Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 13, (2024)
https://www.jneonatalsurg.com

OPEN ACCESS

A Comparative Study Of Diode Laser (810 Nm) Against Traditional Scalpel Approach For Second-Stage Implant Surgery

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.Cite this paper as Dr. Akhilesh Tomar, Dr. Amit Kumar Mishra, Dr. Nidhi Chaudhary, Dr. Taruna Choudhary, Ms.Vasudha.R, Ms. Mona ranjan (2024) A Comparative Study Of Diode Laser (810 Nm) Against Traditional Scalpel Approach For Second-Stage Implant Surgery .Journal of Neonatal Surgery, 13. 1918-1923

ABSTRACT

Introduction: Parallelism in the expansion of implant and laser dentistry are the same as for any other soft tissue dental procedures. Surgical lasers have been used with good results in a variety of ways in implantology, ranging from placement to second-stage surgery for exposure of the buried implant. Laser-assisted technique achieves same results as the traditional technique but with shorter timing, micro-invasiveness, and better patient compliance.

Aim: A comparative study of diode laser (810 nm) against traditional scalpel approach for second-stage implant surgery

Methods: A comparative research was carried out at the Department of Periodontology and Oral Implantology, from October 2020 to September 2021, India, with the approval of the protocol review committee and the institutional ethics committee. It was decided to only include patients who have had implants installed by our team in this research. Patients with healthy keratinized tissue around the implant site and ages ranging from 18 to 58 were included in the research.

As a part of this study, researchers recruited 30 patients who had previously had two-stage implants inserted. Patients were randomised into two groups at random and their implant sites were inspected. Those in Group A had stage II surgery with a regular knife and discovered implants. Group B: Using an 810 nm diode laser as part of stage II surgery, implants were exposed in this group. This research made use of a diode laser at 810 nm operating in continuous mode at a power of 1.5 W.

Results: All participants required the LA, with Group A requiring an average of 1.77 0.42 ml and Group B requiring an average of 0.7 0.01 ml. The statistically significant difference between Group A and Group B was determined to be 1.07 0.41 ml. The p-value must be less than 0.05. The time taken for surgery in each group was recorded in minutes, with the average for Group A being 14.33 3.98 min and the average for Group B being 9.02 2.36 min.

After a 24-hour interval, the mean pain index values in Groups A and B were 6.10.96 and 5.50.57, respectively.

The difference between the groups (after 24 hours) was statistically significant (P 0.05) when examined using an independent t-test. Group A's mean pain index score was 3.9 0.66 at 48 hours and 2.9 0.74 at 72 hours, whereas Group B's mean pain index score was 1.7 0.87 and 0.3 0.59, respectively. At a p-value of " 0.05, the difference between the groups was statistically significant at 48 and 72 hours. The Chi-square test was used to compare HI between Group A and Group B. HI categories, such as poor (Group A = 13.33 percent, Group B = 20 percent), good (Group A = 26.67 percent, Group B = 66.67 percent), very good (Group A = 46.67, Group B = 13.33), and excellent (Group A = 13.33 percent, Group B = 0) all had a P value greater than 0.05, meaning the difference between Group A and Group B was not statistically significant.

Conclusion: When doing second-stage implant surgery using a diode laser, we found that the lack of bleeding and reduced postoperative pain allowed us to perform the procedure with less stress and anaesthetic.. ,

Keywords: *Diode Laser (810 Nm), Scalpel Technique , Second-Stage, Implant, Surgery*

1. INTRODUCTION

Heliotherapy was utilised in ancient Greece to restore health by exposing the body to the sun's rays. Such ailments as rickets, skin cancer, and even insanity were treated by the Chinese using the sun. Phototherapy refers to the use of light to cure a variety of ailments. Theodore Maiman created the first solid state ruby laser in 1960, based on Albert Einstein's theory of spontaneous and stimulated emission of light.[1]

Prototypes for Nd:YAG lasers were reported by Snitzer[2] in 1961. Goldman et al[3] and Stern and Sognnaes reported the first use of a laser on dental tissue.[4] When it comes to laser dentistry, it all started with a paper published by Myers and Myers in 1985, which described the use of a modified ophthalmic Nd:YAG laser for the eradication of dental cavities in vivo.[4] When cutting or coagulation is needed, diode lasers are often employed in a contact application. Initiated or uninitiated usage of the diode laser's tip is possible. It is covered with a substance that absorbs light energy and redirects it to generate heat. As a consequence, cells are ablated and tissue is sliced as a result of this conversion of energy.[5]

For disinfection of the implants or the periodontal sulcus/pocket, an uninitiated diode tip is preferable.[5]

Diode lasers have shown comparable qualities to Nd:YAG lasers that produce a similar wavelength, however Nd:YAG causes a significant rise in temperature in deeper tissue layers. Diode lasers, on the other hand, penetrate less deeply yet generate more heat per unit time. There are several soft tissue treatments that can be performed with diode lasers without causing injury to bone or periosteum, and they can be done without affecting the surrounding tissues since they cause little harm.[6,7]

Dental implant uncovering was the focus of this research, which contrasted diode laser surgery with standard cold scalpel surgery in terms of key characteristics that were evaluated in both instances at certain time intervals.

2. MATERIAL AND METHODS

A comparative research was carried out at the Department of Periodontology and Oral Implantology, from October 2020 to September 2021, India, with the approval of the protocol review committee and the institutional ethics committee

India, with the agreement of the protocol review committee and the institutional ethics committee.

The patient's medical history was meticulously gathered after the receipt of informed permission.

Inclusion and exclusion criteria

It was decided to only include patients who have had implants installed by our team in this research. Patients with healthy keratinized tissue around the implant site and ages ranging from 18 to 58 were included in the research.

Uncooperative patients, individuals with impaired medical conditions, and patients with implant-site inflammation, exposure, or lack of osseointegration were all ruled out.

Methodology

As a part of this study, researchers recruited 30 patients who had previously had two-stage implants inserted.

Patients were randomised into two groups at random and their implant sites were inspected.

Group A: Using a typical scalpel method, implants were exposed during stage II surgery in this group.

Group B: Using an 810 nm diode laser as part of stage II surgery, implants were exposed in this group.

This research made use of a diode laser at 810 nm operating in continuous mode at a power of 1.5 W. No antibiotics were administered to either group's postoperative patients. A need-based analgesic regimen of 400 mg of ibuprofen and 325 mg of paracetamol was administered.

Patient Assessment

Patients were contacted 24 hours after surgery, 48 hours later, and again 72 hours later to evaluate and record pain using a visual analogue scale (VAS).[8]

If they felt the need for an analgesic, patients were instructed to note their VAS pain readings first.

On the 7th day following surgery, patients were brought back to be evaluated for healing using HI,[9] and after that, imprints were made for different topics based on HI.

The requirement for LA and the quantity utilised during surgery (in ml) were measured in both groups before surgery. The duration of the stage II surgery in both groups was noted in minutes after completion of surgery.

Intra-operative bleeding

Surgeons assessed intraoperative bleeding on a scale of one to three, with one being "little bleeding," two being "normal bleeding," and three being "severe."10,

Pain index:

The VAS was used to gauge the severity of the subjects' discomfort.8 It has a range of 0 to 10 values. From 0 to 10, the scale measures the intensity of pain.

Wound HI

It was calculated using recordings of HI that the healing event was clinically evaluated.9 The HI recordings were made on the seventh postoperative day and at the time of the impression taking: After how many days after 2nd stage surgery, impressions may be obtained for prosthesis; the time of impression was recorded.

Statistical analysis

The results were compiled and statistically analyzed using SPSS 25.0.

Results

All participants required the same quantity of LA, with Group A requiring an average of 1.77 0.42 ml and Group B requiring an average of 0.7 0.01 ml. There was a statistically significant P 0.05 difference in mean volume between Group A and Group B. Table 1

The time taken for surgery in each group was recorded in minutes, with the average for Group A being 14.33 3.98 min and the average for Group B being 9.02 2.36 min.

The mean difference between Group A and Group B was 5.31 1.62 minutes, which was statistically significant at P 0.05 for the comparison of operation length between the two groups. Table 2

Thirteen percent of patients in Group A had minimum intraoperative bleeding, 66.67 percent had normal intraoperative bleeding, and 20 percent had severe bleeding. In Group B, all cases had low intraoperative bleeding. The difference between Group A and Group B had a chi-square value of 15.11 and a p-value of 0.05. Table 3

After a 24-hour interval, the mean pain index values in Groups A and B were 6.10.96 and 5.50.57, respectively. The difference between the groups (after 24 hours) was statistically significant (P 0.05) when examined using an independent t-test.

Group A's mean pain index score was 3.9 0.66 at 48 hours and 2.9 0.74 at 72 hours, whereas Group B's mean pain index score was 1.7 0.87 and 0.3 0.59, respectively.

At a p-value of "0.05" the difference between the groups was statistically significant at 48 and 72 hours. Tables 4 and 5

The Chi-square test was used to compare HI between Group A and Group B.

HI categories, such as poor (Group A = 13.33 percent, Group B = 20 percent), good (Group A = 26.67 percent, Group B = 66.67 percent), very good (Group A = 46.67, Group B = 13.33), and excellent (Group A = 13.33 percent, Group B = 0) all had a P value greater than 0.05, meaning the difference between Group A and Group B was not statistically significant.

Table 6

An independent t-test was used to compare the time it took for an impression to form between groups A and B. Group A took an average of 7.95 1.55 days to collect impressions, whereas Group B took an average of 9.88 2.69 days. A statistically significant difference was detected between the two groups, with a mean difference of 2.5 0.99 and a P value of 0.026 (i.e. a P value less than 0.05).

Table 1 Intergroup comparison of amount of local Anesthesia (ml) in group A and group B

Need LA	Mean±SD Group A	Mean±SD Group B	Significance of difference using chi square test		
			t	P	Significance
Amount of LA	1.77 ± 0.42	0.7 ± 0.01	9.88	<0.001	Significant

LA- local Anesthesia ; SD – standard deviation; t test value; P – pvalue (<0.05)

Table 2 Intergroup comparison of duration of surgery (min) in group A and group B

Need LA	Mean±SD	Mean±SD	Significance of difference using chi square test

	Group A	Group B	t	P	Significance
duration of surgery (min)	14.33 ± 3.98	9.02 ± 2.36	4.55	0.004	Significant

SD – standard deviation; t test; P – pvalue (<0.05)

Table 3 Intergroup comparison of amount of intraoperative bleeding in group A and group B

Need LA	Group A n(%)	Group B n(%)	Significance of difference using chi square test χ^2	P	Significance
Minimal bleeding	2 (13.33)	15(100)	15.11	<0.001	Significant
Normal Bleeding	10(66.67)	0			
Excessive bleeding	3(20)	0			

χ^2 -chi square test; n- number of samples ; P – pvalue (<0.05)

Table 4 Intergroup comparison of pain index scores (visual analog scale) between 3 intervals:

Interval	Mean±SD Values at designated intervals	Mean±SD Change from 24h	Significance of difference using paired t test t	P	Significance
Group A					Significant
24h	6.1±0.96	-	-	-	
48h	3.9±0.66	2.8±0.88	10.63	<0.001	
72h	1.7±0.87	3.9±1.11	11.69	<0.001	
Group B					Significant
24h	5.5±0.57	-	-	-	
48h	2.9±0.74	2.9±0.78	10.36	<0.001	
72h	0.3±0.59	4.5±0.59	18.99	<0.001	

SD – standard deviation; t test value ; P – pvalue (<0.05)

Table 5 Intergroup comparison of visual analog scale between group A and group B

	Mean±SD Group A	Mean±SD Group B	Significance of difference using chi square test t	P	Significance
VAS 24h	6.1±0.96	5.5±0.57	2.77	0.042	Significant
VAS 48h	3.9±0.66	2.9±0.74	3.45	0.004	Significant
VAS 72h	1.7±0.87	0.3±0.59	3.12	0.008	Significant

SD – standard deviation; t test; P – pvalue (<0.05) ; VAS - visual analog scale

Table 6 Intergroup comparison of healing index in group A and group B

healing index	Group A	Group B	Significance of difference using chi square test

			χ^2	P	Significance
Poor	2(13.33)	3(20)	3	0.29	NonSignificant
Good	4(26.67)	10(66.67)			
Very Good	7(46.67)	2(13.33)			
Excellent	2(13.33)	0			

LA- local Anesthesia ; χ^2 -chi square test; n- number of samples ; P – pvalue (<0.05)

3. DISCUSSION

The diode laser, which is typically made up of gallium, arsenide, and other components, was employed in this investigation. The laser's wavelength is little absorbed by water, whereas haemoglobin and other pigments completely absorb it[8-10].

Because it has no effect on dental hard tissues, the diode laser is regarded as a good soft tissue laser. Other benefits include smaller unit sizes and cheaper financial expenditures.[11-14]

Because of the simplicity with which they may be utilised, surgical lasers have long been employed instead of scalpels. However, there are many benefits to using a surgical laser on the soft tissues that surround or cover implants. Improved healing and a shorter period before the imprint can be taken are two additional benefits.[10]

When it comes to uncovering implants, diode or other laser systems have shown to be effective in trials and research.[15-18]

All participants required the same quantity of LA, with Group A requiring an average of 1.77 0.42 ml and Group B requiring an average of 0.7 0.01 ml. There was a statistically significant P 0.05 difference in mean volume between Group A and Group B. A higher mean volume of LA was used in Group A, which was in line with the findings of Shalawe et al.[19] and El-Kholey[10] studies (scalpel).

The time taken for surgery in each group was recorded in minutes, with the average for Group A being 14.33 3.98 min and the average for Group B being 9.02 2.36 min. The mean difference between Group A and Group B was found to be 5.31 1.62 minutes, which was statistically significant at P 0.05 when comparing the length of operation in Group A and Group B.

El-Kholey[10] found similar findings, indicating less bleeding when using lasers and typical bleeding while using traditional scalpels. Patients who had laser-assisted surgery reported reduced discomfort statistically. Other studies have found the same thing. The difference between the 810 nm diode laser group and the control group in terms of postoperative pain was statistically significant.

Laser (810 nm) use may be more helpful in operations when the patient or the practitioner expects postoperative discomfort. A few studies have compared the postoperative effects of diode laser and scalpel postfrenectomy, but more are needed. It was shown that patients who were treated with Nd: YAG lasers were more satisfied, had less post-surgical pain, and were more likely to recommend the procedure to others.[20]

There was less discomfort for individuals who had frenectomy surgery using Co2 laser rather than traditional knife surgery, according to a study by Haytac and Ozcelik.[21]

Comparing the healing outcomes between the two groups, group A consistently outperforms group B.

Laser healing histology has a dearth of data, and the findings of this study were not statistically significant.

The slower healing time associated with scalpel wounds compared to laser wounds, according to Jin et al.[22], may be attributable to the decreased amount of transforming growth factor-beta 1 expression.

Limitations

The study's primary drawback is the small sample size. Another drawback is the absence of histological testing for better healing evaluation, which was outside the scope of this research, and the third was the clinical examiner's lack of blindness.

4. CONCLUSION

When doing second-stage implant surgery using a diode laser, we found that the lack of bleeding and reduced postoperative pain allowed us to perform the procedure with less stress and anaesthetic.

Declarations:

Conflicts of interest: There is not any conflict of interest associated with this study

Consent to participate: There is consent to participate.

Consent for publication: There is consent for the publication of this paper.

Authors' contributions: Author equally contributed the work

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