Review Article

EFFICACY OF LOW LEVEL LASER THERAPY TO TREAT OBESITY

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Abstract:
Background: Obesity has been identified as one of the major concern all over the world in recent times. On one hand obesity is the fundamental cause of cardiovascular complications, diabetes etc and on the other hand, this contemporary health issue also exerts a plethora of negative psychosocial impact. Therefore, wide range of researches are being conducted worldwide for integral management of obesity. This study, in particular is one of those types; delving deeper to identify the efficacy of low-level laser therapy for reducing obesity.

Purpose: In recent times, low level laser therapy (LLLT) has been recognised as one of the promising methods for the treatment of obesity. Therefore, this study holds high significance as this has concentrated towards identifying the impact of LLLT on waistline fat as compared to control individuals.

Subjects: 400 obese subjects were randomly divided into two groups: experimental and control group. 200 in experimental and 200 in control.

Design: Randomised experimental control design.

Method: The control group was treated only with exercise twice a week for 4 weeks and the experimental group was treated with both low level laser therapy as well as exercise twice a week for 4 weeks. Waistline circumference were measured with inch tape prior and after treatments in both the groups.

Result: LLLT strategy was found to have reduced the waist line circumference to a considerable extent over a period of 4 weeks as in comparison to the control, group with an identifiable pattern of waistline fat thickness alteration.

Conclusion: This research work, from thorough analysis of results obtained from both dataset, has concluded that, low level laser therapy, as compared to traditional approaches is much more effective and consistent. In addition, for individual with higher fat amount, it is beneficial to combine both exercise, diet and laser therapy to obtain the best outcome.

KEY WORDS: Obesity, low level laser therapy, waistline, inch tape.

Introduction:

In terms of health and medicine, obesity\(^1\) can be defined as a health complication characterised by overweight with a body mass index \(\geq 23\) Kg/m\(^2\). A plethora \(^2\) of research studies have depicted obesity as one of the most significant factors exerting its negative impact on physical, social and psychological aspect of an individual. According to the statistics published by World Obesity Federation, more than 25% of men are suffering from obesity in India, whereas, this percentage is even higher in case of women leading to severe depression and anxiety with a possible risk of suicidal tendencies as well.

National Health Services\(^4\) have made significant contribution in this genre of research by decoding the influence of several medical treatments such as low calorie diet, exercise, medication, surgery etc. Obesity Foundation of India, in this context has put forth a statistics\(^5\) stating the obesity percentage in different states of India. According to this list, Punjab has been placed at the top with male obesity percentage of 30.0% followed by Kerala with 24.3% male obese population. In terms of male obesity, West Bengal has been placed at the 26th rank with a male obesity percentage of 5.4 preceded by only two states Jharkhand and Tripura. On the contrary, this ranking is slightly different in the context of women obese population. West Bengal has been placed at the rank of 16 with average percentage of 7.1% (Aiaaro.in, 2016).

Even though surgeries have been found to be the most effective treatment of obesity\(^6\), however, it has got negative effects associated with invasive techniques. Therefore, researchers have delved deeper into formulating non-invasive\(^7\) efficient technologies and came up with strategies such as cryolipolysis, use of radio frequency and low-level laser therapy (LLLT).

This study, in particular has focused on illustrating the effect of low-level laser therapy against spot fat reduction from the waist line. LLLT has been found to be highly effective in a number of medical conditions\(^8\), such as hair loss, musculoskeletal conditions, teeth complications, etc. However, its efficiency and mechanism of action against obesity is yet to be deciphered. Till date, LLLT has been employed in several wavelengths such as 660 nm, 780 nm, 635 nm etc. But this study specifically has concentrated towards analysing the effect of LLLT with a frequency of 635-680 nm on waist adipose reduction.\(^9\)

Research aim
The aim of this study is to investigate the impact of LLLT with the wavelength of 635 nm-680 nm on spot fat reduction. Gaining a deeper insight into the working principle of LLLT has also been included as an aim of the study.

**Research objectives:**

The research objectives are:

- To comprehend the emerging applications of LLLT in lipolysis in order to reduce adipose tissue present in fatty regions of obese individuals
- To illustrate the working principle and mechanism of action of Low-Level Laser Therapy in fat tissue reduction or spot fat reduction

**Method**

**Sample**

A total of 400 patients in the age group of 30-45 years were included in the study.

The subjects were recruited from the Astique clinic, Kolkata. An informed consent was obtained from the subjects participating in the study.

The criteria for selection of subjects were:

**Inclusion criteria**

- Subjects with age 30 to 45 years.
- Subjects with waist circumference of 35-50 cm.
- Subjects should have a constant body weight.

**Exclusion criteria**

- Those who had cardiovascular diseases such as cardiac arrhythmias, congestive heart failure
- Those who had cardiac surgeries as cardiac bypass, heart transplant surgery, pacemakers
- People who had initially reduced their weight with the help of surgeries such as liposuction, abdominoplasty, stomach stapling, lap band surgery, etc.
- Those who suffered from infections and other wounds as well as trauma
- Those women who were pregnant or planning pregnancy prior to the end of study participation
- Even people suffering from diseases like cancer
- Those who are in current use of medication(s) known to affect weight levels/causing bloating or swelling and for which abstinence during the course of study participation is not safe or medically prudent.
- Subjects with any medical condition known to affect weight levels and/or cause bloating or swelling.
- Subjects with diagnosis of, and/or taking medication for irritable bowel syndrome.
- Subjects with active infection, wound or other external trauma to the areas to be treated with the laser.
- Subjects with known photosensitivity disorder.
- Subjects having serious mental health illness such as dementia or schizophrenia; psychiatric hospitalization in past two years.
- Subjects with developmental disability or cognitive impairment which might preclude adequate comprehension of the informed consent form and/or ability to record the necessary study measurements.

**Sampling**

Convenient sampling technique was used. All the obese patients attending Astique clinic were evaluated and those meeting the inclusion and exclusion criteria were included in the study.

**Design**

Pretest Posttest Experimental Control design

**Instrumentation**

Inch tape

**Procedure for data collection**

Prospective participants were explained about the purpose and the nature of the study and informed consent was obtained from patients willing to participate in the study. A detailed assessment of each and every subject was done. 400 healthy men and women participated in the study from the Astique clinic in Kolkata.

They were randomly assigned into the experimental laser treatment group and to the control placebo treatment group (200 subjects in each group).

They were asked not to change their exercise or diet habits during the trial.

Subjects in the experimental group were treated with 20 min of low level laser therapy followed by 30 min aerobics twice a week for 4 weeks whereas subjects in the control group received sham treatment for the same followed by 30 min aerobics. Standardized waist circumference measurements were taken with a measuring tape before treatment at baseline and after treatment at 4 weeks and after 12 weeks of treatment by 3 different individuals to maintain the reliability of the study.

**Data analysis**

Data analysis was done using

- GraphPad Prism version 5 [San Diego, California: GraphPad Software Inc., 2007]

All variables were skewed by Kolmogorov-Smirnov goodness-of-fit test other than the age which is normally distributed and was analysed using Student’s unpaired t test. Cumulative waist girth loss was measured after 4 weeks and after 12 weeks post treatment both in the control group and the experimental group and the pre test post test result were compared both within the group and between the groups and
the data were analyzed using Friedman statistic test and Mann whitney U test respectively.

### Descriptive statistics of numerical variables – Group 1 [Control i.e. Exercise only; n = 200]

<table>
<thead>
<tr>
<th>Vari</th>
<th>Valid N</th>
<th>Mean</th>
<th>Median</th>
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<th>Maximum</th>
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</table>

AC_B_R1: Abdominal circumference measured by rater1 at baseline  
AC_B_R2: Abdominal circumference measured by rater2 at baseline  
AC_B_R3: Abdominal circumference measured by rater3 at baseline  
AC_1m_R1: Abdominal circumference measured by rater1 at the end of 1month  
AC_1m_R2: Abdominal circumference measured by rater2 at the end of 1month  
AC_1m_R3: Abdominal circumference measured by rater3 at the end of 1month  
AC_3m_R1: Abdominal circumference measured by rater1 at the end of 3month  
AC_3m_R2: Abdominal circumference measured by rater2 at the end of 3month  
AC_3m_R3: Abdominal circumference measured by rater3 at the end of 3month

### Descriptive statistics of numerical variables – Group 2 [Laser + Exercise; n = 100]

<table>
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<th>Maximum</th>
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</table>
The analysis shows that there is no statistically significant difference between group 1 and group 2.

Comparison of numerical variables between groups 1 and 2 – Mann-Whitney U test

<table>
<thead>
<tr>
<th>Variable</th>
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<th>U</th>
<th>Z</th>
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<td>&lt; 0.001</td>
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</table>

The analysis shows that there is no statistically significant difference between both the groups at baseline but there is at the end of one month and as well as at the end of 3 months with a significant change at the end of 3 months.

To assess significance of change within Control (exercise alone) group
The analysis shows that there was a statistically significant difference within the group at the end of 1 month as well as at the end of 3 months.

To assess significance of change within Experimental (laser + exercise) group Friedman test

The analysis shows that there was a statistically significant difference within the group at the end of 1 month as well as at the end of 3 months.
Although there was a significant change both within the groups as well as between the groups but the extent of change which was seen in the experimental group was much higher than the control group.

Discussion

The entire analysis has been conducted in terms of individual readings at baseline, 4 weeks and 12 weeks and finally comparing these values between both the control and experimental groups and within the group. For both the groups all individuals had a waist fat measurement in the range of 35.0 cm-50.0 cm.

Laser therapy is administered in the specific part of the body for instance the abdomen in the study that is the choice of treatment and requires targeting the treatment area. Placing the device on the area of focus through which the laser beam protrudes helps to conduct its role. Benefit of using this therapy is that it is used for shorter period of 15 minutes to 20 minutes duration.

From the study of Honne et al. (2012, p.243), increase in ATP production is seen to activate as low-level laser therapy acts on the mitochondria on a particular protein known as cytochrome c oxidase. This activity of the therapy also contributes in reducing the oxidative stress. Low-level laser therapy has been evaluated to contribute in removing the excess cellulite from the waist circumference and generalized fat in the body.

Laser therapy used for treating obesity is conducted by liquefying the fat content from the desired area, which is referred as emulsification. It is seen that adipocyte cells are reduced in their volume by operating low-level laser therapy, which operates by the process of emulsification. The study of Grummer Strawn (2017, p.1348), confirmed that the cells that are emulsified are eliminated from the specific area into the extracellular space. In the process of low-level laser therapy, the device with the laser beam is allowed to make a transitory pore within the cell membrane of the fat cells. Movement of the fatty substances into the extracellular space is conducted across the aperture. Fat cells are of two types, visceral and subcutaneous. Above the skeletal region is the position of the subcutaneous layer, which is placed beneath the skin. As per Jayawardena et al. (2012, p.1), this position of the subcutaneous layer helps in proper penetration of laser beam for its performance. On the other hand, fat which is situated beneath the skeletal muscle, is considered as the visceral fat, which is difficult to reduce through the process of low-level laser therapy.

Benefits of using this therapy are that patients are not subjected to prolonged duration for the treatment as well as they are not the victim of any pain from the therapy. This is beneficial in comparison to surgical process and medications that possess side effects. On the other hand, Fors et al. (2012, p.135) asserted that low-level laser therapy can be carried out for every individual with obesity. This is in comparison to the surgical or anti-obesity drug treatments that are applicable to restricted patients. This is because different patients possess different diseases and the medication can interfere with the diseases or the ongoing treatment and negatively affect the health. In addition, Eheman et al. (2012, p.2339) pointed out that bariatric surgeries are restricted for normal individuals only with increased weight because it possesses greater risk of turning into complicated outcome. Hence LLLT is safe and very effective in spot fat reduction.

Future research

Along with this, true results based on the experimental data are profitable for future researchers to make progress in their task based on the research outcome. In addition, future researchers also have the possibility of making comparative analysis based on low-level laser therapy and other interventions for obese people as well as to make comparisons between low-level laser therapy outcome for Indian population and other countries.

Relevance to clinical practice

As per Domon and Aebersold (2010, p.721), this study is useful for taking necessary information on positive and negative influences of low-level laser therapy, while considering the provision of this therapy to obese patients. Besides, in practical aspects of clinical treatment methods, the knowledge gained from this research can help to judge the efficacy of LLLT in improving obesity amongst the larger population in India.

Conclusion

This study has enabled us to develop a good insight into the topic of research as the focus is given on efficacy of low-level laser therapy to effectively reduce abdominal fat compared to other mechanisms.

References cited and Bibliography

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