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COMPARISON OF SOFT TISSUE HEALING AFTER CONVENTIONAL GINGIVECTOMY PROCEDURE WITH AND WITHOUT LOW-LEVEL LASER THERAPY (LLLT) - A RANDOMIZED CLINICAL TRIAL

Periodontology

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ABSTRACT

Background: Gingival overgrowth is a common characteristic of gingival disorders. A gingivectomy is a type of periodontal surgery used to address gingival overgrowth caused due to periodontal pockets that are either suprabony or do not extend past the mucogingival junction. The process of wound healing involves the active and intricate restoration of tissue layers and cellular structures. Inflammation, epithelialization, granulation tissue creation, matrix production, and tissue remodelling are among the steps involved. By bio stimulating the inflammatory process, LLLT accelerates tissue repair, reduces pain and swelling, and has no negative side effects. **Aim:** To evaluate the efficacy of low-level laser therapy on soft tissue healing after conventional gingivectomy procedure **Materials and Methods:** The subjects were selected by simple random sampling technique, and 54 sites were randomly grouped as Site A (n=27, conventional gingivectomy with LLLT) and Site B (n= 27, conventional gingivectomy without LLLT). **Results:** Intergroup analysis showed Site A (with LLLT) had a greater mean improvement in wound healing score, reduction in gingival inflammation ($p<0.05$), greater mean reduction in pain and discomfort than Site B (without LLLT). **Conclusion:** From baseline to the 3-month follow-up, all clinical parameters showed a statistically significant improvement at both sites; however, Site A (with LLLT) showed a highly significant improvement.

KEYWORDS

Low level laser therapy, Gingivectomy, Wound Healing.

INTRODUCTION

Gingival hypertrophy is a prevalent feature of gingival diseases. However, due to their many presentations, the doctor finds it challenging to diagnose these entities. Depending on their location, size, extent, etiopathogenesis, etc., they can be categorized into groups. A correct diagnosis is essential since it is the only way to treat these lesions and avoid their recurrence [1].

A gingivectomy is a type of periodontal surgery used to address gingival overgrowth brought on by pockets of periodontal tissue that are either suprabony or do not extend past the mucogingival junction. For prosthetic purposes, a gingivectomy could be necessary to remove damaged tissue. Furthermore, a gingivectomy could be necessary to restore normal gingival architecture, enhance aesthetics, and/or lower the probing depth of the pockets in the periodontal tissues. [2].

The restoration of tissue layers and cellular structures is an intricate and dynamic process known as wound healing. Inflammation, epithelialization, granulation tissue creation, matrix production, and tissue remodelling are among the steps involved. The crucial stage of epithelialization involves interactions between the extracellular matrix and keratinocytes, which migrate, multiply, and differentiate to restore the structure and function of gingival tissue. There are three types of wound healing: primary, secondary, and tertiary. Primary wound healing is the process by which the surgical incision heals cleanly, without infection, and with little side effects. Secondary wounds on the other hand progress more slowly and are more exposed to external factors. Gingivectomy wounds heal by secondary intention and hence associated with bleeding and pain.[3].

In an effort to address these issues and manage the gingiva's cellular activity, several investigations have been conducted using a variety of methods, including laser therapy, periodontal ligament cells, growth factors, and enamel matrix proteins. Nevertheless, there is no method for repairing the injured periodontal tissues, and the choices for regulating the gingiva's cellular activity are still restricted. [3]

Effective pain reduction and increased patient comfort are the two main objectives of periodontal treatment, whether it is non-surgical or surgery. Various modalities been used to improve patient comfort such as use of anaesthetic gel/sprays, analgesics and dressing materials. Also, the application of Low-level laser therapy (LLLT) for minimizing pain during periodontal procedures. [4]

Laser technology for dentistry is a new and very promising subject. In several branches of dentistry and medicine, LLLT has emerged as a viable therapy option. By bio stimulating the inflammatory process, LLLT decreases pain and swelling without causing adverse effects and encourages tissue repair. [5]

The effectiveness of low-level laser treatment (LLLT) on soft tissue recovery following gingivectomy has not been extensively studied. Additionally, there hasn't been any research done to far that assesses how low-level laser therapy affects soft tissue healing following a traditional gingivectomy procedure. In order to compare the effectiveness of low-level laser therapy on soft tissue healing following the traditional gingivectomy technique, this study was carried out.

Rationale

The complicated process of wound healing includes remodelling, granulation tissue formation, re-epithelialization, and inflammation. Healing by secondary intention progresses more slowly and is more exposed to external factors. Laser irradiates and causes changes in structural biochemical and functional aspects of living microbes. By boosting ATP synthesis and causing intracellular metabolic changes, it gives cells vitality and accelerates fibroblast migration, matrix synthesis, cell division, and proliferation. In order to assess the effectiveness of low-level laser therapy on soft tissue healing following a traditional gingivectomy procedure, a randomized double-blind clinical trial was carried out.

Methodology

The subjects for the study were selected based on the following inclusion: Systemically healthy, within the age range of 15-45 years of either sex, having gingival overgrowth with or without presence of pseudo pockets. The exclusion criteria were: Drug induced gingival enlargement, pregnant and lactating women, smokers and tobacco chewers. Clinical parameters assessed were: Gingival enlargement Index (Bokenkamp A and Bohnhorst B 1994)[8], Healing Index (Landry et al 1988)[15], Gingival Index (Sillness and Loe 1964)[16], Pain and discomfort using Visual Analogue Scale (Hayes and Patterson 1921)[17]and number of analgesics taken.

Twenty-seven sites in each group were included in this study. Ethical Clearance was obtained from the Institutional Ethical Committee (IEC) of the institute. The subjects undergoing this study were required

to give a signed informed consent after being informed about the nature of the study in detail and in a language best understood by them. A detailed case history was recorded for each subject participating in the study.

Under local anesthesia bleeding points were marked on external surface of the gingiva corresponding to the depth of the pseudo pockets, at mesiobuccal, midbuccal and distobuccal surfaces using a Krane Kaplan pocket marker. The external bevel incision (continuous) was placed apical to the marked bleeding points at approximately 45º to the long axis of the tooth surface. The gingival tissue was excised, so as to re-create the normal festooned pattern of the gingiva. After the conventional gingivectomy procedure, the site A was irradiated with a Diode Laser using 1.00W output power, wavelength 810 nm, continuous wave, and beam diameter of 2 mm. The armamentarium is shown in figure 1 and figure 2 below. The irradiation was made in non-contact mode, spanning an area of about 1cm2 for 10 sec while holding the delivery tip perpendicular to the tissue surface. The site B was not exposed to laser irradiation. Subjects were recalled after 3days, 1 weeks, 2 weeks, 4 weeks and 3 months post-operatively and all the parameters were evaluated during the follow up visit. (Figure 3)

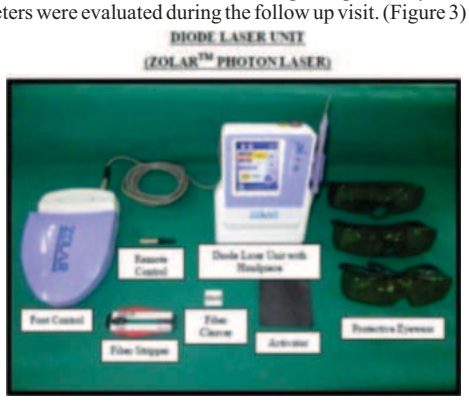


Figure 1

Figure 2

Figure 3

RESULTS

Fifty-four sites with gingival enlargement were randomly divided into Site A and Site B. They were subjected to scaling and root planing and oral hygiene instructions. In this double blinded study, the subjects and evaluator were blinded. Conventional gingivectomy with LLLT was performed at site A and conventional gingivectomy without LLLT was performed at site B.

Statistical Analysis

Gingival Enlargement Index

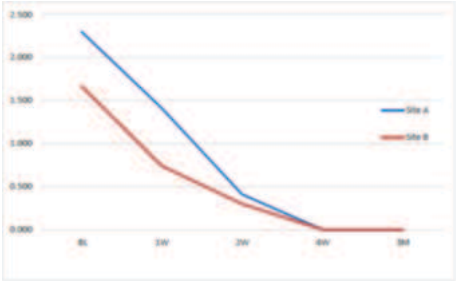
Gingival enlargement was assessed using Bokenkamp A and Bohnhorst B index wherein overgrowth confined to interdental papilla was graded as grade I, hyperplasia of interdental papilla and marginal gingiva was grade II and gingival hyperplasia covering at least three-quarters of tooth crowns is grade.

On intergroup comparison of the Site A and Site B there was a statistically significant reduction in enlargement from baseline (p=0.000) to 3 months (p=1.000). However, the reduction observed on site A was highly significant than site B. (Table 1, Graph 1)

Table 1 – Intergroup Comparison at Site A and Site B for Gingival Enlargement

	Baseline	1week	2weeks	4weeks	3months
Site A	2.300	1.410	0.410	0.000	0.000
Site B	1.670	0.740	0.300	0.000	0.000
p value of Mann-Whitney U test	0.000**	0.000**	0.397#	1.000#	1.000#

There was a statistically highly significant difference seen for the values between the time intervals (p<0.01) with higher values at Baseline and 1week.



Graph 1 – Intergroup Comparison at Site A and Site B for Gingival Enlargement

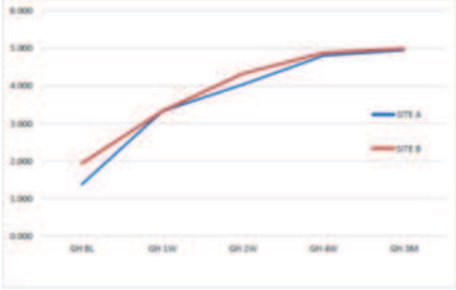
Healing Index

Wound healing was assessed using healing index at 1 week, 2 weeks,4 weeks and 3 months.

On Intergroup comparison between Site A and Site B there was statistically significant increase in healing index from baseline (p=0.002), 1 week (p=1.000) which was non-significant, 2 week (p=0.041),4 weeks(p=0.448) which was non-significant and 3 months (p=0.317) (Table 2, Graph 2).

Table 2 - Intergroup Comparison Between Site A and Site B for Healing Index

	Baseline	1week	2weeks	4weeks	3months
Site A	1.370	3.330	4.040	4.810	4.960
Site B	1.930	3.330	4.330	4.890	5.000
p value of Mann-Whitney U test	0.002**	1.000#	0.041*	0.448#	0.317#



Graph 2 - Intergroup Comparison Between Site A and Site B for Healing Index

Gingival Index

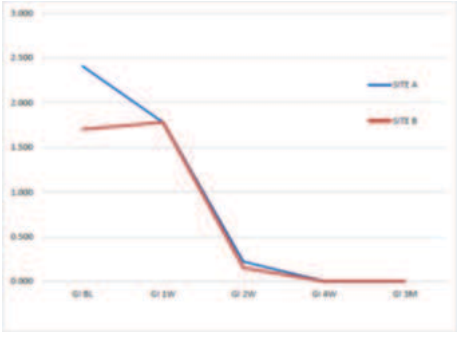
Gingival index was assessed at baseline, 1 week, 2 weeks, 4weeks, and 3 months.

On intergroup comparison gingival index at baseline had higher values as compared to Site A (Table 6) (Graph 6)

On Intergroup comparison gingival index was non-significant at 3 months and 4 weeks with p>0.05 (Table 6, Graph 6)

Table 3- Intergroup Comparison Between Site A and Site B For Gingival Index

	Baseline	1week	2weeks	4weeks	3months
Site A	2.410	1.780	0.220	0.000	0.000
Site B	1.700	1.780	0.150	0.000	0.000
p value of Mann-Whitney U test	0.000**	1.000#	0.488#	1.000#	1.000#



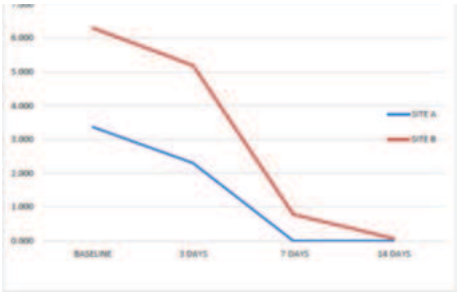
Graph 3- Intergroup Comparison Between Site A and Site B for Gingival Index

VAS Score for Pain and Discomfort

Pain and discomfort were assessed using VAS scale. The subjects were asked to rate the pain and discomfort experienced by them on a scale from score 0(least pain) to score10(severe pain). This assessment was done at baseline, 3days, 7days and 14 days. (Table 8, Graph 8)

Table 4 - Intergroup Comparison Between Site A and Site B for VAS Score

	Baseline	3Days	1week	2weeks
Site A	3.370	2.300	0.000	0.000
Site B	6.300	5.190	0.780	0.070
p value of Mann-Whitney U test	0.000**	0.000**	0.000**	0.153#



Graph 4 - Intergroup Comparison Between Site A and Site B for VAS Score

Number of Analgesics Taken

Subjects with site B had taken more analgesics than subjects with site A which signifies that LLLT had beneficial effect on healing and pain reduction.

DISCUSSION

A harmonious relationship between the teeth and the gums (gingiva) is essential for an aesthetic smile. Inflammation of gingiva and subsequent enlargement due to plaque and other etiological factors results in an unesthetic smile as well as interferes with oral hygiene maintenance.

Gingivectomy refers to the removal of the gingiva. Gingivectomy offers the visibility and accessibility required for the full removal of surface deposits and extensive root smoothing by eliminating the diseased wall that covers the tooth surface. If the pocket wall is solid and fibrous, the gingivectomy procedure can be used to (1) remove suprabony pockets, no matter how deep they are; (2) remove gingival enlargements; or (3) remove suprabony periodontal abscesses.[18]

Mester and colleagues' study established low-level laser therapy (LLLT) as a therapeutic technique after they observed enhanced wound healing when a low-energy (1 J/cm2) ruby laser was applied. This sparked a greater interest in learning about and creating new low-energy laser uses and technology.[19]

Gingival Enlargement

In the present study there was statistically significant reduction in gingival enlargement at both sites, but more significant reduction was seen at site A that is the site with LLLT. The results of this study were similar to the study conducted by Tony, et al. (2013) [14]

Tony, et al. (2013) [14] assessed the effectiveness of diode laser gingivectomy as an adjunct to nonsurgical periodontal treatment in managing gingival health in 30 patients with gingival enlargement receiving fixed orthodontic appliance therapy. Results showed that adjunctive laser use can lead to earlier and greater improvement in gingival health.

Healing Index-

In the present study there was statistically significant increase in healing index at both sites, but more significance was seen at site A. The results of this study were similar to the study conducted by Mohamed, et al. (2020) [20]

Mohamed, et al. (2020) [20] assessed 10 patients with bilaterally symmetrical gingival hyperplasia in lower anterior teeth found that both diode laser and electrocautery were effective in performing gingivectomy. Electrocautery was found to be superior in terms of postoperative pain, while diode laser showed better instrument performance and healing improvement.

Gingival Index-

In the present study there was statistically significant reduction in gingival index at both sites, but more significant reduction was seen at Site B that is the LLLT group. The results of this study were similar to the study conducted by Musa F, et al. (2017) [21]

Musa F, et al. (2017) [21] compared the efficiency of diode laser in performing gingivectomy compared to scalpel in patients with chronic inflammatory enlargement. Thirty patients were divided into a control group and a study group. Diode laser 940nm was found to be beneficial in achieving haemostasis and improving gingival health compared to scalpel techniques.

Pain and Discomfort

In the present study there was statistically significant reduction in pain and discomfort at both sites, but more significant reduction was seen at site B that is the LLLT group. The results of this study were similar to the study conducted by Kusakci-Seker B, et al. (2020) [3]

Kusakci-Seker B, et al. (2020)[3] A study examining the impact of non- thermal atmospheric pressure plasma application (NTAPP) on wound healing after gingivectomy and gingivoplasty found that NTAPP enhances epithelialization and stimulates wound healing, as evidenced by digital photographs and Landry Wound Healing Index scores, and visual analogue scale scores.

Number of Analgesics

In the present study number of analgesics taken by subjects were recorded. Till date there has been no assessment done of this parameter in the earlier studies. It was observed that in subjects who received LLLT the number of analgesics taken was considerably less as compared to those who did not receive LLLT.

CONCLUSION

Fifty-four selected sites with gingival enlargement were randomly divided into Site A and Site B. phase I therapy was performed in all the subjects and oral hygiene instructions were given. In this double blinded study, the subjects and evaluator were blinded. Conventional gingivectomy with LLLT was performed at Site A and only conventional gingivectomy without LLLT was performed at Site B. Subjects were recalled after surgery at 3days, 1week, 2weeks, 4weeks

and 3months for follow-up. A statistically highly significant improvement was seen at Site A with LLLT.

Thus, within the limits of this study, it can be concluded that low-level laser therapy showed beneficial effect on wound healing after conventional gingivectomy along with minimal pain and discomfort. Long follow up clinical trials with larger sample size are necessary to further evaluate the results of this study and establish the long-term success of this approach.

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