

SUBJECTS, MATERIAL AND METHODS

Selection criteria

Parkinsonian patients were selected from the outpatient department Neurology and Neurological Rehabilitation, King Khalid hospital , Najran University. Thirty patients diagnosed gred3 according to modified Hoehn Yahr classification of disabilities , they were diagnosed on laboratory and clinical bases by their own specialists , their ages ranged from 50 – 77 years , they had the same degree of impairments, all patient's otherwise clinically and medically stable , they were otherwise medically fit to participate in the study according to procedure , they had sufficient cognition to understand the requirements of the study , they had no surgical interference . They had no signs of aphasia , they had sufficient vision and hearing , the patients were randomly and equally divided into two groups .**Group (1)** : was a control group and consists of 15 patients of both sexes who received strengthening exercises of masseter and temporalis , PNF technique for head and neck, Lateral manipulation of TMJ and postural correction exercises of head and neck. Time of exercises 45 min, repetition10 times, stretching equal strengthening and rest inbetween , three times per week, day after day. **Group (2)**: was experimental group consists of 15 patients of both sexes who received low frequency electromagnetic therapy 0.5Hz,20min.30%intenisty and the same exercises program. They were subjected to the **following assessment**: degree of disabilities, muscle tension (power) assessment, angle of TMJ opening, pain of TMJ and muscle activities . **Inclusion criteria**: Thirty Parkinsonian patients of both sexes, stage III according to modified Hoehn and Yahr classification of disabilities . All patients were medically stable by measuring vital signs which include (blood pressure, temperature, pulse rate and respiratory rate) .All patients were conscious and co-operative. All patients

were medically, neurologically and psychologically normal. All patients had no disability secondary to orthopedic problems or surgery. All patients had no impairment of general or special senses. **Exclusion criteria:** Severe degree of disabilities, Parkinsonian patients having complications, psychological unstable , non co-operative patients during assessment of the research and persons having history of diabetes up to second degree relations were excluded.

Evaluation procedures: Patient's preparation before putting EMG electrodes over the skin for each patient, it should be shaving the hair at the picking areas and cleaning it by alcohol to remove the dead layers of the skin in site of EMG electrodes (masseter and temporalis). **Electrodes testing procedures**: Recording surface electrode was placed on the belly of a muscle. **Electrodiagnostic Test:** Technical steps of application EMG including; electrode placement, skin temperature correction, determination of nerve stimulation intensity and analysis of the evoked neuro- electrical response . The system comprises an electronic monitor and a report generation system. The registry stores all electrophysiological data including raw wave forms and limited demographic information (age, height, weight and gender). The EMG tests are typically performed by official clinical staffs that undergo training by the manufacture. The instrument and the data registry have automated quality assurance software that confirms and tracts ongoing staff competence. Each study is coded with the primary clinical indication for the evaluations.

Instrumentation: A-EMG Neuropac. B-Digital goniometer. C-Lafayette tensiometer. D-ASA electromagnetic.
E-Visual Analogue Scale. F-Digital mouth caliper.

Electromyography (EMG) Unit: It contains of EMG apparatus, Disposable surface EMG electrodes and Data processing computer unit. The neuro pack S1 MEC-9400K, 4 channel EMG/EP system. Disposable and radiolucent electrodes. **Electrodes:** Vitrode F Disposable Electrodes, G210DPart No. F-150M, Adult, solid tape, 25×45 mm, 3 pcs × 50 packs/box. Vitrode V Disposable Electrodes, G272APart No. V-09OM3, Adult/Child, 3 lead, DIN, lead length 1 m, 25×45 mm, 3 colors × 30 packs/box. The electrodes were self adhesive with active surface area of 1cm2 in diameter. The electrodes consist of plastic foam material with a silver plate disc on one side and silver plate snap in the center on the other side. Early released protective sheet is placed over the electrode side to keep the electrolyte part of the disc in its position. The electrodes were connected to EMG apparatus channel.

Materials and methods : Thirty patients were diagnosed grade3 according to modified Hoehn and Yahr of disabilities , their ages ranged from 50-77years old and their weight ranged from 60-88Kg.They were randomly divided into two equal groups (G1 and G2). G1 was treated by exercises therapy program only, the exercise training group performed training for 6 weeks (3 days/week , 45 min, 50-80%VO2max) and G2 was treated by the same exercise program as G2 and low frequency electromagnetic therapy. All patients were assessed by electromyography, Digital mouth caliper, Lafayette Tensiometer and Visual Analogue scale for measurement of TMJ dysfunctions.

Detailed socio-demographic data, family history and medical history were taken from all the subjects and their physical and clinical examinations were done on very first day of the visit to physical therapy department .Informed consent was taken from each of the subjects. On the day of experiment was collected. Anthropometric measurements were taken before and after the treatment sessions, Neurological parameters of median nerve were measured by a standard EMG machine, were included according to the protocol

recommended : action potential were measured by Electromyography(EMG) equipment . Range of motion of TMJ were measured by Digital caliper .Muscle power (tension) of masseter and temporalis were measured by Tensiometer, Pain was measured by Visual analogue scale and degree of TMJ of disabilities were measured by modified unified Parkinsonian rating scales.

Statistical analysis : The results of two groups were statistically analyzed by t-test to compare the differences within each group and between the two groups. The statistical package of social science (SPSS version 10) was used for data processing the P-value 0.05 level significance.

Data Summarized by using : The arithmetic mean average describing the central tendency of observation where The standard deviation (S.D) used to measure to described the results around mean where paired and unpaired t-test was performed to determine the significance difference pre and post within the same group and the differences between the two groups .

RESULTS

Subjects Characteristics

Thirty males and females subjects participated in the study, their ages ranged between (50 – 77) years with mean age (56.4±6.6) years, their weights ranged between (60 – 88) kg with mean weight (75 ±7.7) kg. The subjects were divided into two equal groups. Each group consisted of fifteen subjects. The characteristics of subjects in each group are shown in Table (1) and Fig(1).

Table (1): Characteristics of subjects in each group.

	Group 1		Group 2		P	Sig.
	Mean	S.D	Mean	S.D		
Age (yrs)	56.7	±6.3	56.1	±7.2	0.81	NS
Weight (Kg)	75.3	±6.8	74.8	±8.7	0.87	NS

P > 0.05: indicates Non significance. **NS: Non significance.**

The independent t test between the two groups showed no significant differences between groups or within groups of age (where P value was 0.81) and weight (where P value was 0.87), as shown in Table (1)and fig(1&2).

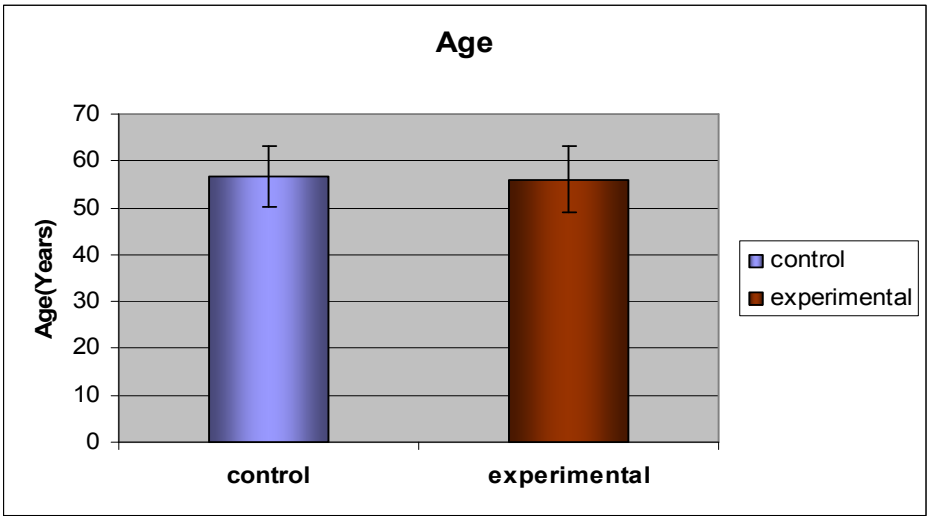

Figure (1): Showing the age characteristics of subjects in each group.

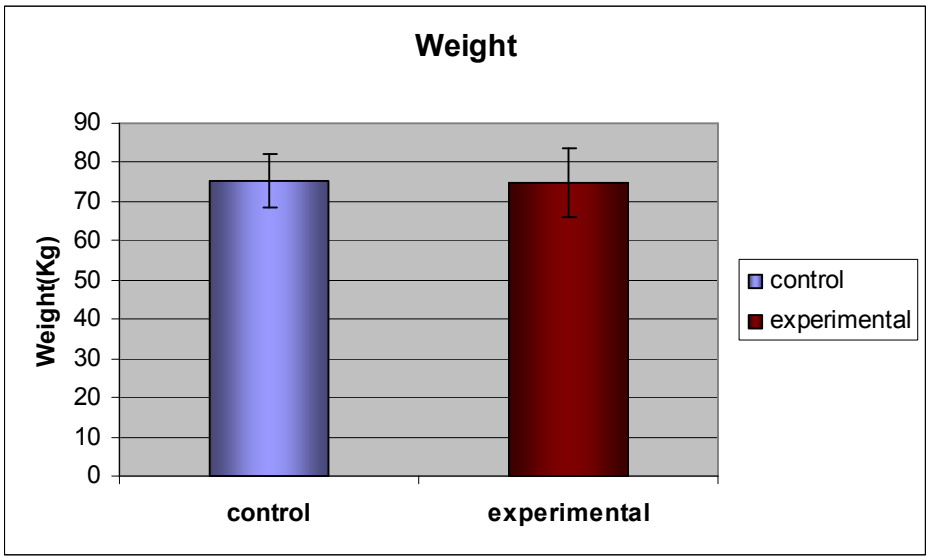

Figure (2): Showing the weight characteristics of subjects in each group.

Differences in Hoehn test between the two groups

The results of the independent t-test between the two groups revealed that there were no significant differences in the Hoehn test measured before the experimental trial where the t value was -0.38, while P was 0.707, and moderate significant differences when measured post experimental trial where the t value was 3.95, while P was 0.001as shown in Table (2) and Fig(3).

Table (2): Results of the t-test between the two groups of Hoehn test measured before and after the experimental trial.

		Mean	SD	T	P
Pre-test	G I	2.5	±0.5	-0.38	0.707
	GII	2.5	±0.5		
Post-test	G I	2.2	±0.5	3.95	0.001**
	GII	1.7	±0.3		

Differences in Hoehn test within the two groups

The results of the dependant t-test between pre and post test of group I revealed that there were mild significant differences in the Hoehn test where the t value was 2.82, while P was 0.014, and moderate significant differences between pre and post test of group II where the t value was 10.46, while P was 0.001 as shown in table (3) and Fig. (3).

Table (3): Results of the t-test within the two groups of Hoehn test measured before and after the experimental trial.

		Mean	SD	T	P
Group I	Pre	2.5	±0.5	2.82	0.014 *
	Post	2.2	±0.5		
Group II	Pre	2.5	±0.5	10.46	0.001**
	Post	1.7	±0.3		

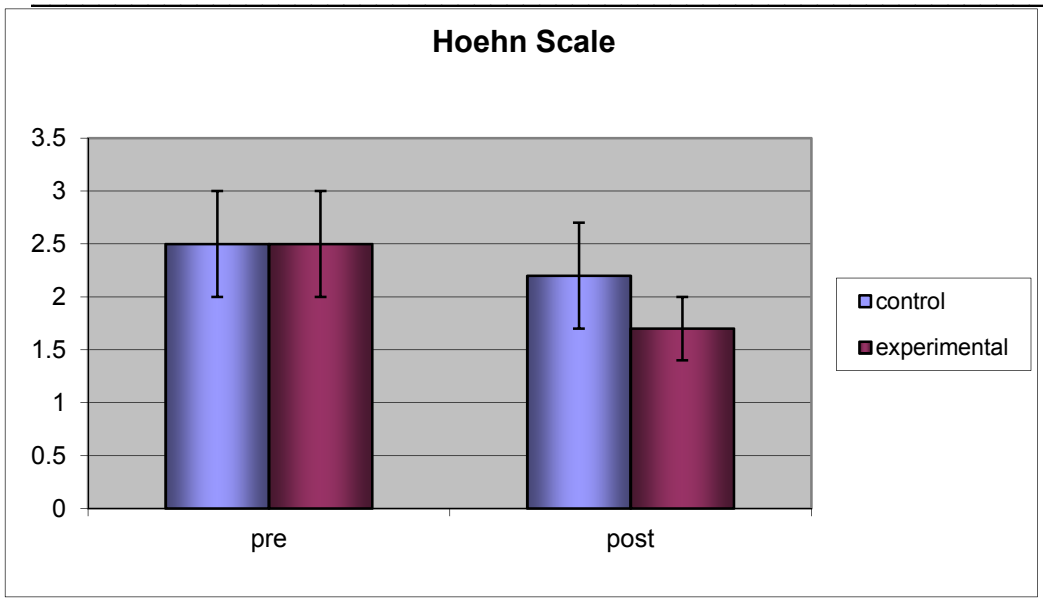

Fig (3): Showing the results of Hoehn test in each group.

Differences in muscle power test between the two groups

The results of the independent t-test between the two groups revealed that there were no significant differences in muscle power test measured before the experimental trial where the t value was -0.414, while P was 0.682, and moderate significant differences when measured post experimental trial where the t value was -8.78, while P was 0.001as shown in Table (4) and Fig.(4).

Table (4): Results of the t-test between the two groups of muscle power test measured before and after the experimental trial.

		Mean	SD	T	P
Pre-test	G I	8.7	±1.5	-0.414	0.682
	GII	8.9	±1.1		
Post-test	G I	10.8	±1.6	-8.78	0.001**
	GII	15.2	±1.1		

Differences in muscle power test within the two groups

The results of the dependant t-test between pre and post test of group I revealed that there were mild significant differences in muscle power test where the t value was -12.91, while P was 0.01, and moderate significant differences between pre and post test of group II where the t value was -23.44, while P was 0.001 as shown in table (5) and Fig. (4).

Table (5): Results of the t-test within the two groups of muscle power test measured before and after the experimental trial.

		Mean	SD	T	P
Group I	**Pre**	8.7	±1.5	**-12.91**	**0.01***
	Post	10.8	±1.6		
Group II	**Pre**	8.9	±1.1	**-23.44**	**0.001****
	Post	15.2	±1.1		

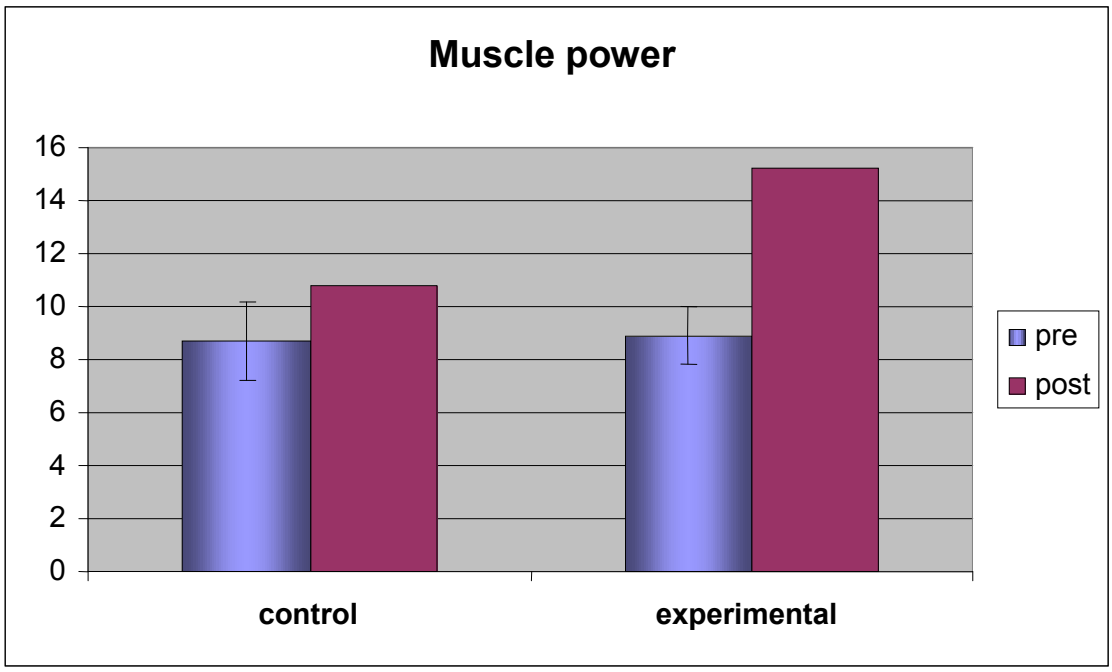

Figure (4): Showing the results of muscle power test in each group.

Differences in Angle of mouth opening between the two groups

The results of the independent t-test between the two groups revealed that there were no significant differences in angle of mouth opening measured before the experimental trial where the t value was -0.542, while P was 0.592, and moderate significant differences when measured post experimental trial where the t value was -15.944, while P was 0.001as shown in Table (6) and Fig. (5).

Table (6): Results of the t-test between the two groups of measured Angle of mouth opening before and after the experimental trial.

		Mean	SD	T	P
Pre-test	**G I**	4.3	±0.3	-0.542	0.592
	GII	4.3	±0.3		
Post-test	**G I**	4.8	±0.4	-15.944	0.001
	GII	6.8	±0.3		

Differences in Angle of mouth opening within the two groups

The results of the dependant t-test between pre and post test of group I revealed that there were mild significant differences in foot angle where the t value was -12.91, while P was 0.01, and moderate significant differences between pre and post test of group II where the t value was -23.44, while P was 0.001 as shown in Table (7) and Fig. (5).

Table (7): Results of the t-test within the two groups of angle of mouth opening measured before and after the experimental trial.

		Mean	SD	T	P
Group I	**Pre**	4.3	±0.3	**-12.91**	**0.01***
	Post	4.8	±0.4		
Group II	**Pre**	4.3	±0.3	**-23.44**	**0.001****
	Post	6.8	±0.3		

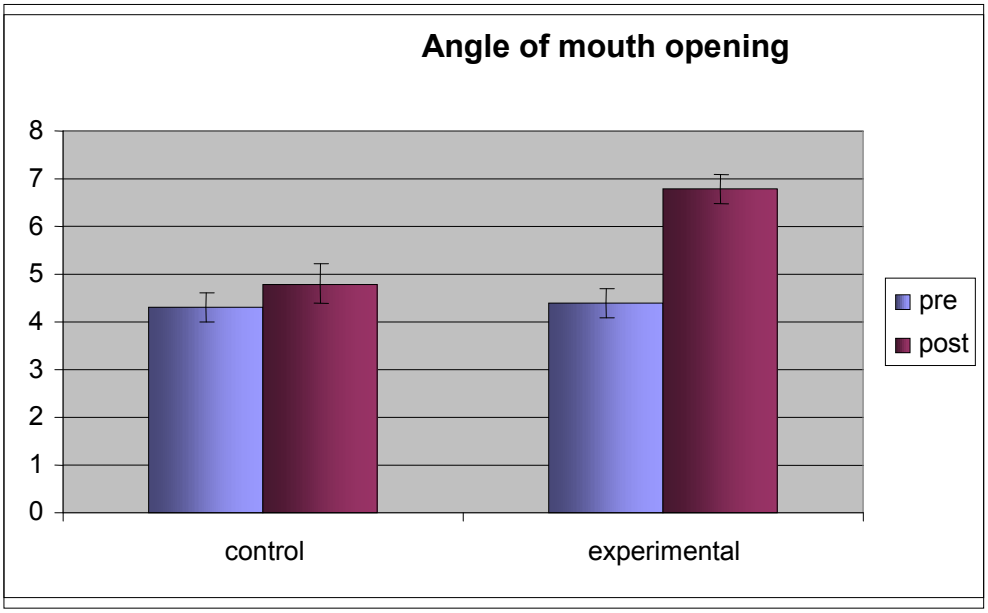

Figure (5): Showing the results of angle of mouth opening in each group.

Differences in pain control between the two groups

The results of the independent t-test between the two groups revealed that there were no significant differences in pain control measured before the experimental trial where the t value was 0.6, while P was 0.97, and moderate significant differences when measured post experimental trial where the t value was -6.38, while P was 0.001as shown in Table (8) and Fig. (6).

Table (8): Results of the t-test between the two groups of pain control measured before and after the experimental trial.

		Mean	SD	T	P
Pre-test	**G I**	38.64	±0.3	0.6	0.97
	GII	38.04	±0.3		
Post-test	**G I**	42.4	±0.4	-6.38	0.001**
	GII	50.7	±0.3		

Differences in pain control within the two groups

The results of the dependant t-test between pre and post test of group I revealed that there were mild significant differences in pain control where the t value was -9.51, while P was 0.01, and moderate significant differences between pre and post test of group II where the t value was -14.4, while P was 0.001 as shown in Table (9) and Fig. (6).

Table (9): Results of the t-test within the two groups of pain control measured before and after the experimental trial.

		Mean	SD	T	P
Group I	**Pre**	38.64	±0.3	**-9.51**	**0.01***
	Post	42.4	±0.4		
Group II	**Pre**	38.04	±0.3	**-14.4**	**0.001****
	Post	50.7	±0.3		

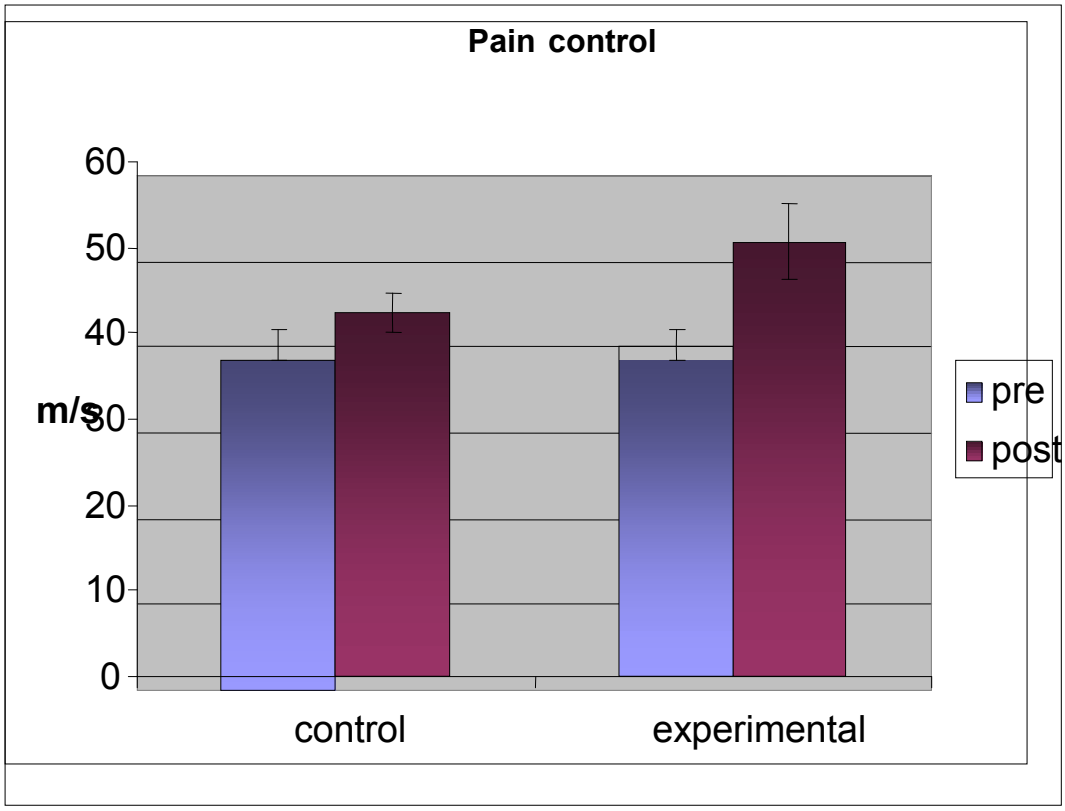

Figure (6): Showing the results of pain control in each group.

Differences in EMG of Masseter muscles between the two groups

The results of the independent t-test between the two groups revealed that there were no significant differences in EMG for measured Masseter muscles before the experimental trial where the t value was -0.374 , while P was 0.711, and moderate significant differences when measured post experimental trial where the t value was -15.19, while P was 0.002 as shown in Table (10) and Fig.(7).

Table (10): Results of the t-test between the two groups of EMG of Masseter muscles measured before and after the experimental trial.

		Mean	SD	T	P
Pre-test	G I	0.6	±0.1	-0.374	0.711
	GII	0.6	±0.1		
Post-test	G I	0.9	±0.1	-15.19	0.002
	GII	1.5	±0.1		

Differences In EMG of Masseter muscles within the two groups

The results of the dependant t-test between pre and post test of group I revealed that there were mild significant differences in EMG of masseter muscle where the t value was -15.9 while P was 0.01 and moderate significant differences between pre and post test of group II where the t value was -29.79, while P was 0.001 as shown in Table (11) and Fig. (7).

Table (11): Results of the t-test within the two groups of EMG of Masseter muscles measured before and after the experimental trial.

		Mean	SD	T	P
Group I	Pre	0.6	±0.1	-15.9	0.01*
	Post	0.9	±0.1		
Group II	Pre	0.6	±0.1	-29.79	0.001**
	Post	1.5	±0.1		

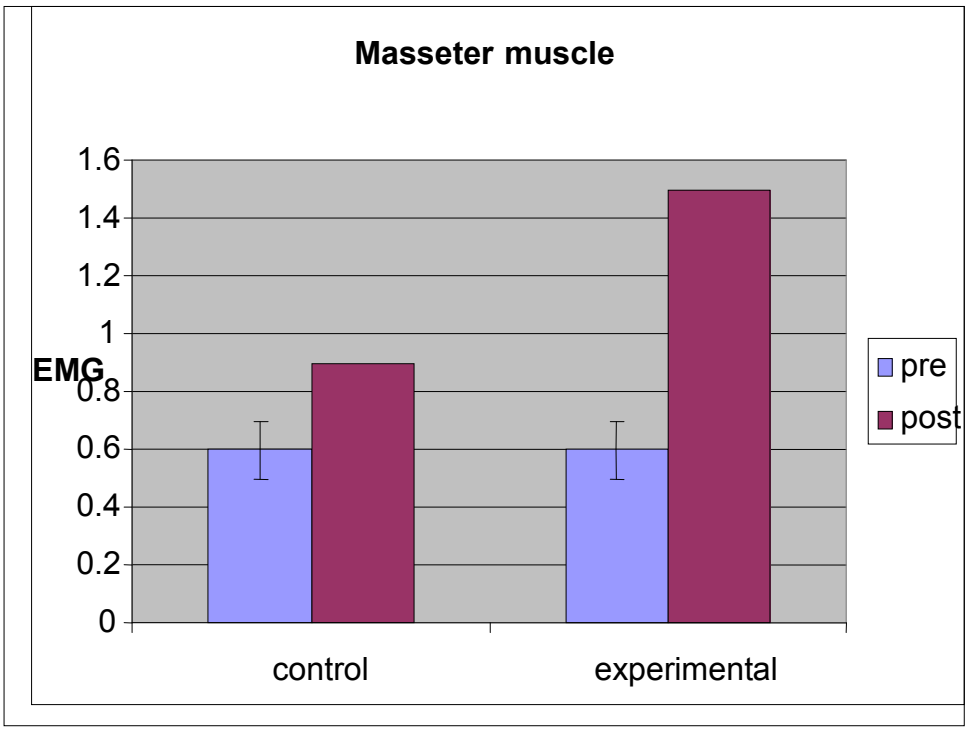

Figure (7): Showing the results of EMG of masseter muscle time in each group.

Differences in EMG of temporalis between the two groups

The results of the independent t-test between the two groups revealed that there were no significant differences in EMG for temporalis muscle measured before the experimental trial where the t value was -0.132 , while P was 0.896 and moderate significant differences when measured post experimental trial where the t value was -2.93, while P was 0.007 as shown in Table (12) and Fig.(8)

Table (12): Results of the t-test between the two groups of EMG of temporalis muscle measured before and after the experimental trial.

		Mean	SD	T	P
Pre-test	G I	0.6	±0.1	-0.132	0.896
	GII	0.6	±0.1		
Post-test	G I	0.9	±0.1	-2.93	0.007**
	GII	1.1	±0.1		

Differences in EMG of temporalis muscle within the two groups

The results of the dependant t-test between pre and post test of group I revealed that there were mild significant differences in EMG of temporalis muscle where the t value was -13.26 while P was 0.01 and moderate significant differences between pre and post test of group II where the t value was -20.58, while P was 0.001 as shown in Table (13) and Fig. (8).

Table (13): Results of the t-test within the two groups of EMG of temporalis muscle measured before and after the experimental trial.

		Mean	SD	T	P
Group I	Pre	0.6	±0.1	-13.26	0.01*
	Post	0.9	±0.1		
Group II	Pre	0.6	±0.1	-20.58	0.001**
	Post	1.1	±0.1		

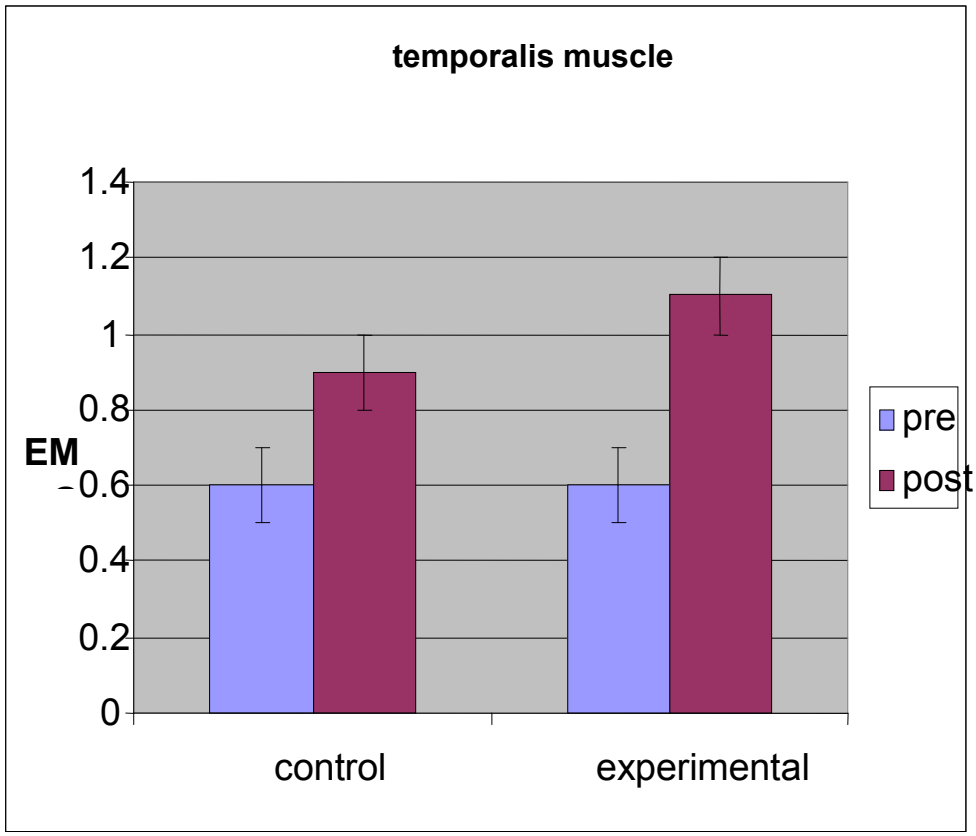

Figure (8): Showing The results of EMG of temporalis muscle time in each group.

DISCUSSION

The purpose of this study is to investigate the effect of low frequency electromagnetic stimulation on electromyographic muscle activities(masseter and temporalis), angle of mouth opening of tempromandibular joint, and pain control in cases of Parkinsonian patients. Referred to thirty Parkinsonian patients of both sexes (18 male and 12 female). Their ages during conducting this work were between 50-77 years, the patients are assessed by a modified (H&Y) staging of disabilities, unified Parkinson's disease rating scale, pain scale, Tensiometer and EMG amplitude of different muscles (masseter and temporalis) before and after the treatment program. Thirty Parkinsonian patients are randomly divided into two equal groups (GI and GII). GI received the traditional physical therapy program and GII received the same physical therapy program and low frequency electromagnetic stimulation. The statistics showed that there is a mild improvement in GI after the treatment program while there is a significant improvement in GII after the treatment program.

Although, there have been several recent clinical studies showing the positive effect of low frequency electromagnetic stimulation on Parkinsonian patients, such treatment hasn't been widely used in clinical setting yet. Several studies have demonstrated effects superior to those obtained by neurodevelopment therapy intervention [20].

Our study showed that there was a strong relationship between the application of low frequency magnetic field and the improvement of TMD parameter, where there was moderate significant difference in muscle power, range of motion and angle of mouth opening. These results were confirmed those obtained by [21] who applied the electromagnetic stimulation (EMS) with 0.2 Hz on two idiopathic

Parkinsonian patients suffering from gait disorders and there was a mild improvement in stride width and posture during gait.

Our assessment in this study revealed that, the flexion attitude of head and neck in Parkinson's disease has the ability to cause frequent TMD, trismus, rigidity, bradykinesia, cardiorespiratory affection, kyphosis, loss of balance, narrow base of support and loss of postural reaction. Some of these changes related to dose of L-dopa and the most didn't respond to any drugs, so this study scope on some important tasks of daily activities, gait and muscle activities [22].

Also, our EMG amplitude assessment of certain muscles activities during mouth opening (masseter and pterygoid) revealed that there is small amplitude where the mean was (0.8-0.9 mV), this results are in agreement with [23] when tibialis anterior muscle (T.A) with amplitude was assessed(0.8 mV) and gastrocnemus muscle (G.C) with amplitude (0.9 mV) on 30 Parkinsonian patients suffering from frequent falling. The patients were assessed by EMG before the treatment program which included gait training, balance exercises and weight bearing exercises. The program of treatment continued for 8 weeks, each session 30 min, day after day. Finally, the patients were assessed again. The statistics showed that there was a mild but not significant improvement in muscle amplitude as it has became in T.A (0.9 mV) and in GC (1.3 mV).

Also, our study is agreement with [24] in using UPDRS to assess muscle power, and angle of mouth opening in 50 idiopathic Parkinsonian patients and 30 atherosclerotic Parkinsonian patients. They have suffered from frequent falling, freezing and tremor. In addition, [25] used UPDRS in 39 Parkinsonian patients to assess bradykinesia, rigidity, depression and balance. Also, [26] used UPDRS in 16 Parkinsonian patients to assess hand function and ADL.

This study is accordance with [27] when they assessed Co-ordination in 21 Parkinsonian patients stage II and III according to H & Y. They mentioned that the complex Co-ordination of leg and arm swing during walking was one of the main output features of the central nervous system. Moreover, many neurological impairments affected the brain interfere with co-ordination of movements especially during gait function. Poor timing of toe-off, heel strike and weight shifting as well as bilateral symmetry exposed was based on experimental evidence.

In our study, we agree with other authors who mentioned that the Orofacial function in Parkinsonian patients has some typical features in the mechanism of TMJ disturbance but differ individually according to the extent and location of cerebral damage. After the assessment of different Orofacial parameters by EMG methods in 49 vascular Parkinsonian patients they found that, there was muscle spasm, decrease TMJ range of motion and limitation of mouth opening. They related these changes to the contractures of the muscles, rigidity, delayed reaction time, bradykinesia and freezing. Numerous balance studies have shown that in 20 post encephalitic cases the transfer and rotation activities markedly decreased during walking. The flexion attitude was also a common symptom affecting balance, posture and gait. Such deficits lead to short step length, prolonged step time, insufficient hip, knee and ankle excursion, frequent falling and increase energy consumption [28].

The present study is in a accordance with [29] who concluded that TMS 0.4Hz with a physical therapy program seemed to address most of Parkinsonian patients problems as function of ADL and also had the ability to improve many of gait disorders, balance, shuffling, falling and narrow base of support.

The external application of low frequency EMS could alter the cerebral excitability, brain rhythms, circadian

rhythmicity and variety of behaviors in humans [30] One mechanism which had received wide experimental support evaluated the effect of EMFS on calcium flux patterns [31] Some of the most important calcium processes such as resting membrane potential, synaptic neurotransmitter synthesis and compound action muscle potential which were essential for the functioning of the neuron, are influenced by electromagnetic facilitations (EMFs) [32].In addition, the amplification via calcium flux could also provide the means by which the membrane mediates effects of EMFs on intracellular biochemical process [33].

Pulsed applications of EMFs at a specific range of frequencies, intensities and wave forms corresponding to the magnetic window of neural activity may alter calcium channel functions and thus increase the synthesis and synaptic release of neurotransmitter. In addition, pulsed EMFs may affect transmembrane calcium oscillations and thus alter resting membrane potential and neural excitability[34].

Moreover,[35]reported that the external application of EMFs affects neuroendocrine systems specifically the circadian rhythms of melatonin secretions from the pineal gland. Melatonin receptors have been demonstrated in the striatum and brainstem reticular formation [36]. The effect of EMS on the secretion of melatonin was relevant to the pathogenesis of Parkinson's disease since melatonin secretion was diminished in patients with the disease [37] and also because melatonin regulate midbrain and limbic dopaminergic activity[38] as well as noradrenergic and serotonergic activity [39].

Recent studies on Parkinsonian patients suggested that the dopaminergic neurons were in a state of oxidative stress as evidenced by increased cellular iron accumulation, decreased glutathione levels and damage of neurons molecules including lipids, protein and deoxyneuclic acid (DNA) [44]. This oxidative stress was believed to facilitate the degeneration of striate dopamine neurons in Parkinson's disease and limited their ability to synthesis, store and release of dopamine. Augmentation production by intermittent TMS diminished oxidative stress, enhance neural activity and slow the rate of degeneration of dopamine neurons in PD[45].

Our study is supported by [46] who used EMS with 2Hz on 9 Parkinsonian patients suffering from muscle weakness of TMJ. The patients were assessed by dynamic EMG changes where the mean amplitude of T.A was 0.8 mV and GC was 0.9 mV before the treatment. These the patients were treated by TMS were 0.7 Hz, 20 min. each session, day after day for 6 weeks. After that, the patients were reassessed, there was improvement in EMG amplitude as T.A 1.0 mV and GC 1.3 mV. Also, [47] mentioned that after 3 months of treatment by TMS 0.5 Hz in pilot study on 3 post encephalitic male patients suffering from limited trunk mobility, there was a significant improvement in trunk mobility measured by shuppered test and electronic goniometer of lumbar region. Moreover[48] stated that the application of TMS for at least 2 months on 16 idiopathic PD leads to increase the release of dopamine in striatum and improve most of symptoms.

The low frequency EMS 0.2 Hz in a experimental studies was applied on 70 idiopathic Parkinsonian patients divided into 7 groups, for 3 months, the patients were assessed by analysis of blood sampling for certain enzymes and by brain mapping. After the end of treatment by EMS, they concluded that there was an increase in apomorphine neurotransmitter enzymes and increased in the concentration of dopamine in striatum. Also, the long lasting treatment with TMS in PD was useful not only in depression but also in the treatment of hypokinesia, rigidity and tremor. So the TMS was considered the most appropriate method to be introduced as an effective therapeutic modalities in the treatment of PD [49].

This present study is in agreement with [50] who applied EMS on 12 idiopathic Parkinsonian patients suffering from rigidity. The treatment continued for 2 months with 0.5 Hz for 20 min, the patients were assessed by timing of certain activities as changing position from sitting to standing) and walking for 5m. After the treatment, the patient were assessed again. The statistics showed that there was a significant improvement in all activities.

After the researches were applied on more than 49 vascular Parkinsonian patients manifested by impaired memory and cognition, [21] applied EMS 0.3 Hz for 3 months, day after day. The patients assessed by measured position emission tomography and brain angiography. He concluded that after the treatment program, the cerebral blood flow has been increased to the premotor cortical areas and to the striatum EMS activates the cortical motor area by antidromic facilitation to the corticospinal tract through the current flow to the internal capsule or transynaptic flow via the striatum.

Moreover, [22]found that EMS elicits the motor evoked potential response in the contralateral extremities after stimulation to each frontal cortex, excitation of the frontal cortical regions including motor, premotor and supplementary areas. Hence [43] reported that EMS not only activates the cortex via the corticospinal tract in PD but also activates transynaptically upon dysfunctional basal ganglia circuits via the striatum.

In this experimental study the analysis of mean values before and after the treatment program by tensiometer showed that, there was a significant difference between the two groups with the best results for GII, this means that EMS 0.5 Hz, 30% intensity and 20 min duration gave the best results in UPDRS.

In our study, we used 0.5 Hz EMS similar to work done by [46]where the results were the same but different in the frequencies of stimulation 2Hz. They proved that was an improvement in both slowness of walking and decreased arm swings. Also, these results were supported and confirmed by [47] when the extracted EMS 0.5Hz was useful and effective in the treatment of 10 atherosclerotic cases of PD for 2 months, day after day. EMS coincides with balance training producing an appropriate pattern of gait through improves the integration of descending motor drive which consequently improve gait dynamics including initiation and stopping of movement.

In this study 0.5 Hz was chosen in accordance with many studies, while [48] was applied 10 Hz in another study of EMS 10Hz on Parkinsonian subjects for 6 weeks. The results showed that, there was defect in walking pattern of many patients and the patients were unable to walk at their normal comfortable speed. While[40] showed that the result of this experimental study of low frequency of EMS than 10 Hz were more effective and [17] confirmed that the higher levels more than 5Hz can affect the gait pattern in an undesired manner. So, [39] chosen 0.5 Hz the most suitable frequencies in the treatment of Parkinsonian patients.

Our findings of this experimental study are closely agreement and supported by the findings of [21] who applied EMS with different frequencies 0.5Hz, 5Hz and 10 Hz on 30 idiopathic Parkinsonian patients. They were divided into 3 equal groups accord to degree of disabilities of H & Y. The treatment program was applied for 2 months, 3 sessions per week, 30% intensities and 20 min in duration. GI was treated by 0.5 Hz, GII by 5 Hz and GIII by 10Hz. finally the results showed that there were moderate significant differences in GI, mild improvements in GII and no improvements in GI. So, they concluded that the higher frequencies of TMS more than 5Hz, 30% intensities and 20 min hadn't any effect on gait pattern.

The statistical findings of this work were supported by [28] when they conducted a case report on idiopathic female Parkinson's disease. She has suffered from

frequent falling during gait. The gait training for this patient required a continuous help from the therapist to assist the balance and prevent frequent falling. She received an additional therapy by EMS 0.3 Hz, 3 times per week, 20 min for 6 weeks. Her gait ability was assessed every two weeks by UPDRS. At the end of the second week she required only an intermittent help instead of a firm continuous support. After four weeks, she required a minimal help and after the six weeks she required only a verbal support and the patient was able to walk independently on the ground. Three months after the end of the study, the patient was still walking independently.

Our results are in agreement with the findings of [10] when they applied a study on 30 idiopathic Parkinsonian patients, the subjects have limited the range of motion in lower extremities, contractures of neck muscles and disturbance of balance. They were treated by EMS 0.9 Hz and a physical therapy program included (range of motion exercises, mobility and flexibility exercises). The treatment was done for 12 weeks, 3 days per week (day after day), the patients were assessed by H & Y grade 3 of disabilities and by digital goniometer. At the end of the treatment program, the results showed that there was a significant improvement in the range of motion but minimal improvement in balance.

Also, the results of this work are accepted by the work of [22] when they applied EMS 0.3 Hz on 9 postencephalitic Parkinsonian patients and assessed ROM of trunk by digital goniometer and ADL by H & Y. The treatment program was applied for 10 weeks. The results showed that there was an improvement in ADL activities more than ROM in lumbar region. These results are supported by [44] when they examined the beneficial effects of EMS 0.4 Hz on 5 idiopathic male Parkinsonian patients. The main problems of patients were short stride length and lack of reciprocal arm motion during walking. They were treated for 8 weeks, day after day and they were assessed by H & Y as stage 4. Their statistics revealed that there were changes in walking pattern and H & Y has become stage 3.

In this study, we used the dynamic EMG to assess mean amplitude of certain muscles, this is similar to the work of [9] who used EMG amplitude in the assessment of biceps brachii in 26 idiopathic Parkinsonian patients suffering from an impaired hand function. They were divided into two equal groups, GI Consists of 13 patients 0.8 mV in amplitude and stage 3 in H & Y, GII consists of 13 patients 0.7 mV in amplitude and stage 4 in H & Y. The patients in GI were treated by anti-Parkinsonian drugs while GII was treated by TMS 0.4Hz. The treatment program was applied for 2 months, 3 sessions every week. After the end of the treatment program, in GI although medications decreased the clinical symptoms of patients but statistically it wasn't significant, while in GII there was an observable improvement in EMG amplitude (1.1 mV) and hand function stage 3 in H & Y.

In contrast to our study [42] applied a study on 15 male idiopathic PD who suffering from retropulsion during walking, to determine the effect of EMS 8Hz with regular rehabilitation program, H & Y stages 3, the treatment program continued for 2 weeks, daily sessions. Finally, they reported that, there wasn't any significant improvement.

Our Statistics showed that the amplitude of masseter muscles was significantly improved after EMS from (mean 0.8 mV) to (mean 1.3mV), these result was confirmed by [33] who found changes in the mean amplitude of dynamic EMG after the application of EMS 0.6Hz on 47 idiopathic Parkinsonian patients. They were assessed by the dynamic EMG where the mean amplitude changes of gastrocnemus muscle (0.8mV) and tibialis anterior muscle (0.7mV) before the treatment program. The treatment was applied by EMS 0.4 Hz for 2 months,

sessions day after day. At the end of the treatment program, the patients were assessed again, the statistics revealed that there was a significant improvement in EMG mean amplitude of gastrocnemus muscle to (1.3mV) and tibialis anterior muscle to (1.0mV). Moreover, they reported that there were different changes in EMG as increased duration of motor evoked potential, increased number of phases and increased amplitude.

Besides that, our study showed that there was a significant increase in EMG mean amplitude of masseter muscle after EMS from (0.8mV) to (1.4mV), this is in agreement with [44] who applied four different EMS frequencies (0.5Hz, 1Hz,5Hz and 10 Hz) on four selected groups of Parkinsonian patients of the same degree of disabilities according to H & Y stage 3 in ADL. The patients were treated by EMS for 20 min., day after day. They were assessed by EMG for activities of biceps brachii muscle mean amplitude (0.7mV) and triceps muscle mean amplitude (0.8mV) before the treatment program. The statistics after the treatment program showed that there were significant differences in mean biceps muscle amplitude (1.4mV) and stage II in H & Y of GI otherwise in GII there was a mild improvement but no significant changes in GIII and GIV.

In our present study the statistics revealed that, there was improvement in EMG mean amplitude of temporalis muscles from (0.6mV) to (1.1mV). This result was supported by [2] who applied EMS 0.3Hz on 29 idiopathic Parkinsonian patients. The treatment program was applied for 3 months, day after day. They have suffered from lack of bed activities when assessed by H & Y stage III and EMG amplitude of external oblique muscle of trunk was (0.7mV) before treatment program. Finally, the results concluded that there were significant changes in EMG amplitude (1.3mV) and a minimal improvement in bed activities.Also[45]concluded by analyzing the firing pattern of motor units on 32 Parkinsonian by the effect of TMS 0.5Hz, which increased the rate of firing pattern and increased in motor unit action potential.

In our work, there is improvement in angle of opening of TMJ in both groups with the best results for EMS group. This coincides with the work of [46]who applied EMS 0.3Hz on 27 post encephalitic patients suffering from limited neck movement (flexion, extension and rotation) as measured by digital goniometer. They were divided into two equal groups, GI was a control group treated by traditional physical therapy program while GII was an experimental group which received the same exercise program and TMS 0.3Hz for 2 months, each session 20 min, day after day. After the treatment program, there was significant differences in TMS group as compared to non TMS group.

Finally, in this experimental study the analysis of mean values before and after the treatment by EMS showed that there were significant differences within the two groups with the best results of GII. These results mean that EMS 0.5 Hz, 30% intensity and 20 min duration have given the best results according to EMG,UPDRS, Tensiometer, digital mouth caliper and pain scale. This prognosis may be a result of optimal application of EMS technique, suitable frequency, appropriate intensity and optimum duration.

SUMMARY

The purpose of the study is to evaluate whether rhythmical low frequency electromagnetic stimulation can improve the degree of disabilities according to UPDRS and modified Hoehn and Yahr scale, pain, angle of mouth opening, muscle power and electromyographic muscle activities of TMJ in Parkinsonian patients. 30 male and female Parkinsonian patients were selected from outpatient clinic of King Khalid hospital and outpatient clinic of Neuromuscular and Neurosurgical Disorders, Najran University, their ages ranged from 50 to 77

years with the mean age of (56.±6.6) years were participated in this study. Patients were randomly divided into two equal groups each group consisted of 15 patients, GI is a control group and was treated by traditional physical therapy program (Stretching exercises, strengthening exercises, PNF of head and neck and manipulation of TMJ) without magnetic stimulation and GII is an experimental group and was treated by low frequency electromagnetic stimulation and also the same previous traditional physical therapy program. All subjects have received their exercise training for 40 min (five minutes training and five minutes rest respectively), this means 20 minutes training and 20 minutes rest, three days per week, day after day for six weeks, magnetic stimulation with frequency 0.5 Hz,30% intensity and 20 min. duration. All patients were assessed clinically by EMG,UPDRS, Tensiometer, Digital mouth caliper and Visual Analogue scale .The statistical results showed a significant difference between the two groups with the best results for GII.

RECOMMENDATIONS

With the limitation of this study and from the obtained statistical results further investigations and research studies are recommended as further studies should be attempted to describe the effect of magnetic stimulation on speech, cognition and facial expression with different frequencies and intensities of magnetic stimulation to treat many different disabilities in different neurological diseases.

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مستقبل علاج اضطرابات مفصل الفك في مرضى الشلل الرعاش

د/ ياسر إبراهيم على سعده ، أ.د/ محمد سعيد توفيق أ.د م/ رضا نوفل ٠مدرس بقسم اضطرابات الجهاز العصبي العضلي وجراحتها جامعة القاهرة، كلية العلاج الطبيعى، جامعة القاهرة٠ أستاذ وظائف الأعضاء ،جامعة الزقازيق٠ الأستاذ المساعد بقسم جراحة الوجه والفكين ،جامعة الأزهر٠

كان الهدف من هذه الدراسة هو تقييم مدى تأثير المجال الكهرومغناطيسي على مشاكل مفصل الفك في مرضى الشلل الرعاش، ولقد أجريت هذه الدراسة على ٣٠ مريضاً مصابين بمرض الشلل الرعاش من الرجال والسيدات، وتراوحت أعمارهم مابين ٥٠ عاماً وحتى ٧٧ عاماً، قسموا عشوائياً إلى مجموعتين متساويتين، بالنسبة للمجموعة الأولى فقد عولجت ببرنامج تأهيلي ملائم لذلك استغرق التمرين ٤٠ دقيقة بواقع خمس دقائق للتدريب وخمس دقائق راحة، دون أي مجال كهرومغناطيسي، أما المجموعة الثانية فقد عولجت بالمجال الكهرومغناطيسي تردد ٠.٥ هرتز وقوة المجال ٣٠% لمدة ٢٠ دقيقة وذلك على مدار ستة أسابيع ، ثلاث مرات أسبوعيا يوم بعد يوم، وتم إجراء القياسات الحيوية لجميع المرضى مثل ضغط الدم ودرجة الحرارة ومعدل ضربات القلب ومعدل التنفس لجميع المرضى ثلاثة مرات لكل مريض قبل، أثناء وبعد العلاج في كل جلسة. كما تم تقييم المرضى قبل وبعد العلاج عن طريق قياس شدة الألم ، قياس قوة عضلات الفك ، قياس زاوية فتح الفم ،قياس شحنة العضلات باستخدام جهاز رسم العضلات الكهربي .

وقد أوضحت نتائج المعالجة والتحليلات الإحصائية أن هناك تحسن إحصائي واضح ذو دلالة إحصائية حيث أن أفضل النتائج كانت لصالح المجموعة الثانية. مما سبق يتضح إحصائيا أن العلاج الكهرومغناطيسي بتردد ٠.٥ وبنسبة ٣٠% ولمدة ٢٠ دقيقة في خلال ستة أسابيع تعتبر من أفضل الطرق لتأهيل مشاكل مفصل الفك لدى مرضى الشلل الرعاش.

الكلمات الدالة: التنبيه الكهرومغناطيسي – الألم – رسم العضلات الكهربي – مفصل الفك - الشلل الرعاش- قوة العضلات.