

Randomized Split-Face Controlled Study to Evaluate Low Level Laser Therapy (LLLT) for Treatment of Acne Vulgaris in Adolescents

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1. Abstract

1.1. Background: Acne vulgaris as a chronic inflammatory disease of the pilosebaceous unit, is the most common skin disorder regardless of gender, skin colour or ethnicity. No mortality associated with acne, but significant physical and psychological morbidity. Acne therapies, topical or systemic, targeting one of its pathogenic factors, have many drawbacks and poor compliance. Laser and light therapy greatly enhance acne management. Promising results with infrared laser had been reported. Also, photobiostimulation of acne vulgaris was more effective than many pharmacological products.

1.2. Objective: To evaluate the effectiveness of low level laser therapy for treatment of acne vulgaris in adolescents.

Methods: Half-face of twenty cases, four males and sixteen females between eleven and eighteen years treated with 905 nm Giotto diode laser for thirty minutes. The other half is control. Two sessions per week for eight weeks and three month follow up after treatment was done.

1.3. Results: Reduction in acne lesion count 32.78% after two weeks of treatment, 46.4% after four weeks. Significant reduction (63.35%) at the end of eight weeks treatment (p-value=0.002) and 59.87% (p-value=0.002) after three months follow up as regards the control side. Scoring of acne lesion severity using GAGS showed significant decrease, in relation to the control side after four weeks of treatment (p-value=0.002), high significance after

eight weeks (p-value<0.001) and persistent high significance after three months follow up (p-value<0.001). No detectable side effects and high significant patient satisfaction.

1.4. Conclusion: Treatment of acne vulgaris in adolescents with low level diode laser is safe and effective.

2. Background

Novel and promising results in acne treatment with infrared lasers had been reported (1). In 2013, photobiostimulation of acne vulgaris was applied as monotherapy or complementary with antibiotics and was effective than many pharmacological products for acne treatment (2).

3. Objective

To evaluate the efficacy and safety of the low level 905 nm diode laser for treatment of acne vulgaris in adolescents.

4. Introduction

Acne vulgaris is a chronic inflammatory disease of the pilosebaceous unit and is one of the most common dermatologic diseases, affecting teenagers as well as adults, with a possibility to cause long-lasting psychosocial and physical effects. Conventional treatments such as topical and oral medications are often associated with poor compliance, lack of durable remission and potential side effects. If untreated, acne may lead to scarring, dyspigmentation and physical discomfort (3). Medical treatments for acne vulgaris include a variety of topical and oral medications. Poor compliance, lack of durable remission, and potential side effects are common

drawbacks to these treatments. Therefore, there is a growing demand for a fast, safe, and side-effect-free novel therapy. Lasers/light-based devices may offer an alternative to conventional acne modalities in selected patients, such as non-responder or noncompliant patients or in antibiotic resistance patients. A variety of light and laser devices has been used for the treatment of acne, including the potassium titanyl phosphate laser, the 585- and 595-nm pulsed dye lasers, the 1450-nm diode laser, radiofrequency devices, intense pulsed light sources, and photodynamic therapy using 5-aminolevulinic acid and indocyanine green. These devices are thought to target the underlying pathogenic factors such as propionibacterium acnes colonization, increased sebaceous gland activity, and the cutaneous inflammatory response. The devices used to treat acne may be separated into groups based on approach; namely devices that directly or indirectly target P. acnes are UVA/UVB, blue light, blue and red light combination, devices that alter the sebaceous

gland structure include aminolevulinic acid (ALA) and photodynamic therapy (PDT), infrared lasers, radiofrequency, and devices that exert an effect on both are pulsed dye laser (PDL), potassium titanyl phosphate (KTP) laser and intense pulsed light (IPL) (4). LLLT or photobiostimulation refers to the use of photons at a non thermal irradiance to alter biological activity. The energy or power densities used are low compared to other forms of laser therapy. LLLT involves exposing cells or tissues to low-levels of red and near infrared(NIR) light(5). As Low Level Laser Therapy (LLLT) had attracted attention in many clinical fields, a study in 2011 on the effectiveness of light-emitting phototherapy(LED-LLLT) particularly for the 633nm and 830 nm wavelengths, done by Kim et al.,(6),concluded that provided a LED phototherapy system has the correct wavelength for target cells, delivers an appropriate power density and an adequate energy density, then it will be at least partly, if not significantly, effective.



Giotto diode laser is an infrared laser emitting 905 nm.



Figure 1a and 1b: Before treatment; After treatment



Figure 2a and 2b: Before treatment; After treatment



Figure 3a and 3b: Before treatment; After treatment



Figure 4a and 4b: Before treatment; After treatment

5. Patients and Methods

To evaluate the effect of Low level Laser Therapy (LLLT) for treatment of acne vulgaris in adolescents, 20 patients were enrolled in the study (4 males and 16 females) with average age between 11 and 18 years .Half-face is treated by Giotto Diode Laser 905 nm ,5000HZ,80W, 72m J for 30 minute session. Two sessions were given per week for 8 weeks. The other half of the face is exposed to sham light, Evaluation was done through Global Acne Grading System (GAGS) to grade acne lesions according to severity (from 0 to 4) and calculate the local score by multiplying the location factor by the grade. GAGS and lesion counting is done

before treatment, after 2 weeks, after 4 weeks, after 8 weeks of the treatment and after 3 month follow up. Standardized photographs were used also in the assessment. Visual analogue scale is used to evaluate patient satisfaction. After two week of treatment, decrease in the mean \pm SD total acne lesions count had occurred on the treated side [11.50 \pm 4.93] representing 32.78% reduction but still non significant in relation to the mean \pm SD total acne lesion count at the control side [12.90 \pm 8.40] p-value=0.681. At the treated side, the reduction was significant in comparison with the same values before treatment [17.11 \pm 9.27] p-value=0.035. After four weeks of treatment, more decrease in the mean \pm SD

total acne lesions count had occurred [9.17 +SD=4.73] representing 46.4% reduction compared with the same values before treatment [17.11 + 9.27] p-value=0.003 i.e significant decrease of the acne lesion in relation to the same values before treatment, but still non-significant in comparison with the control side [13.20 + 8.52] p-value=0.114. At the end of the treatment after eight weeks, there was significant decrease in the mean \pm SD total acne lesions count [6.27 + 3.94], in relation to the control side [Mean 13.25+ 8.59] p-value=0.002. There was high significant decrease in the mean \pm SD total acne lesions count at the treated side [6.27 + 3.94] representing 63.35% reduction compared with the same values before treatment. p-value<0.0001. At the 3 m follow up, Still there is significant decrease in the acne lesions count at the treated side [Mean =6.78 +SD=4.15](representing 59.87% reduction) in comparison with the control side [Mean=13.45 +SD=8.80] p-value=0.002. High significant decrease in the mean \pm SD total acne lesions count after three month of the treatment in the treated side [6.78 + 4.15] representing 59.87% reduction in comparison with the same value before treatment p-value<0.0001. As for the severity of the acne lesions as evaluated using GAGS, after two weeks of treatment, there was slight decrease in the mean \pm SD values of GAGS [7.11 \pm 3.64], in relation to the same values on the control side [8.15 + 4.64] but still non significant (p-value = 0.458). After four weeks of treatment mean \pm SD values of GAGS values at the treated side, showed significant decrease [5.39 + 2.75] in relation to the control side [8.25+ 4.96] p-value =0.002. After eight weeks of treatment (end of sessions), there was high significant decrease in the values of GAGS [3.27 + 1.22] in relation to the control side [Mean=8.40 +SD=4.75] p-value <0.0001 which denotes the effectiveness of the treatment and the cumulative effect of the treatment which increased gradually from two weeks till the end of the treatment at eight weeks. Follow up for the patients was done for three month and still there was high significant difference in the values of GAGS [mean value of the GAGS=3.65+ SD=1.37] of the treated side and the control side [Mean=8.45 +SD =4.84] p-value<0.0001 denoting relative long term remission. Non significant increase in GAGS in the control side during the course of the disease. Between the twenty patients studied, four patients (representing 20% of the study group) showed 70% to 90% reduction in acne lesion count after the end of the treatment. Eight patients (representing 40% of the study group) showed 50 to 70% reduction in the acne lesion count. Twelve patients (representing 60% of the study group) showed 50% to 90% reduction in the acne lesion count. Six patients (representing 30% of the study group) showed 20% to 40% reduction in their acne lesion count. Two patients (representing 10%) showed no reduction in the acne lesion count. Eight patients (representing 40% of the study group)

showed less than 50% reduction in the acne lesion count

6. Discussion

Acne vulgaris is a chronic inflammatory disorder of the pilosebaceous unit where there is abnormal desquamation of the follicular epithelium, obstruction of the pilosebaceous canal, inflammation and formation of papules, pustules and nodules (7). Novel and promising results in acne treatment with infrared lasers had been reported by Moneib et al., 2014. A significant reduction (p < .0001) in the mean count of lesions was observed after treatment and in the follow-up period. A significant reduction in the size of sebaceous glands was also evident after laser treatment. So, treatment of active acne with the 1,550-nm erbium glass laser is effective. Papules, pustules, and nodules all respond well to therapy. The sebaceous gland size decreased significantly, which accounts for the long remission period. As, the 1450-nm diode laser has been found to damage sebaceous glands selectively and to be effective for the treatment of inflammatory acne on the back. To evaluate the efficacy and safety of the 1450-nm diode laser in the treatment of inflammatory facial acne vulgaris Friedman et al 2004, All patients had a reduction in acne lesions. This was the first published report documenting the safety and efficacy of laser treatment for inflammatory facial acne., clinical improvement was seen in all patients and was generally dramatic, even in those refractory to previous treatment with oral isotretinoin (8). Bogle et al., 2007 evaluated the use of the 1,540-nm erbium:glass laser in the treatment of moderate to severe inflammatory acne on the face. So, treatment of inflammatory facial acne with the 1,540-nm erbium:glass laser was effective and relatively painless (9).

Liu et al., 2016 evaluated the short-term and long-term effects of the 1550 nm erbium:glass (Er:glass) fractional laser in the treatment of facial acne vulgaris, concluding that acne can be successfully treated by 1550 nm Er:glass fractional laser, with few side effects and prolonged acne clearing (10). Kareem, in 2005, studied the efficacy of low level infrared laser therapy in treatment of acne vulgaris. He enrolled forty patients were enrolled in the study divided randomly into two equal groups, study group consisted of 20 patients (6 females and 14 males) received infrared 908 nm laser therapy, their ages ranged from 18 -33 years and control group of 20 patients, their ages ranged from 18 -35 years, received shame treatment. The result showed that there was a significant improvement in the study group (p-value=0.001). No significant difference in the control group. To our knowledge, our study is the first one that evaluate this infrared wavelength (905 nm) by these parameters as low level diode laser therapy for the treatment of acne vulgaris in this age group (adolescents between eleven and eighteen years). There was gradual decrease in the mean values of the acne lesions from the beginning of the treatment till the end

of the treatment. The decrease was persistent even with 3 month follow up denoting relative long term remission. At the end of the 8 weeks treatment there was significant decrease in acne lesion count at the treated side in relation to the control side and high significant decrease in relation to the same values before treatment. Follow up after three month of the treatment, persistent significant decrease of the acne lesion count at the treated side in relation to the control side, and high significant decrease in relation to the same values before treatment. This proves the cumulative and long term effect of the infrared diode laser on the sebaceous glands interfering with its role in the pathogenesis of acne vulgaris. And also proves the biological effects of LLLT and the absorption of the 905 nm by porphyrins that had produced by P.acnes as a part of its normal metabolism altering the biological activity. The treatment was safe there was no side effects. According to the Visual Analogue Score (VAS), the patients satisfaction was highly significant (p -value<0.001) from 2 weeks after treatment and persist till 3 month after treatment, denoting patient satisfaction. Statistically, non significant difference within the twenty patients study group as regards the sex or family history, before treatment and at the end of the eight weeks treatment. Non significant difference before treatment between age group eleven to fourteen and fifteen to eighteen, but there is significant difference between them after treatment, where the second group showed more reduction in acne lesion count.

7. Conclusion

Laser and light-based acne treatments can be an alternative to medical treatment for non responders and is associated with minimal adverse effects. These devices also offer an option for those patients who have moderate to severe acne but are concerned about oral medications because of potential adverse effects. Long-term improvements have been documented with laser treatments, thus avoiding the need for an oral antibiotic. The acne clearance produced by devices targeting P. acnes is generally short-lived and requires continued follow-up treatments. Devices that target sebaceous glands are all effective to varying degrees based upon the principle of selective damage to the sebaceous gland. Low Level Laser therapy (LLLT) using infrared diode laser(905nm) found to be safe and effective for treatment of acne vulgaris in adolescents.

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