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Comparative Evaluation of the Effects of Low-Level Laser Therapy and Ozone Application on Wound Healing After Gingivectomy and Gingivoplasty: A Randomized Control Clinical Trial

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Abstract

AIM: The aim of this randomized controlled clinical trial was to clinically evaluate and compare the effect of ozonated water and Low level laser therapy (LLLT) on the early wound healing period of gingivectomy and gingivoplasty wounds by clinical analysis. **Materials & Methods:** Forty-five patients were randomly allocated into 3 groups, test group 1 (ozone therapy n=15), test group 2 (LLLT application n=14) and control group (no treatment n=15). Ozone irrigation was done on the surgical site with a concentration of 4ppm for 5-10 minutes, LLLT application was performed with diode LASER (810 nm) immediately after the surgical therapy and on day 3, day 7, day 21. Wound surface area, wound healing index, quality of life, plaque index, sulcus bleeding index were investigated. **Results:** At day 21 statistically significant smaller wounds were observed in both ozone and LLLT groups compared to control group. However, intergroup comparison between the ozone and LLLT group did not show statistically significant difference in wound surface area evaluated by staining technique and image J analysis. The wound healing index, VAS score OHIP -14 questionnaire, analgesics consumed, plaque index, sulcus bleeding index showed a statistically significant reduction from baseline to day 21in all groups. **Conclusion:** Ozone therapy is safe and effective in promoting wound healing during the 1st 3 weeks post-surgery. Ozone therapy and LLLT application enhanced wound healing after gingivectomy and gingivoplasty procedures, accompanied by better quality of life and reduced pain .

Keywords: Gingivectomy, Wound healing, Aqueous ozone, Low level laser therapy, Oral health impact profile, Early wound healing.

INTRODUCTION

Gingival enlargement is an overgrowth or increase in size of the gingiva [1]. The gingival enlargement or overgrowth is related to various etiologic factors such as dental plaque, mouth breathing, hormonal imbalance and medications [2]. Gingival enlargement may hamper patient's aesthetics if present in the anterior areas and may also lead to further plaque accumulation due to altered gingival contours, thus causing further destruction. Gingivectomy is the most commonly performed surgical procedure for the treatment of gingival enlargements [3]. which creates a favourable physiologic gingival topography that facilitates desirable plaque control [4].

The wound site after gingivectomy and gingivoplasty procedures heals by secondary intention and takes about 32 days for complete epithelialization and about 49 days for connective tissue maturation [5]. Multiple local and systemic factors can interfere with one or more phases of wound healing leading to impaired tissue healing.Some of the local factors that can deleteriously effect wound healing are wound hypoxia , infection , foreign body and lack of vascularity [6]. Oxygenation plays a key role in wound healing as it facilitates cellular proliferations and prevents infections [7]. During the initial stages of wound healing there is profuse oxygen consumption owing to the high rate of metabolism. Optimal oxygen levels will benefit a healing wound. Therapeutic options to deliver oxygen to a healing wound include hyperbaric oxygen therapy (HBOT) and ozone application.

Ozone has various beneficial effects such as anti-microbial activity, increases pO_2 in tissues, improves metabolism of inflamed tissues, facilitates proper oxygen metabolism, increased circulation and oxidation of bio molecules [8].

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Photobiomodulation (PBM), which is also known as low level laser therapy (LLLT) has been well documented as an effective application for accelerating wound healing by enhancing collagen production, increasing levels of growth factors and extracellular matrix-remodeling proteins, and by stimulating synthesis of adenosine triphosphate [9] fibroblastic proliferation, and angiogenesis in a dose-dependent manner. LLLT also suppresses inflammation by reducing pro-inflammatory cytokines and increases local microcirculation by angiogenesis and vasodilation [10]. It enhances the differentiation of stem cells and progenitor cells which in turn lead to healing of tissues [11]. It increases patient postoperative comfort by stimulating the processes of regeneration and epithelialization. This also increases the motility of keratinocytes and enhances neovascularisation; all these factors collectively contribute to an improved wound healing.

Therefore the aim of the present study was to clinically evaluate and compare the effects of LLLT or ozone application on wound healing and patient morbidity of gingiva after gingivectomy and gingivoplasty.

MATERIALS AND METHODS

Study population: The research was conducted in the Department of Periodontics, Krishnadevaraya college of dental science, Bengaluru, where 45 subjects were recruited. The subjects were recruited based on the following inclusion and exclusion criteria.

A. Inclusion criteria:

a. Systemically healthy.

b. Presence of gingival enlargement involving the mandibular or maxillary anterior region indicated for gingivectomy or gingivoplasty.

c. No attachment and bone loss.

d. Patients with satisfactory oral hygiene.

B. Exclusion criteria:

a. Patients who had a history of periodontal treatment in the last 6 months.

b. Smokers and alcohol users.

c. Pregnant women or lactating women.

d. Medically compromised patients.

Study design and clinical parameters

This was a prospective, single centre, single blinded (examiner), balanced randomized (1:1:1) controlled clinical trial with parallel group, randomly divided into control (no intervention), Test Group 1 (Ozone water application), and Test Group 2 (LLLT application).

Surgical Procedure:

Patients were anaesthetised with 2% Lignocaine Hydrochloride and 1:80000 adrenaline. The incision line was delineated with a pocket marker. For the gingivectomy and gingivoplasty procedure the scalloped external bevel incision was placed with a Kirkland knife and a #15 Bard-Parker blade. A sulcular incision was done and the inter dental tissue was released with the help of an Orban's interdental knife. The excised tissues were removed with the help of curettes, gingivoplasty was done with periodontal knives. Upon completion of the surgical procedure the

surgical sites were subjected to the randomly allocated treatment (ozone / LLLT application).

OZONE APLICATION:

After hemostasis ozonated water was applied to the test group 1 (Fig no 1). Ozone generator [5] was used for preparing the ozonated irrigating solution .The ozonated water was prepared according to manufacturer instructions .The tube of the machine was connected to a 1000 ml bottle containing 1000 cc of distilled water for 15 minutes with a power of 30 Watts. The concentration of ozone in the solution was 4 ppm. The analysis of the ozonated water was done at a water testing laboratory. The surgical site was irrigated with a 10 ml syringe with ozonated water for 5-10 minutes. To facilitate ozone irrigation a 20 gauge blunt needle was used [12].

LOW LEVEL LASER THERAPY APPLICATION:

In test group 2 LLLT was applied in surgical site (Fig No 1). The laser used in this study was a diode laser with a wavelength of 810 nm, [13] spot size of 400µm**,** output power of 300mW, power density of 4.5J/cm2 and was irradiated for 15 seconds (3 seconds /5 sites) in perpendicular direction, non- contact and continuous wave mode. Application was performed from 1mm (paper point guidance) above the wound area for each tooth at 5 different points (4 corner points, 1 center point) [14]. LLLT and ozone application was initiated immediately in their respective groups after gingivectomy / gingivoplasty. The same protocol was repeated on 3rd and 7th day. In the control group no additional procedure such as irrigation was carried out after surgery.(Fig No. 3)

OUTCOMES:

Clinical parameters were assessed at baseline, 3rd, 7th and 21st day after surgical procedure.The primary outcome that was assessed was wound surface area (Fig no 2,3,4) by a disclosing solution and evaluated by Image J analysis. The secondary objectives that were assessed are Wound healing index, Oral health impact profile -14 [15], Visual analog scale for pain / discomfort [16] , Plaque Index (Sillness T and Loe H, 1964), Sulcus bleeding index (Mombelli A) and Number of tablets consumed.

Statistical analysis:

Statistical Package for Social Sciences [SPSS] for Windows Version 22.0 Released 2013. Armonk, NY: IBM Corp., will be used to perform statistical analyses.

Friedman's test followed by Wilcoxon Sign, Kruskal Wallis test, Mann Whitney Post hoc test was used to compare the mean VAS scores for pain, Wound Healing Index scores, OHIP 14 scores and analgesics consumed between 3 groups at different time intervals. Wilcoxon signed Rank Post hoc test was used to compare the mean VAS scores for pain, Wound Healing Index scores, OHIP 14 scores and analgesics consumed between different time intervals in each study group. The level of significance [P-Value] was set at $P<0.05$.

RESULTS

The present study was carried out to analyse and compare the effectiveness of low level laser therapy and ozone application on wound healing after gingivectomy and gingivoplasty recruited from June 2021 to December 2022, and were followed up till February 2023. In the current study 45 patients were enrolled and 15 patients were randomly assigned to control group, 15 patients to test group 1 (ozone) and 15 patients to test group 2 (LLLT). All the patients who were enrolled for the study completed the study tenure, returned for scheduled maintenance visits and were analysed for outcomes. No patients were lost to follow up in either group.

The baseline characteristics of the enrolled patients is reported in Table No 1 and 2.

Outcomes and estimation

While there was no statistically significant difference between the wound surface area of ozone applied and control sites immediately after gingivectomy, there is a significant difference between control and LLLT sites, and ozone and LLLT sites. When control and test groups were analysed, at all-time intervals on 3rd, 7th and 21st day the ozone group and LLLT showed significantly higher reduction of WSA compared to control group. Between the 2 test groups the LLLT group showed a significantly a higher WSA reduction on day 3 and day 21 (Table no 3, 4). The wound healing index score was significantly higher in the control group than ozone and LLLT group on day 3. Between the test groups ozone group showed a significantly higher score on day 3, however on day 7 and day 21 all the groups showed similar wound healing index scores (Table no 5). On day 3 the control group significantly showed higher scores than test groups, but VAS score is similar between test groups. The same trend was noted on day 7 and day 21. It was noted that on day 3 both the test group patients consumed significantly more tablets than the control group. However between the test groups ozone showed significantly lesser TC than LLLT group. By the 7th day in ozone group patient did not consume any tablets compared to control and LLLT group. On the 21st day patients in all groups did not consume any tablets. On day 3, 7, 21 no significant difference was seen between all groups for PI. On day 3, 7, 21 no significant difference was seen between all groups for SBI.

DISSCUSSION

Gingivectomy is a surgical protocol to excise diseased gingiva or hyperplasia of the gingiva to establish normal gingival anatomy and improve aesthetics and plaque control [2]. Re-epithelialization is a critical phase that includes interactions between the extracellular matrix and keratinocytes that migrate, proliferate, and differentiate, thereby restoring gingival tissue function and structure [17]. In addition to the complex wound healing process, the bleeding and pain that are frequently seen after gingivectomy is also an issue. Attempts to overcome these problems such as controlling the cellular activity by using growth factors, [18] enamel matrix proteins, [19] periodontal ligament cells and LASER [20] applications have reported favourable outcomes. Wound biomodification has attempted to change the oxygen concentration in a healing wound site as oxygen plays an important role in wound healing and is vital for energy production, protein synthesis, cellular proliferation, angiogenesis and restoration of tissue functions. A wound with a hypoxic environment is associated with compromised healing, thus increasing the risk of infection [21].

Another popular wound biomodification is LLLT which stimulates mitochondrial activity, inflammation and angiogenesis, increases oxygen availability and helps heal both hard and soft tissues [22]. It has been suggested that LLLT promotes dissociation of oxygen from oxyhemoglobin in the tissue capillary beds, which makes more oxygen available for oxidative metabolism and ATP production. LLLT which is based on biostimulation / biomodulation may induce cellular processes that influence wound healing. Various studies have concluded that LLLT improves wound healing after periodontal surgical procedures. Adjunctive therapies such ozone therapy have also shown to improve wound healing. Ozone therapy that has been practiced since 1817, is popular due to its antimicrobial, tissue friendly and wound healing properties. The positive impact of ozone therapy as an adjunct to non-surgical periodontal therapy has been clinically documented. Ozone therapy enhances vascularity, improves oxygen perfusion thereby accelerating metabolism, improves antioxidant mechanisms, stimulates immune system and increases secretion of growth factors [23]. The scientific literature contains more information on the antimicrobial effect of ozone, with very few articles on wound healing. However very few studies have analysed and compared the role of LLLT and ozone therapy in periodontal surgical procedures to improve early wound healing. Therefore in the current trial the adjunctive effect of LLLT and ozone therapy on early wound healing was analysed and compared on the 3rd, 7th and 21st day post gingivectomy.

Many techniques, including random visual inspection, [24] graded scale, [25] assessment of cytokines such as TGF-β1, PDGF-BB, and IL-8, [26] topical application of 3% H_2O_2, [27] biometric evaluation, [25] histologic analysis by hematoxylin and eosin (H&E) and Masson's trichrome stain (MT)[28] and staining with plaque disclosing solutions such as methylene blue, [29] erythrosine [30] and 2 - tone dye (mira 2- tone, [14] Alpha plac [31]) are used to analyse wound healing. A popular method to analyse epithelium is applying plaque-disclosing solution over the surgical area using a cotton pellet and leaving it for 2 min. Later, the patient is asked to rinse with water. The areas where epithelium is absent, abraded or lacking sufficient keratinization stained with the dye and could be distinguished from normal gingiva. Staining of the wound surface is seen with methylene blue, erythrosine in 1:50 dilution for 30 seconds and 2 - tone dye (Mira 2- tone, Alpha plac). Although histologic analysis is the gold standard, it is not preferred because it requires a second surgery and has ethical implications. The darkly stained surface were considered as sites still undergoing wound healing with the lack of enough layers of epithelium [14].

The LLLT protocol employed in the study was a diode laser with wavelength of 810 nm, spot size of 400µm, output power of 300mW, power density of 4.5J/cm2 and was irradiated for 15 seconds which is similar to Uslu M **[32]** study which used LLLT as an adjunctive treatment post gingivectomy to improve wound healing.The current trial used ozonated water at 4ppm concentration. Bocci V [33] generated ozonated water by using a glass cylinder which was about ¾th filled with deionized and bidistilled water through which the gas mixture (oxygen-ozone) was bubbled continuously for at least 5 min to achieve saturation. The ozonated water was irrigated using a sterile 5ml syringe with a blunt 21 gauge needle. The same protocol is followed in the current study.

In the present study wound surface re-epithelialization was measured by staining with plaque disclosing agent and Image J analysis. This protocol has been followed by various authors [34, 35, 36] and is an indirect measure of re-epithelialization.Wound surface assessment showed significant reduction in wound surface area in both test groups when compared to control, but when both the test groups were compared except for 7th day analysis it was similar indicating similar surface epithelialization at day 3 and day 21. The percentage reduction of wound surface area is higher in LLLT group (99.85%) when compared to ozone group (99.48%) and control group (96.12 %) on 21st day). When Isler S C *et al* [27] compared the effect of LLLT and ozone therapy on re-epithelialization of palatal donor site, he noted significantly smaller wounds in ozone group compared with control group which is in accordance with the outcomes of the current trial. He did not observe significant difference between the LLLT and ozone groups which is similar to our study, he also did not observe significant difference between the LLLT and control group, which is contradictory to our study. The difference in the outcomes noted may be due to different methods used for analysing epithelialization (Isler used H_2O_2 method). Uslu M *et al* [32] performed ozone therapy and LLLT application on gingivectomy wounds, he observed no difference between the groups on 3rd and 7th day contrary to our observation wherein significantly higher reduction was seen in both the test groups as opposed to control group.They also observed complete epithelialization among few patients in all the groups contradictory to our study. This difference may be attributed to the different method of wound surface analysis and also due to the subjective nature of analysis. Ozcelik O *et al* [14] assessed the effect of LLLT on healing of gingiva after gingivectomy and gingivoplasty. He reported that while there was no difference between the stained surface area of the LLLT applied and control sites immediately after gingivectomy, but on the postsurgical 3rd, 7th, and 15th day LLLT applied

sites showed significantly lower stained areas which is similar to our study. Similar outcomes were also noted by Amorim J C *et al* [25] with adjunctive use of LLLT. When ozonated oil (Patel PV *et al*) [37] and ozonised water (Filippi *et al*) [38] were investigated on early wound healing it was noted that significant improvement in epithelial healing was seen on 7th and 21st, which reiterates our finding that ozone therapy accelerates wound re-epithelialization . Wound healing index by Landry *et al* grades the wound on a scale of 1–5. WHI scores on day 0, 7 and 21 were same in all the groups. However on day 3 control group showed significantly better scores than the test groups. Between the test groups ozone showed a better score than LLLT on day 3. This is in contrast to Uslu M *et al* [32] observation where in no difference was seen. However, when Lingamaneni S *et al* [39] investigated the effects of LLLT on gingival healing after gingivectomy and no statistically significant difference in healing scores at day 0, 3 and 7 postoperative visit was reported which is similar to the outcomes of this trial, however on day 14 a significantly better healing was observed in the LLLT groups. By the 7th and 21st day post-surgery all the 3 groups had no pain. However on 3rd day all patients reported pain while patients in ozone and LLLT group reported lesser frequency of pain. Patients in both the test groups reported lesser frequency of discomfort to eat as compared to control group. Regarding self consciousness most patients in all groups were not self conscious. This results corresponds with Tasdemir Z *et al* [8] who reported significant differences in quality of life of test and control groups on day 6 postoperatively but this difference disappeared by day 13. Similarly Kazancioglu *et al* [41] demonstrated the positive effects of ozone therapy on patients quality of life after 3rd molar extractions. Uslu M *et al* [32] reported that the OHIP-14 score of the control group on the 7th day was higher than the LLLT group but no difference was observed between the groups on day 0 and day 14. At baseline the VAS score of present study is not statistically different between control , test group 1 and test group 2. On day 3 there is statistically significant higher VAS score in the control group as compared to the test groups but no statistically significant difference between ozone and LLLT group. A similar trend was seen on day 7 and day 21. Uslu M *et al* [32] showed a similar values on day 3 and day 7 where VAS of control group was higher than LLLT and ozone group. The VAS level of the ozone group was higher than LLLT group on 3rd and 7th day, in contrast to the findings in our study, intergroup difference between ozone and LLLT group on day 3 and 7 did not show any statistically significant difference between them. Both studies showed similar results on day 21 with no significant difference. Tasdemir Z *et al* [40] showed significantly higher VAS values in the control group than the test group during the 1st week post surgery which is similar to current study. Kazancioglu HO *et al* [41] reported significantly lower pain in ozonated groups than the control group after extraction of 3rd molar, which is similar to our study. Isler S C *et al* [27] showed a similar results, the mean VAS scores are higher in control group compared to ozone and LLLT group at all times. However, the comparison of VAS scores should be interpreted with caution as most of the studies analysed other periodontal surgeries such as FGG, palatal donor site wound, 3rd molar extraction etc. On day 3 statistically higher number of analgesics were consumed by the test groups, on day 7 and 21 there was no difference between all the 3 groups. The outcomes of the current trial are in contrast to that of Uslu *et al* [32] and Tasdemir Z *et al* [40] where more analgesics were consumed in the control group. However Isler *et al* [27] reported similar outcomes wherein the number of analgesics consumed in the first post operative week did not vary significantly between the groups. In the current study there is a reduction of plaque index and SBI from day 0 to day 21 which is statistically not significant between the 3 groups. Kshitish D *et al* [42] and Isler *et al* [27] reported similar outcomes where no significant differences was seen between the control, ozone and LLLT group on 14th and 30th day. However, Rajesh *et al*36 and Sivaraman T *et al* [42] reported statistically significant reduction in plaque index between ozonated oil and control group.

LIMITATIONS

The small sample size of the study may have a considerable bearing on the results therefore it should be interpreted with due diligence. The average age of the study population was very young (24 years-ozone group, 24 years- LLLT group, 25 years -control group) and did not have any systemic complications, healing after gingivectomy is generally very simple, quick and uncomplicated process for which the need for adjunctive treatment seems unnecessary. The image analysis protocol employed for wound surface area evaluation is totally dependent on the operator and may be subjected to errors; only histologic or immunohistologic studies will provide clear evidence on the effect of ozone or LLLT on wound healing at a cellular level.

Future direction

The smaller sample size may distort the outcome of the studies hence future studies with increased sample size may be beneficial. There is a need for clinical trials assessing wound healing in older individuals as increasing age is a deterrent for healing. Wound healing assessment of ozone therapy / LLLT in systemically compromised patients specially diabetics will be beneficial. Complex periodontal surgeries such as regenerative periodontal procedures and perioplastic surgeries which exhibit complicated and longer healing periods may benefit additionally from the use of adjunctive ozone therapy or LLLT and should be critically evaluated. In permissible situations histological analysis with throw better light on the healing potential of ozone therapy and LLLT.

Figure 1: Ozone water irrigation and LLLT application

Figure 2: In ozone group Day 0, 3, 7, 21 evaluation of wound surface area

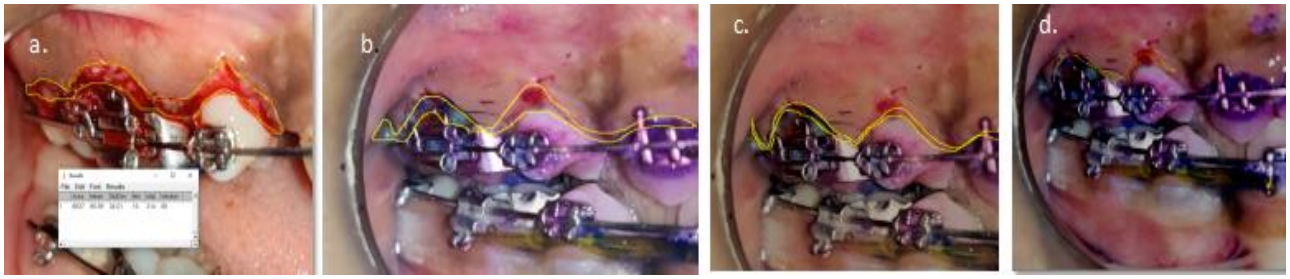

Figure 3: In LLLT group Day 0, 3,7,21 and evaluation of wound surface area

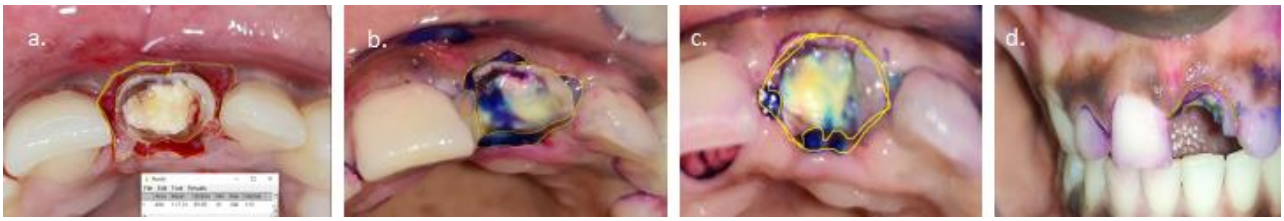

Figure 4: Day 0, 3,7 , 21 and evaluation of wound surface area in control group

Table 1: Baseline Demographic Data

		Control group(N=15) (no intervention)	Test group 1(N=15) (Ozone)	Test group 2(N=15) (LLLT)
Age (years)		25.5 years	24.0	24.8
Gender (female)		8 (53.3%)	6(38.0%)	5 (33.3%)
Site	**Maxillary anterior**	8 (53.3 %)	9(60%)	5 (33.3%)
	Mandibular anterior	7(46.7%)	6(38%)	10(66.7)

Table 2: Clinical characteristics on the baseline day

Baseline characteristics Day 0	WSA (area =mm2)	WHI	OHIP-14	VAS	TC	PI	SBI
CONTROL	358283±18772	0±0	2.66±0.57	6.50±1.80	2.60±0.52	1.00±0.00	2.00±0.00
TEST GROUP 1	348413±12001	0±0	1.26±1.55	6.23±1.24	3.00±0.94	1.38±0.20	1.27±0.30
TEST GROUP 2	328337±9909	0±0	1.41±1.16	6.780±1.31	3.00±0.00	1.60±0.22	1.27±0.38

Table 3: Inter group comparison of WSA on day 0, day 3, day 7, day 21. Student 't' test *Statistically significant

	WSA0				**WSA3**			
	Mean	**SD**	**T**	**P Value**	**Mean**	**SD**	**T**	**P Value**
Control	358283	18772	1.654	0.120	47656	6022	3.072	0.008*
Ozone	348413	12001			40056	3201		
Control	358283	18772	8.804	0.000*	47656	6022	11.815	0.000*
LLT	328337	9909			27236	2335		
Ozone	348413	12001	9.637	0.000*	40056	3201	13.952	0.000*
LLT	328337	9909			27236	2335		
	WSA7				**WSA21**			
	Mean	**SD**	**T**	**P Value**	**Mean**	**SD**	**T**	**P Value**
Control	7462	1121	7.246	0.000*	4727	562	11.168	0.000*
Ozone	4677	901			2480	501		
Control	7462	1121	9.679	0.000*	4727	562	12.517	0.000*
LLT	3725	783			2598	299		
Ozone	4677	901	2.334	0.032*	2480	501	0.754	0.463
LLT	3725	783			2598	299		

Table 4: Inter group comparison difference of WSA in control group, test group 1 and test group 2. Student 't' test

		Control		**Ozone**		**T Value**	**P Value**
Groups	***N***	***Average***	***SD***	***Average***	***SD***		
WSA 0 to 3	15	76.25%	21.56%	90.81%	8.95%	2.333	0.0331*
WSA 0 to 7	15	91.55%	9.66%	97.59%	1.32%	2.318	0.0339*
WSA 0 to 21	15	96.12%	4.63%	99.48%	1.04%	2.654	0.0189*
		Control		LLT		T Value	P Value
Groups	*N*	*Average*	*SD*	*Average*	*SD*		
WSA 0 to 3	15	76.25%	21.56%	94.84%	1.11%	3.222	0.0061*
WSA 0 to 7	15	91.55%	9.66%	99.50%	0.20%	3.081	0.0081*
WSA 0 to 21	15	96.12%	4.63%	99.85%	0.05%	3.016	0.0093*
		Ozone		LLT		T Value	P Value
Groups	*N*	*Average*	*SD*	*Average*	*SD*		
WSA 0 to 3	15	90.81%	8.95%	94.84%	1.11%	1.674	0.1163
WSA 0 to 7	15	97.59%	1.32%	99.50%	0.20%	5.333	0.0001*
WSA 0 to 21	15	99.48%	1.04%	99.85%	0.05%	1.312	0.2105

Table 5: Inter group comparison of wound healing index at day 0, day 3 day 7 day 21 between control, test group 1 and test group 2 Student 't' test * Statistically significant

	WH0				**WH3**			
	Mean	**SD**	**T**	**P Value**	**Mean**	**SD**	**T**	**P Value**
Control	0	0	0.000*	1.000	2.70	0.23	2.455	0.028*
Ozone	0	0			2.50	0.20		
Control	0	0	0.000*	1.000	2.70	0.23	7.346	0.000*
LLT	0	0			2.10	0.20		
Ozone	0	0	0.000*	1.000	2.50	0.20	5.292	0.000*
LLT	0	0			2.10	0.20		
	WH7				WH21			
	Mean	SD	T	P Value	Mean	SD	T	P Value
Control	3.00	0.00	0.000	1.000	4.00	0.00	0.000	1.000
Ozone	3.00	0.00			4.00	0.00		
Control	3.00	0.00	0.000	1.000	4.00	0.00	0.000	1.000
LLT	3.00	0.00			4.00	0.00		
Ozone	3.00	0.00	0.000	1.000	4.00	0.00	0.000	1.000
LLT	3.00	0.00			4.00	0.00		

CONCLUSION

Within the limits of the present study, it can't be concluded that ozone therapy enhanced wound healing after gingivectomy similar to LLLT. The wound surface area reduction can be interpreted as better wound healing which also correlates with higher WHI, better quality of life, lesser VAS score in the ozone treated group. Ozonated water application showed no adverse effects and was well tolerated by the patients. These encouraging results prompt the use of ozonated water as an adjunct to surgical periodontal treatment. Standardization of ozone therapy protocol is needed and hence more randomized control trials should be planned.

Conflict of Interest

None declared.

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None declared.

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