

Effect of Laser Therapy Versus Aerobic Exercise Training on Small Airway Ventilation and Selected Immune System Response in Asthmatic Children

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ABSTRACT

Background: Asthma is common in children affects about 18% of children less than 12 years of age worldwide and its prevalence is increasing. Patients with bronchial asthma have poor ventilation in small airway which gradually impairs their overall physical ability and reduces health related quality of life. Many people turn to alternative and complementary treatment. **Objective:** To compare the effect of laser acupuncture therapy and aerobic exercise on small airway ventilation (the greatest affected lung area) and immune system in asthmatic children. **Methods:** Thirty six asthmatic children participated in this study and divided into two equal groups; group (1) received medical treatment and the usual physiotherapy in addition to laser acupuncture therapy, where group (2) received medical treatment and the usual physiotherapy in addition to aerobic exercise training. The program continued for two months. Measurements of IgG, FEF0.2-1.2%, FEF25-75% and MEF50% obtained before starting of the study and after two successive months. **Results:** The results of this study indicated that there were significant improvements in the measurement parameters including IgG, FEF0.2-1.2%, FEF25-75% and MEF50% for both groups, where there was no significant difference between both groups ($p < 0.05$).

INTRODUCTION

Bronchial asthma is a chronic inflammatory disease of the lower respiratory tract. It is characterized by non-specific bronchial hyper-responsiveness which may lead to variable and reversible airflow obstruction that is often reversible either spontaneously or with treatment³.

Asthma affects about 100 million people worldwide¹⁰. During the past several decades; this prevalence has been increased by 5% to 6% per year reaching 30%-40% in many countries²¹.

Laser therapy has biostimulative and tissue regenerative properties as well as antimicrobial, anti-inflammatory and analgesic effects. Studies on its effects on respiratory disease have shown improvement in gas exchange and pulmonary functions, as well as enhanced immunity and other health benefits^{2,20}.

Laser has a reinforcement effect on the immune function of the body fluid and cells through increasing serum gamma globulin^{12,14}.

Exercise has the capacity to protect and even enhance the immune response. Experimental studies have shown that a regular exercise program of brisk walking can

bolster many defenses of the immune system¹¹.

Exercise can also improve the mental wellness. Regular aerobic exercise can help relieve mild to moderate degrees of depression and anxiety. It is not clear whether exercise boosts the immune system directly or works through a link with the brain and nervous system¹⁸.

The aim of this study was to determine the effect of laser acupuncture therapy and aerobic exercise on immune system and small airway ventilation (the greatest affected area in the lung) in asthmatic children.

SUBJECTS, MATERIAL AND METHODS

Subjects

Thirty six asthmatic children of both sexes (20 boys and 16 girls), their age ranged between 8 -12 years. They were selected from the Pediatric Department of Abassia Chest Hospital. They received bronchodilators, antibiotics and received no supplemental oxygen. They were classified randomly into two groups of equal numbers: Group (1) laser therapy group and group (2) aerobic exercise group.

The children were examined by specialized physician to exclude subjects with any other disorders. Parents of the children have their written consent form to allow their children to participate in the study and received a through explanation about the significance of the study, the procedures and the duration of the study. The children were examined by specialized physician to exclude subjects with any disorders. Parents of the children gave their written consent form to allow their children to participate in the study and received a through explanation about the

significance of the study, the procedures and the duration of the study.

Equipment

- 1- Laboratory kits to measure immunoglobulin G (IgG) level in the serum.
- 2- Ventilatory function test instrument (Schiler-spirovit SP-10) was used to measure the average of forced expiratory flow rate at 0.2-1.2% of forced vital capacity (FEF_{0.2-1.2%}), the average of forced expiratory flow rate at 25-75% of forced vital capacity (FEF_{25-75%}) and maximum expiratory flow rate at 50% of forced vital capacity (MEF_{50%}).
- 3- Acuhealth professional 900 Acuhealth Australia (An Acupuncture point detector and cunometer were used to detect the acupuncture points for the respiratory system disorders, fig. (1a, b, c and d).
- 4- Standard weight and height scale (Metro type- England) was used to measure weight and height to calculate the body mass index to exclude obese subjects.
- 5- Bicycle ergometer (Monark 818E, Sweden) was used to perform the aerobic exercise training.
- 6- Laser LTU 904 retroflected shield (class I laser product manufactured by laserex technologies PTYLTD, Australia)

PROCEDURES

Patients were divided into two equal groups:

Group (1) (Laser therapy group): patients of this group received medical treatment & the usual physiotherapy in addition to laser acupuncture therapy. Each acupuncture point of the immune system received laser therapy for 90 seconds, three sessions per week for one month. The child was bare skin; the sites of acupuncture points were

detected and confirmed by the acupuncture point detector and cleaned by alcohol. Both patient and the therapist used protective glasses to protect their eyes from laser therapy. The acupuncture points of the immune system are 5 points ⁽⁹⁾ as illustrated in Figures (1a, b, c & d)

Dubi (St.36): In the depression below the patella on the lateral side of the ligamentum patellae .Figure (1a).

Zusanli (St.37): One finger breadth lateral to the inferior end of the tibial tuberosity. Figure (1a).

Quchi (L.I.11): At the outer end of the elbow crease when the elbow is semiflexed. Figure (1b).

Dazhui (GV.14): On the back midline between the dorsal spines of the 7th cervical and 1st thoracic vertebra. Figure (1c).

Hegu (L.I. 4): It is situated in the web between the index and thumb on the dorsal (posterior) aspect of the hand, may be located when the index and thumb are adducted at the highest point of the muscles on the back of the hand. Figure (1d).

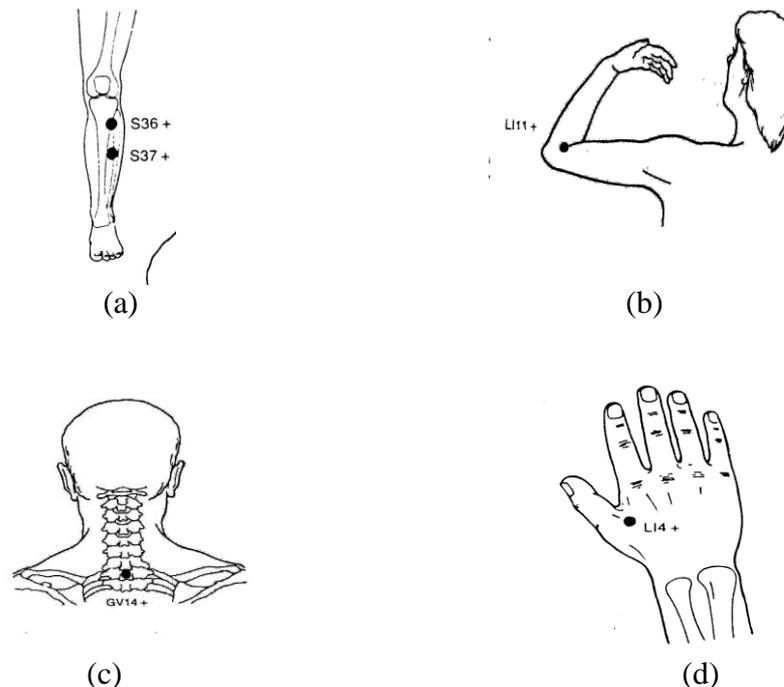


Fig. (1a, b, c and d): The acupuncture points for the immune system.

Group (2): (Aerobic exercise group): patients of this group received medical treatment and the usual physiotherapy in addition to aerobic exercise training using bicycle ergometer , the session began with 5

minutes warm up in the form of stretching exercise and walking in places (warm-up). Then the subject started the bicycle ergometer training for 20 minutes with an intensity of 60% of maximal heart rate for one month and

increased gradually for 70 % of maximal heart rate during the second month of the program. The workload was gradually reduced over 5 minutes (Cool down). The treatment conducted three sessions per week for two successive months^(16, 17).

Each child rest comfortably in a quite room and 2.5 ml venous blood sample was obtained for measurement of (IgG) in addition measurement of ventilatory function test before starting of the study and at the end of the study after one month.

Statistical analysis

The mean values of immunoglobulin G (IgG), $FEF_{0.2-1.2\%}$, $FEF_{25-75\%}$ and $MEF_{50\%}$ obtained before and after two months in both groups were compared using paired "t" test. Independent "t" test was used for the comparison between the two groups ($P < 0.05$).

RESULTS

The results of this study indicated that there were significant improvements in the mean values of IgG, $FEF_{0.2-1.2\%}$, $FEF_{25-75\%}$ and $MEF_{50\%}$ post treatment in group 1 (Laser therapy group) as shown in table (1) and illustrated in figure (2).

Table (1): The differences between the pre and post mean values IgG, $FEF_{0.2-1.2\%}$, $FEF_{25-75\%}$ and $MEF_{50\%}$ in group 1 (Laser therapy group).

Measured parameters	Mean \pm SD		t- value	Significance
	Pre	Post		
IgG (mg/dl)	0.73 \pm 0.21	0.98 \pm 0.23	4.66	Sig.
$FEF_{0.2-1.2\%}$ (L/sec.)	0.88 \pm 0.27	1.19 \pm 0.26	4.91	Sig.
$FEF_{25-75\%}$ (L/sec.)	0.65 \pm 0.25	0.98 \pm 0.24	5.40	Sig.
$MEF_{50\%}$ (L/sec.)	0.48 \pm 0.17	0.75 \pm 0.22	4.95	Sig.

Level of significance $p < 0.05$

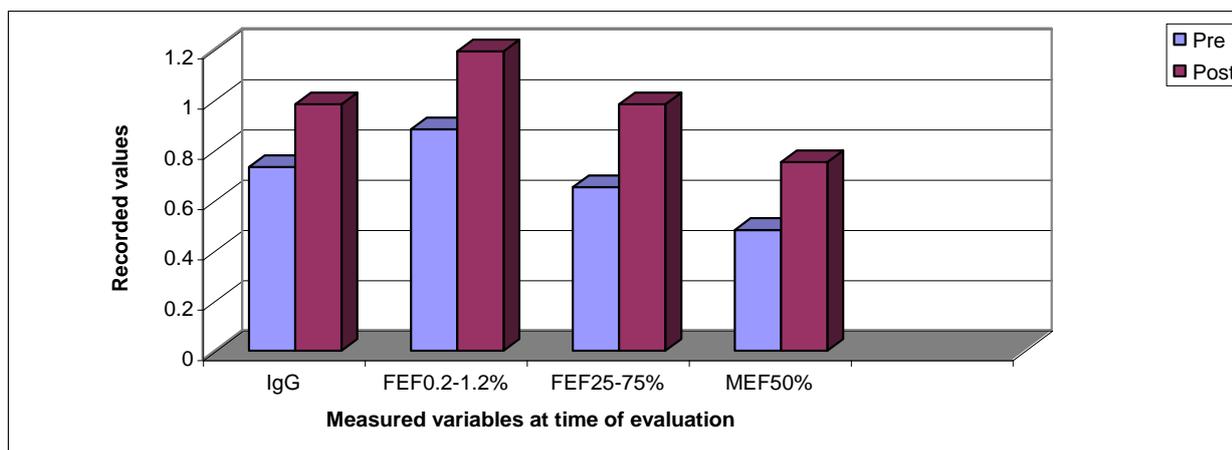


Fig. (2): The differences between the pre and post mean values of IgG, $FEF_{0.2-1.2\%}$, $FEF_{25-75\%}$ and $MEF_{50\%}$ in group 1 (Laser therapy group).

The results of this study also indicated that there were significant improvements in the mean values of IgG, FEF_{0.2-1.2%}, FEF_{25-75%}

and MEF_{50%} post treatment in group 2 (Laser therapy group) as shown in table (2) and illustrated in figure (3).

Table (2): The differences between the pre and post mean values of IgG, FEF_{0.2-1.2%}, FEF_{25-75%} and MEF_{50%} in group 2 (Aerobic exercise group).

Measured parameters	Mean \pm SD		t- value	Significance
	Pre	Post		
IgG (mg/dl)	0.70 \pm 0.22	0.95 \pm 0.20	4.51	Sig.
FEF _{0.2-1.2%} (L/sec.)	0.85 \pm 0.23	1.13 \pm 0.25	4.78	Sig.
FEF _{25-75%} (L/sec.)	0.64 \pm 0.21	0.92 \pm 0.22	5.13	Sig.
MEF _{50%} (L/sec.)	0.46 \pm 0.15	0.70 \pm 0.18	4.89	Sig.

Level of significance $p < 0.05$

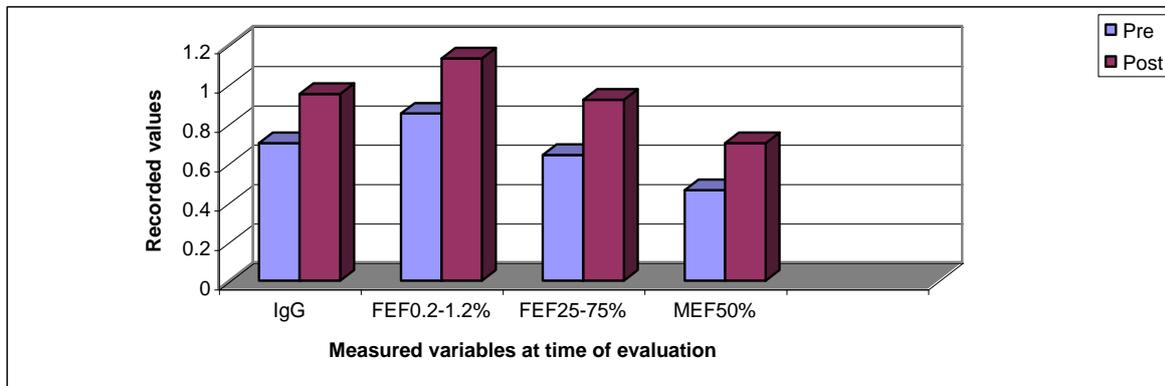


Fig. (3): The differences between the pre and post mean values of IgG, FEF_{0.2-1.2%}, FEF_{25-75%} and MEF_{50%} in group 2 (Aerobic exercise group).

Finally, as shown in table (3) and illustrated in figure (4), the results of this study indicated that there were no significant differences between the mean values of IgG,

FEF_{0.2-1.2%}, FEF_{25-75%} and MEF_{50%} post treatment in group (1) when compared with that of group (2).

Table (3): The difference between the mean values of IgG, FEF_{0.2-1.2%}, FEF_{25-75%} and MEF_{50%} post treatment in group (1) when compared with that of group (2).

Measured parameters	Mean \pm SD		t- value	Significance
	Laser therapy group	Aerobic exercise group		
IgG (mg/dl)	0.98 \pm 0.23	0.95 \pm 0.20	0.65	Non Sig.
FEF _{0.2-1.2%} (L/sec.)	1.13 \pm 0.25	1.19 \pm 0.26	0.59	Non Sig.
FEF _{25-75%} (L/sec.)	0.92 \pm 0.22	0.98 \pm 0.24	0.48	Non Sig.
MEF _{50%} (L/sec.)	0.70 \pm 0.18	0.75 \pm 0.22	0.61	Non Sig.

Level of significance $p < 0.05$

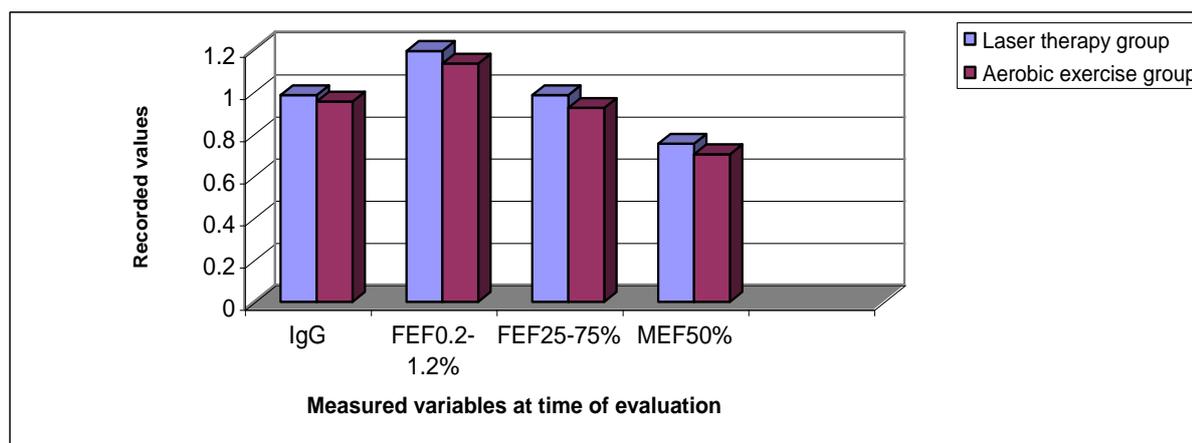


Fig. (4): The difference between the mean values of IgG , FEF_{0.2-1.2%} , FEF_{25-75%} and MEF_{50%} post treatment in group (1) when compared with that of group (2).

DISCUSSION

This study was conducted to compare the effect of laser acupuncture therapy and aerobic exercise on small airway ventilation (the greatest affected lung area) and immune system in asthmatic children.

The results of this study indicated that there were significant improvements in the mean values of IgG, FEF_{0.2-1.2%}, FEF_{25-75%} and MEF_{50%} post treatment in both groups, whereas there was no significant difference between both groups.

In group (1) :-

The improvement in the mean values of FEF_{0.2-1.2%}, FEF_{25-75%} and MEF_{50%} (measures that indicate condition of small airways ventilation) after low intensity laser therapy might be related to broncholytic effect, disappearance of inflammatory changes in bronchial mucosa, and improved potency of small airways¹⁵.

The improvement of small airways ventilation in asthmatic children in this study after low intensity laser therapy was due to its anti inflammatory effect and improved potency of the small airways⁵.

A pronounced improvements in the measured lung functions and gas exchange parameters that were observed in patients with bronchial asthma who received laser acupuncture treatment might be due to the effect of low intensity laser therapy on improvement of the general condition, normalization of body temperature, reduction of cough, disappearance of inflammatory changes in bronchial mucosa, activation of proliferative processes and normalization of bronchial secretion which indicated increase of tissue metabolism and improvement of epithelial cover^{2,15}. Also laser therapy displayed a good immunocorrection effect¹⁹.

Laser therapy was found to promote pulmonary vascularity, better microcircularity blood flow and improved pulmonary function in patients with pulmonary tuberculosis¹³.

The improvements in the mean value of IgG post Laser therapy treatment might be because its enforcement effect on the immune function of the body fluids and cells through increasing serum gamma globulin¹⁴. Laser may cause stimulation to the immune system through T-cellular immunity¹⁰. Also laser

therapy displayed a good immunocorrection effect¹⁹.

A noticeable improvement in the clinical functional and immunological characteristics was observed in 83% of asthmatic patients who received laser acupuncture therapy¹.

A recent study found increased activity of phagocytes, stimulation of T-lymphocytes and higher levels of lysozyme in the saliva were reported in patients with sinusitis who receiving laser therapy. As low level laser has an exciting role both in immunobiological functions for immune system disease and to activate the normal reaction of immune system components against harmful bodies⁷.

In group (2) :-

The improvement in the mean values of IgG, FEF_{0.2-1.2%}, FEF_{25-75%} and MEF_{50%} after aerobic exercise might be related to disappearance of inflammatory changes in bronchial mucosa and improve potency of airways and respiratory muscles strength^{4,16}.

Pulmonary rehabilitation programs involve lower limbs exercises, usually treadmill or bicycle ergometer can increase walking distance and health related quality of life in people with asthma⁴.

Participation in physical activity is an important part of a child's normal psychosocial development and self image. Physical activity is especially important in children with asthma, activities such as running and bicycling are associated with improved fitness and decreased severity of asthma symptoms⁶.

Aerobic exercise improves aerobic fitness in asthmatics and normal participants. Additional benefits of improved ventilatory capacity and decreased hypercapnea of exercise occurred in patients with mild asthma⁸.

Physical activities are important for children with asthma as running and bicycling

are associated with improved fitness and decreased severity of asthma symptoms⁶.

Supervised aerobic training program for two months, three sessions every week for thirty minutes per session in children with moderate to severe stable asthma improved their cardio respiratory fitness¹⁶.

Even relatively low levels of aerobic exercise can protect your immune system. Twenty to 30 minutes of brisk walking five days per week is an ideal training program for maintaining a healthy immune response¹¹.

Conclusion

Both laser acupuncture therapy and aerobic exercise can be considered as valid and effective modalities in the management of asthmatic patients.

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الملخص العربي

استجابة التهوية في المسارات الهوائية الدقيقة وجهاز المناعة للعلاج بالليزر مقابل التمرينات الهوائية لدى الأطفال المصابين بالربو

يعتبر المسارات الهوائية الدقيقة من أكثر أجزاء الرئة تأثراً بمرضى الربو وبالتالي هناك حاجة دائمة لإثبات فعالية طرق جديدة لتحسين التهوية في هذه المسارات الدقيقة والحد من الأزمات الربوية. أجرى البحث علمستوثلاثين طفلاً من الجنسين حيث قسمت العينة الى مجموعتين : المجموعة الدراسية الأولى تلقت العلاج بالليزر والعلاج الطبيعي التقليدي المتمثل في تدريبات التنفس بالإضافة للعلاج بالأدوية والمجموعة الدراسية الثانية تلقت تدريبات هوائية على الدراجة الثابتة بالإضافة للعلاج بالأدوية وتم قياس وظائف الرئة لتحديد مقدار التهوية بالمسارات الهوائية الدقيقة ومستوى الأجسام المضادة (ج) قبل الدراسة وبعد شهرين متتابعين من العلاج . وقد أظهرت النتائج تحسن ذو دلالة احصائية في وظائف التهوية بالمسارات الهوائية الدقيقة وزيادة مستوى الأجسام المضادة (ج) بعد العلاج في كلتا المجموعتين وبدرجة اكبر في المجموعة الدراسية الاولى عنها في المجموعة الدراسية الثانية وبالتالي يمكن اعتبار كلا من العلاج بالليزر والتمارين الهوائية وسيلتين فعاليتين في علاج الأطفال المصابين بالربو.