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Polarized Light Therapy Versus Pulsed Electromagnetic Field Therapy on Chronic Rhinosinusitis

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Abstract: Purpose: to evaluate the efficacy of polarized light therapy versus pulsed electromagnetic field therapy on chronic rhinosinusitis. **Methods of evaluation** (Measurement of the sinusitis symptom score (SSS) and the computerized tomography scan (CTS) for maxillary sinus). **Methods:-** Forty patients with ages ranging from 25 to 40 years and suffer from chronic maxillary rhinosinusitis. They were selected from the outpatient clinic of the Otorhinolaryngology (ENT) department at Cairo University Hospitals. They were divided into two groups. Group (A) composed of 20 patients received the Bioptron light therapy (BLT) (10 minutes session over each maxillary sinus day after day for three months). Group (B) received the pulsed electromagnetic field therapy (PEMFT) (10 minutes session over each maxillary sinus day after day for three months). All patients received the traditional physical therapy in the form of facial infrared superficial heating for 3 minutes and cheek massage for another 3 minutes in addition to the same medical care and medications. The treatment program was conducted for 10 minutes, 3 times / week for three months. Measurements were conducted before starting the treatment as a first record and at the end of the third month of treatment as a second (final) record. **Results and conclusion:-** Results showed that application of both the BLT and PEMFT had a valuable improving effects on chronic rhinosinusitis as evidenced by the highly significant decreases in sinusitis symptom score and the computerized tomography scan for maxillary sinus. But the PEMFT was more fruitful than the BLT in improving the chronic rhinosinusitis.

Key words (Bioptron light therapy, Pulsed electromagnetic field therapy, Chronic rhinosinusitis, Sinusitis symptom score and Computerized tomography scan for maxillary sinus).

Introduction

Chronic rhinosinusitis (CRS) is a common, long-term condition and a significant health problem. Newer classifications of sinusitis refer to it as rhinosinusitis, because cannot occur without some inflammation of the nose (rhinitis)**.** Sinusitis represents a significant health and socioeconomic problem, with 29.2 million adult patients in the United States. It is estimated that sinusitis accounts for more than 25 million office visited to doctors in the united states each year, In 1996, the total costs were estimated at $5.8 billion annually, [3,4,7.]

CRS negatively affects quality of life, can substantially impair function, and results in reduced workplace productivity .The etiology of CRS is multifactorial (e.g. viral, bacterial, or fungal infection, allergy, and environmental factors) and no effective treatment has been established. The definition of CRS is based on symptoms and signs, symptoms of inflammation of the paranasal sinuses persist more than 8-12 weeks or more than 3 or 4 acute episodes per year, each lasting for at least 10 days. The major symptoms of sinusitis are facial pain / pressure, nasal obstruction (blockage), nasal drip, hyposmia (weakness and disturbance of smell), purulence in nasal cavity on examination, and fever in acute episodes. Headaches, halitosis (bad breath), fatigue, dental pain, cough, and ear pain have been classified as minor symptoms. The minor symptoms achieve diagnostic significance when one or more of the major symptoms are present among the symptoms. Nasal obstruction or posterior discharge is usually the main complaint in patients CRS[12,13,17..]

Chronic sinusitis can cause more indolent symptoms that persist for months. Nasal congestion and postnasal drainage are the most common symptoms of chronic sinusitis. Chronic cough that is described as worse at night or on awakening in the morning is also a commonly described symptom of chronic sinusitis. Clinical evidence of chronic sinusitis may be subtle and less overt than in acute sinusitis unless the patient is having an acute sinusitis exacerbation. Because this diagnosis may be more difficult to make in the primary care setting or in a setting without radiographic or rhinoscopic capabilities, Lanza and Kennedy have proposed a major and minor classification system to define chronic sinusitis by the manifesting symptoms [2,3,4,717,18.]

Polarized light from low power lasers and non-laser devices has been used as a non-invasive therapy in the treatment of various musculoskeletal disorders, acceleration of wound healing and treatment of skin ulcers. Although the polarized light is known to have numerous photo-biostimulatory effects including cell proliferation, enhanced collagen synthesis, changes to the circulatory system and anti-inflammatory actions, the precise mechanism of its action still remains unclear. The available non-laser optical devices are the Bioptron products which emit a wide beam of polarized, non-coherent, polychromatic, low energy light that contain wavelengths from the visible spectrum (480-700nm) and infrared radiation (700-3400nm); this range provides optimal penetration and stimulation of the tissues without the risk of DNA damage[8,11,20.]

Bioptron light therapy (BLT) device emits light that is polarized, polychromatic, non-coherent and of low energy. The light emitted has a wide range of wavelengths (480-3400nm) and differs from laser light, which is mono-chromatic (of narrow wavelength), coherent, polarized and of high or low energy. Possible risk of burns is present with the laser therapy, while not possible with the Bioptron light therapy. User skills are essential in laser therapy, but not essential with the Bioptron light therapy**.** Higher costs are present with the laser therapy, but not with the Bioptron light therapy, in addition, treatment of large area is available with the Bioptron light therapy[5,8,11,16,21.]

The ancient people discovered magnetic phenomenon about 2000 years ago. Certain lead colored stones notably at Magnesia "a province in Asia Minor" were found to possess the property of attracting iron filling or small pieces of steel. Since it was found in Magnesia it was given the name of magnetite. During the past few decades, the biological effects of electric currents and electromagnetic fields (EMF) have become a topic of increasing attention. Endogenous electrical and electrochemical interactions are associated with many basic physiological processes, ranging from ion binding and molecular conformation in the cell membrane to the macroscopic mechanical properties of tissues[1,,9,10.]

Pulsed electromagnetic field therapy is a physical therapy modality that has been widely used for increasing permeability of the cell membrane and blood circulation, increasing oxygen supply, increasing ATP production, stimulating healing process and epithelialization of the injured tissues, accelerating bone healing, improving fibroblastic as well as osteoblastic activities, plus its anti-inflammatory and analgesic effect, [1,6,14,19.]

Material and Methods

Subjects:

This study was carried out on forty patients with ages ranging from 25 to 40 years and suffer from chronic maxillary rhinosinusitis. They were selected from the outpatient clinic of the Otorhinolaryngology (ENT) department at Cairo University Hospitals. They were divided into two groups. Group (A) composed of 20 patients received the Bioptron light therapy (BLT) (10 minutes session over each maxillary sinus day after

day for three months). Group (B) received the pulsed electromagnetic field therapy (PEMFT) (10 minutes session over each maxillary sinus day after day for three months). All patients received the traditional physical therapy in the form of facial infrared superficial heating for 3 minutes and cheek massage for another 3 minutes in addition to the same medical care and medications. The treatment program was conducted for 10 minutes, 3 times / week for three months. Measurements were conducted before starting the treatment as a first record and at the end of the third month of treatment as a second (final) record.

Instrumentation:

In this study the measuring equipment were the sinusitis symptom score (SSS) and the computerized tomography scan (CTS) for maxillary sinus), while the therapeutic equipment was the Bioptron Compact III polarized light therapy system (PAG-860 manufactured in Switzerland) and the pulsed electromagnetic field therapy unit (JAMAVA® S Magneto therapeutic apparatus), [2,7,13,15.]

Procedures

Evaluation:

1-Sinusitis Symptom Score (SSS): was used to evaluate the 6 items of facial pain, post nasal drip (PND), nasal obstruction (NO), nasal discharge (ND), hyposmia (smell weakness and disturbance) and cough. All patients were instructed to circle a number from 0 to 3 on each line of the 6 items of the SSS, that best describes the average symptoms that have them, where (0) means that symptom is absent and (3) means that symptom is the worst as patient imagine for the 6 items and eventually the total score was summated before treatment and at the end of the third month of treatment program to be statistically treated, The values of the six symptoms were added to obtain the total score representing the sinusitis symptom score with score ranging from 0 (minimal symptoms) to 18 (maximal symptoms),[12,13.]

2- **Computerized Tomography Scan (CTS) for maxillary sinus:** for detecting thickness of the mucosal lining of the maxillary sinus in mm, where (0) means that thickening of the mucosal lining of the maxillary sinus is absent, CT scan findings evaluated the severity of the rhinosinusitis using the same scoring of 0–3 (absent, mild, moderate, or severe) , [7,13,15.]

1- Treatment procedures of the BLT and the PEMFT:

Procedures of the polarized light therapy for the study group (A):

Steps of the BLT treatment procedures: With the patient in the comfortable sitting position, area of treatment (cheeks) was cleaned, BLT device preparation: the plug of the BLT unit was inserted into the main current supply; the on/off switch was switched on. Then set the treatment parameters of BLT. BLT application: point the light beam at the area to be treated (for each side of the two cheeks over the maxillary sinus areas), holding the device at right angle (90°) perpendicular to the surface of the treated area and maintaining a distance of 10 cm from the surface of it and applying the BLT for about 10 minutes over each maxillary sinus, frequency of application was day after day and the treatment program was conducted 3 times / week for three months [5,8,11,16,20,21].

Procedures of the pulsed electromagnetic field therapy for the study group (B): Steps of the PEMFT treatment procedures: The pulsed electromagnetic field therapy (PEMF) was applied once daily, three times per week for 3 months. Each session was conducted for 10 minutes over each maxillary sinus with the patient in the comfortable sitting position; area of treatment (cheeks) was cleaned. Active surface of the JAMAVA apparatus was fixed directly on each side of the two cheeks over the maxillary sinus areas. Also active surface of the apparatus was covered with disposable Cling's film to avoid cross contamination among patients. Programme of PEMF for the second study group (B) had the following characteristics: A programme of mild impulses, soothing North polarity of the magnetic pulses with frequency up to 12 Hz, [1, 6, 9, 10,14,19.]

Data analysis:

Sinusitis symptom score (SSS) and the computerized tomography scan (CTS) for maxillary sinus), were measured pre-treatment as a first record and after three months as a second final record in both groups.

Collected data were fed into computer for the statistical analysis; descriptive statistics as mean, standard deviation, minimum and maximum were calculated for each group. The t-test was done to compare the mean difference of the two groups before and after application and within each group. Alpha point of 0.05 was used as a level of significance,[22.]

Results:

As shown in table (1) and figure (1), the mean value of the SSS before treatment was (15.800 ± 0.380) degrees in the first study group (BLT), while after treatment was (8.867 ± 0.639) degrees. These results revealed a highly significant reduction in SSS (P < 0.0001). While in the second study group (PEMFT), the mean value of the SSS before treatment was (15.867 ± 0.363) degrees, while after treatment was (6.800 ± 0.416) degrees. Also these results revealed a highly significant reduction in the SSS (P < 0.0001).

Table (1): Comparison of the mean values of the sinusitis symptom score (SSS) in degrees before and after treatment in the two study and groups

	Before treatment		After treatment		Mean difference	T-value	P.value	Level of significance
	Mean	SD	Mean	SD				
First Study Group (BLT group)	**15.800**	**0.1380**	**8.867**	**0.639**	**6.93300**	47.43	0.0001	Highly significant decrease
Second study Group (PEMFT group)	**15.867**	**0.363**	**6.800**	**0.416**	**9.06700**	**73.44**	0.0001	Highly significant decrease

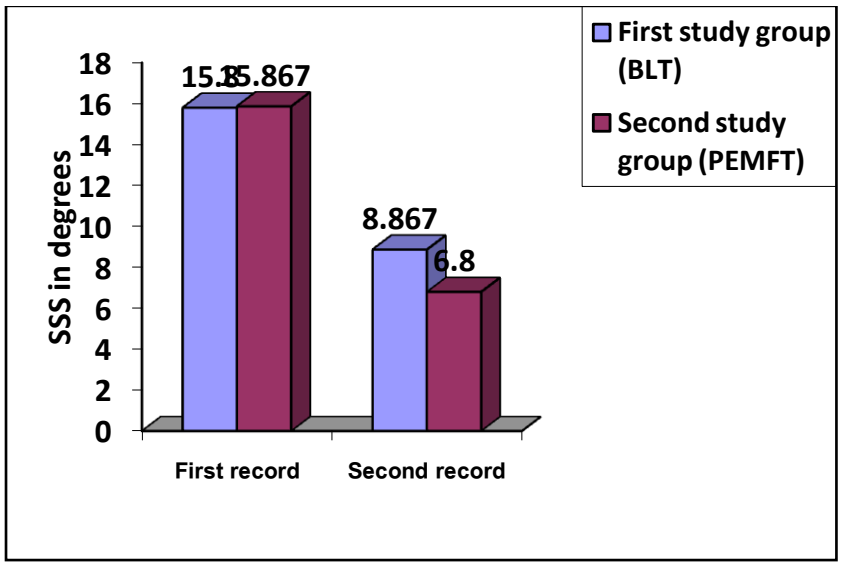

Fig (1): Mean values of the sinusitis symptom score (SSS) before and after treatment in both groups.

As shown in table (2) and figure (2), the mean value of the computerized tomography scan (CTS) for maxillary sinus) in degrees before treatment was (2.9333 ± 0.0667) degrees in the first study group (BLT), while after treatment was (1.333 ± 0.126) degrees. These results revealed a highly significant reduction in computerized tomography scan (CTS) for maxillary sinus), (P < 0.0001), while in the second study group

(PEMFT), the mean value of the computerized tomography scan (CTS) for maxillary sinus) before treatment was (2.8571 ± 0.0971) degrees, while after treatment was (0.733 ± 0.118) degrees, also these results revealed a highly significant reduction in the computerized tomography scan (CTS) for maxillary sinus) ($P < 0.0001$).

Table (2): Comparison of the mean values of the computerized tomography scan (CTS) for maxillary sinus) before and after treatment in the two groups

	Before treatment		After treatment		Mean difference	T-value	P.value	Level of significance
	Mean	SD	Mean	SD				
First Study Group (BLT group)	**2.9333**	**0.0667**	**1.333**	**0.126**	**1.60030**	50.20	0.0001	Highly significant decrease
Second study Group (PEMFT group)	**2.8571**	**0.0971**	**0.733**	**0.118**	**2.12410**	**62.16**	0.0001	Highly significant decrease

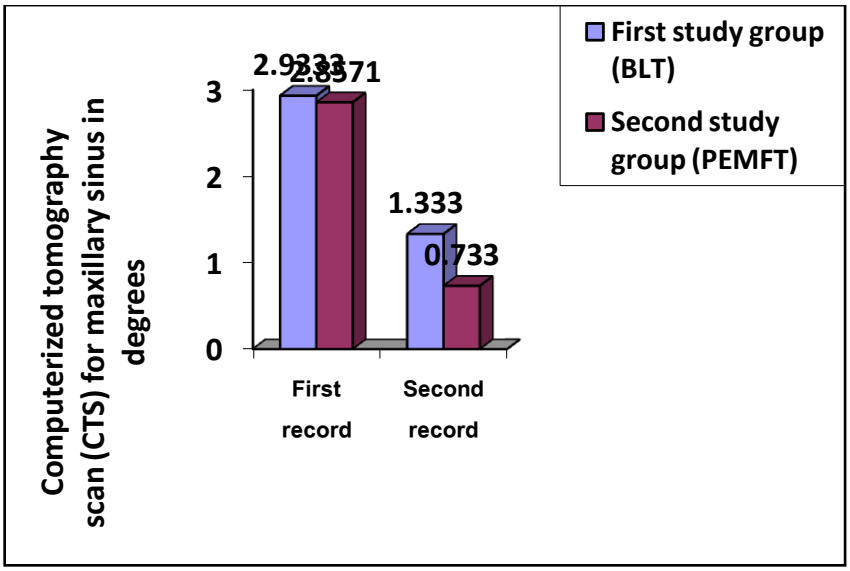

Fig (2): Mean values of the computerized tomography scan (CTS) for maxillary sinus) of the 2 records in both groups.

Discussion

Several factors can increase your risk of chronic sinusitis or worsen its symptoms once you have the disorder as allergies; allergies are much more common among people with chronic sinusitis than they are among people in the general population, this is especially true of allergies that are present year-round, such as dust mites, animal dander, molds, and cockroaches. What's more, allergies that are poorly controlled can worsen the symptoms of chronic sinusitis, exposure to airborne irritants or tobacco smoke, exposure to cigarette smoke or certain environmental toxins, such as formaldehyde, can increase the risk of chronic sinusitis, immune system disorders; people who have certain immune system problems are at increased risk of chronic sinusitis[3, 4,7,17.]

Chronic sinusitis can cause more indolent symptoms that persist for months. Nasal congestion and postnasal drainage are the most common symptoms of chronic sinusitis. Chronic cough that is described as worse at night or on awakening in the morning is also a commonly described symptom of chronic sinusitis.

Clinical evidence of chronic sinusitis may be subtle and less overt than in acute sinusitis unless the patient is having an acute sinusitis exacerbation. Because this diagnosis may be more difficult to make in the primary care setting or in a setting without radiographic or rhinoscopic capabilities, Lanza and Kennedy have proposed a major and minor classification system to define chronic sinusitis by the manifesting symptoms[7, 12, 13,18.]

The biostimulative effects of Bioptron light are the result of synergy between different mechanisms of action as; harmonize the metabolic processes, reinforce the human defence system, stimulate regenerative and reparative processes of the entire organism, promote wound healing and relieve pain or decrease its intensity. The scientific mechanisms underlying various light therapy treatments are still under investigation. However, in general scientists have identified various biological effects that can be initiated and achieved as a result of light stimulation. These include; stimulation of neoangiogenesis, improvement of circulation, increasing the process of phagocytosis, stimulation and activation of ATP production, enhancement of important specific enzymes involved in cell regeneration, increasing the activity of lymphatic system, activation of fibroblast activity and increasing the production of collagen, increasing DNA and RNA production and reducing the excitability of nervous tissue as well as increasing the muscle relaxation[8,11,20,21.]

Magnetic phenomenon was discovered about 2000 years ago by the ancient people. Magnet is the native magnetic oxide of iron, a body that has the property of attracting particles of iron, cobalt, nickel or any of various metallic alloy, and that has magnetic polarity, i.e. when freely suspended, it tends to assume a definite direction between the magnetic poles of the earth. Bio magnetism is the relation between magnetism and biology is usually associated with the effect of an external magnetic field on living organisms or parts of them. The action of a magnetic field causes either intensified growth of living organisms or a slow-down of their activities or even death. Magnetic field changes the properties of circuits, even if there is no current passing through it. This applies to liquid crystalline circuits. Liquid crystals are present in every cell; they change their properties under the effect of the magnetic field. They are compounds whose form neither a liquid nor a crystal but transitional form between liquid and crystals[1, 6,9,14, 19.]

The findings of the present study showed non-significant differences in the pre-treatment records of both SSS and CTS between the mean values of the first and second study groups.

Results of the first study group revealed a highly significant decrease in the mean values of SSS and CTS, after application of the BLT, when compared against the pre-application results. Also results of the second study group revealed a highly significant decrease in the mean values of SSS and CTS, after application of the PEMFT, when compared against the pre-application results.

Significant differences showed in the first and second study groups were consistent with those observed and recorded by[1,5,6,8,9,10,11,14,16,19,20,21].

Results of this study support the expectation that application of both the BLT and PEMFT had a valuable improving effects on chronic rhinosinusitis as evidenced by the highly significant decreases in sinusitis symptom score and the computerized tomography scan for maxillary sinus. But the PEMFT was more fruitful than the BLT in improving the chronic rhinosinusitis.

Conclusion

Application of both the BLT and PEMFT had a valuable improving effects on chronic rhinosinusitis as evidenced by the highly significant decreases in sinusitis symptom score and the computerized tomography scan for maxillary sinus. But the PEMFT was more fruitful than the BLT in improving the chronic rhinosinusitis.

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