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Effect of Diode Lasers in Gingivectomy- A Systematic Review

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ABSTRACT:

Background: Different methods can remove tissue during gingivectomy and produce a good gingival margin. Lasers are commonly used nowadays. A continuous or pulsed diode laser with wavelengths spanning from 810 to 980 nm was considered a viable instrument for oral soft tissue surgery. A diode laser is a type of laser system in which an electric current produces photons with wavelengths of 810, 940, and 980nm.

Aim:To evaluate the effects of diode lasers on gingivectomy.

Materials and Methods: PubMed, Cochrane Central Register of Controlled Trials (CENTRAL), science direct, Wiley, and other databases were used to conduct a literature search. Wiley, MEDLINE plus using MeSH terms-diode lasers, gingivectomy. A literature search was conducted to gather relevant data. Of 246 articles screened,32 full-text articles were assessed for eligibility, and PubMed, Cochrane Central Register of Controlled Trials (CENTRAL), science direct, Wiley, and other databases were used to conduct a literature search. Five randomized controlled trials were included for the review process.

Results:The diode lasers gingivectomy was compared with conventional gingivectomy, which showed that pain and bleeding were lesser and also observed that healing was better as compared to conventional gingivectomy.

Conclusion: The diode lasers were found to be effective in reducing postoperative pain, healing index, bleeding, improving overall gingival health.

Keywords: Diode lasers, gingivectomy, Postoperative Pain, Wound Healing, Gingival Health.

INTRODUCTION

The process of amplification of light via stimulated emission of radiation is known as referred to as LASER. When scientist Albert Einstein described the notion of stimulated emission in 1917, the laser concept was born. Dental lasers are a novel technology that is being employed in clinical dentistry to solve the disadvantages of traditional dental procedures. Lasers were first utilized in dentistry in the 1960s, but their popularity has exploded in recent years. This technology animprovements in medicine and dentistry are playing an increasingly important role in patient care and well-being. [1]

The most popular lasers used in dentistry are Holmium Yttrium Aluminium garnet (Ho: YAG), Neodymium-doped yttrium Aluminium Garnet (Nd: YAG), Carbon Dioxide Laser (CO2), Erbium-Doped Yttrium Aluminium Garnet (Er: YAG), Neodymium-doped Yttrium Aluminium Perovskite (Nd: YAP), gallium arsenide Soft and hard tissue surgery, root planing (the removal of calculus from the root surfaces), cavity preparation in the enamel and dentin, detection of dental caries, cleaning the root canal system, etching, and caries prevention by changing the crystalline structure are all clinical applications of lasers in dentistry.[2]

The diode laser is a type of laser system in which photons of wavelengths of 810,940,980nm are produced by an electric current. The use of diode laser in soft tissue oral surgery has been studied for facial pigmentation and vascular lesion, as well as for frenectomy, gingivectomy, fibroma, epulis fissuratum. The benefits of laser surgery include a largely bloodless surgical and postoperative course with minimum oedema and scars.[3]

Gingivectomy is a surgical procedure that removes the gingiva. It is a procedure that can be done to treat gingivitis. It's also utilized to eliminate extra gum tissue for cosmetic purposes. Reasons, such as to change the appearance of a smile.

Because developments in laser technology continue to make equipment cheaper and easier to use, laser gingivectomy is becoming more popular. Lasers are also most exact and, thanks to the laser's heat, allow for faster healing and cauterization, as well as a lesser danger of infection from contaminated metal equipment.

During and/or after orthodontic treatment, persistent inflammatory gingival overgrowths are quite prevalent. Overgrowths can sometimes make orthodontic treatment more difficult and/or interrupt it. Despite frequent patient education and encouragement on oral cleanliness, patients frequently acquire gingival overgrowths due to poor compliance and difficult orthodontic appliance designs. Gingival overgrowths are treated surgically with gingivoplasty or gingivectomy using surgical knives and blades. The patient's traditional ways are being reintroduced after the development of soft tissue LASERS.[4]

Laser operations in the oral cavity have shown various excellent effects in both hard and soft tissue procedures during the previous decade. children have proved to be receptive to laser soft tissue surgery.[5] Scalpels, chemosurgery, lasers, electrosurgery can all be used to conduct gingivectomy.[6] Soft tissue manipulation such as gingival recontouring a frenectomy can now be performed with enhanced epithelialization and wound healing, thanks to the introduction of diode lasers that are highly absorbable by melanin and haemoglobin.[7][8][9] Coagulation, protein denaturation, drying, vapourization, and carbonization are all caused by localized heat at the energy absorption point. this could close blood vessels and block pain receptors near the wound.[10][8]

As a result, employing diode lasers may be advantageous due to enhanced control, lower pain, inflammation and faster wound healing.[7][10][11][12] Because their effect is limited to sift tissues, diode lasers may ensure appropriate hemostasis, reduce infection risk, prevent damage to teeth and bone.[13]

They may also aid soft tissue recovery while boosting esthetics.[14][15][7] Oedema, less swelling, faster healing can also be the benefits of laser surgery.[16][17]Therefore the present study is planned to evaluate the effect of diode lasers on gingivectomy. Hence this study aims to evaluate the effect of diode lasers on gingivectomy.

MATERIALS AND METHODS:

Search Strategy

Published literature on assessing the effects of diode lasers on gingivectomy which includes original articles and research papers in databases such as Pubmed, Cochrane, Science Direct, Wiley were taken into study for review. "**diode lasers and gingivectomy**".

Inclusion criteria:

1. Comparative studies on effects of diode lasers.
2. Studies published in English.
3. Randomized clinical trials.
4. Full-textarticles.

Exclusion criteria:

1. Articles published in other languages.
2. Only abstracts available.
3. Unrelatedarticles.
4. Animal studies and in-vitrostudies.

Search Engines:

1.PubMed
2.wiley
3.science direct
4.spie digital library
5.Medline plus

After the search using the appropriate mesh terms, 246 articles were found from the online databases. After duplicates removal, 120 articles were screened, and 32 full-text articles were available. Applied inclusion-exclusion criteria and final four related articles were selected for further assessment.

Figure 1:Flow diagram showing the number of studies identified, screened, assessed for eligibility, excluded and included in the systematic review.

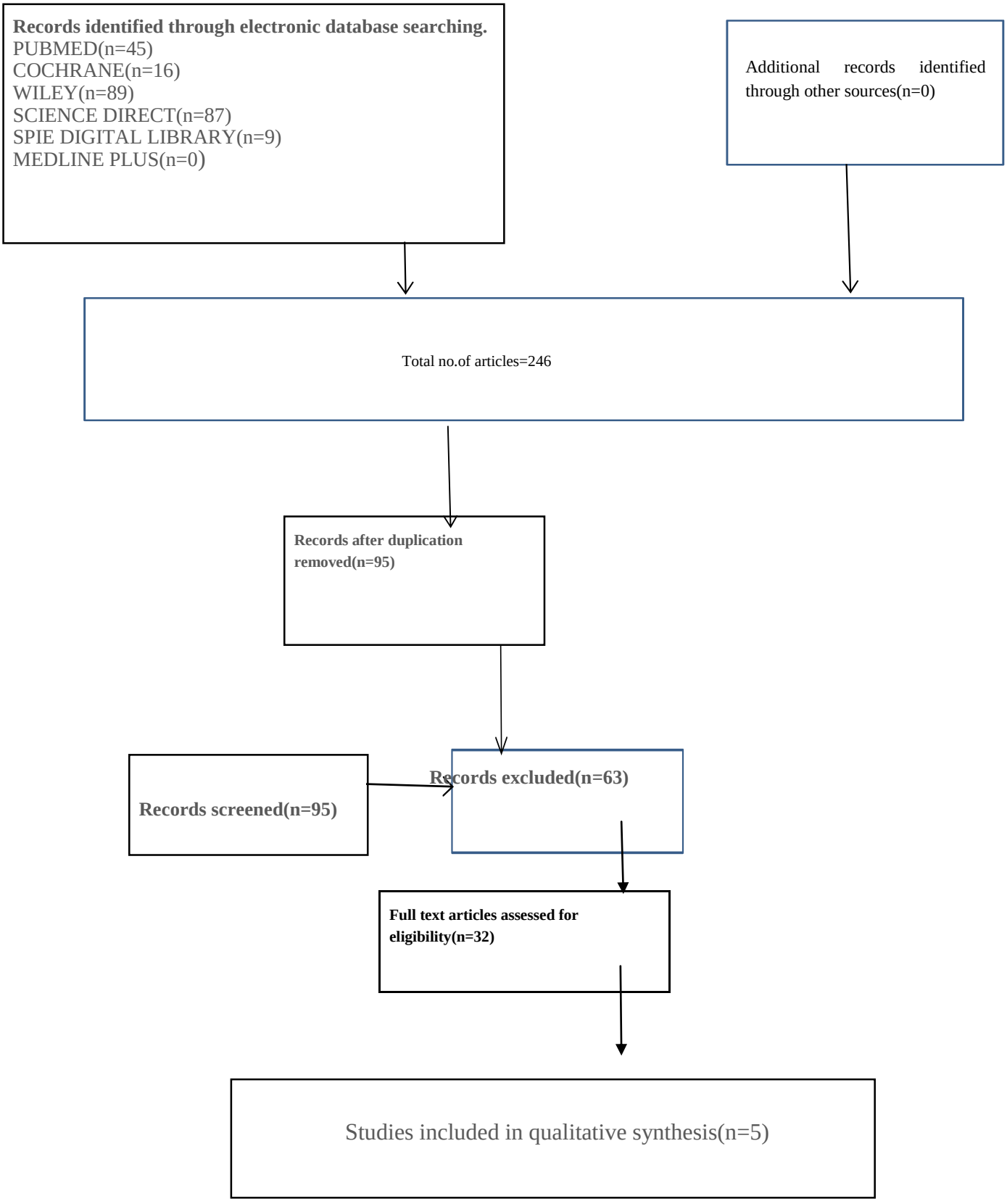

TABLE 1:CHARACTERISTICS OF THE INCLUDED STUDY IN THE SYSTEMATIC REVIEW

AUTHOR NAME	YEAR	SAMPLE SIZE	PATIENT CHARACTERISTICS	DURATION	NUMBER (CASE/CONTROL)
TONY ET AL[18]	2012	30	Patients aged Between 10-40 years are fit, healthy non-smokers undergoing FOAT and had gingival enlargement on the labial side of the anteriorteeth	6 months	4 GROUPS of 2 treatment Case-received non-surgical periodontal treatment and diode laser gingivectomy (950nm) Control-received non surgical periodontal treatment only
FARHAD SOBOUTI ET AL[19]	2014	30	Patientsaged BetweenIn the front maxilla, patients aged 17 to 29 years old require an esthetic-only gingivectomy.	6 months	Case-(15 subjects) laser-assisted surgery Control-(15 subjects)conventional surgery using a scalpel
ELIF ONCU ET AL[20]	2017	20	Patients who were periodontically healthy and needed esthetic-only gingivectomyin the anteriormaxilla	1 month	Casegroup(10 subjects)-laser asisted surgery Controlgroup(10 subjects)-traditional surgery usingscalpel
BHAGYASHREE RAJENDRA KOHALE ET AL [21]	2018	40	Patients who are fit healthy and who hadgingival enlargementin maxillaryandmandibular anterior region.	12 month	Case group-surgical gingivectomy with LLLT Control group- surgical gingivectomy withoutLLLT
SHREYA LINGAMANENI ET AL [22]	2019	10	Patients aged between 18-50 years who are systematically healthy require gingivectomy procedures bilaterally in either maxillary, mandibular teeth	4 months	10 patients treated with diode laser and the other side without any treatment.

TABLE 2:OUTCOME DATA AS REPORTED IN INCLUDED STUDIES

AUTHOR NAME	YEAR	EFFECT MEASURE	RESULTS
Tony et al [18]	2012	Plaque index(PI),gingival index(GI),bleeding on probing(BOP),probing pocket depth(PPD),gingival overgrowth index(GOI)	Percentage of sites with a plaque at 1 month (P.01), 3 months (P.01), and 6 months(P.05) compared to baseline; percentage of sites with BOP at 1 month (P.01), 3 months (P.01), and 6 months (P.05); percentage of sites with gingival inflammation at 3 months (P.01) and 6 months (P.01); mean PPD at 1 month (P.01), 3 months (P.01), and 6 months (P.01Clinical parameters in the control group differed significantlyfrom those intheexperimental group.
Farhad sobouti et al [19]	2014	Bleeding assessment pain assessment using the visual analogue scale(VAS)	which wassignificantly higher than the experimental group(0.36)out of 4.Experimental patients had no post-surgical pain(VSA1 and VSA2=0).in the control group, the average VSA1 was 5.2 out of 10.
Elif oncu et al [20]	2017	Pain and bleeding assessment using VAS.	Theaverage **postoperative pain** in the control and test groups was 7.1 out of 10 and 2.4 out of ten, respectively. The average bleeding rates were **1.32** and**0.24**intheconventional and diode laser groups, respectively.
Bhagyashree Rajendra Kohale et al [21]	2018	Painassessment usingNRS(numeric pain rating scale), Healingindexscores,degreeo fkeratinization.	On the third postoperative day, the test group's mean NRS ratingswere**3.25 ± 0.55**, but by the seventh day, they had droppedto**0.95 ±0.51**. At the end of one month, there was a further decrease in mean pain scores in the control group. On the third postoperative day, the control group's mean healing score was **2.60 ±0.50**, which increased to **2.85±0.36** on the seventh day. The mean healing scores climbed to **4.75 ±0.44** on the 30th day. On the third postoperative day, the mean healing score in the test group was **3.00 ± 0.00**, which climbed to **3.35 ± 0.48** on the seventh day. The average healing scores improved to**5.00 ± 0.00** on day 30.
Shreya lingamaneni et al [22]	2019	Assessmentof healing index scores and darkly stained areas.	**HI**, scores on the 3rd-day postoperative for the test group was 3.3 ± 0.483, and the control group was **2.9 ± 0.875**. 14th day postoperative it was **5 ± 0** and **4.4 ±0.516** for test and control groups, respectively. Darkly stained areas on 3rd-day postoperativewere **40.187 ± 11.46**and **49.271±11.30** respectively for the test group and control group.on 14th day postoperative, it was **1.664 ± 1.47**and **8.146±4.19**respectively for test and control groups.

TABLE 3:BIAS ASSESSMENT AS INCLUDED IN THE STUDIES

AUTHOR NAME	*RANDOM SEQUENCE GENERATION*	*ALLOCATION CONCEALMENT*	*BLINDING OF OUTCOME*	*INCOMPLETE OUTCOME DATA*	*BLINDING OF PARTICIPANTS ANDPERSONNEL*	*SELECTIVE REPORTING*
Tony et al[18]	+	-	+	-	+	+
Farhad Sobouti et al [19]	+	+	+	+	?	+
Elif oncu et al[20]	+	-	+	+	+	+
Bhagyashree Rajendra Kohale et al[21]	?	?	+	+	+	+
Shreyalingamaneni et al[22]	-	?	+	+	-	+

'+'=low risk of bias, '-'=high risk of bias, '?'=Unclear risk of bias

Table 3 shows the bias analysis of all the included studies. It is characterized by high-risk bias'- ', low-risk bias'+', unclear risk bias'?'. Categorization was done according to the Cochrane risk of bias tools for randomized controlled trials.

DISCUSSION:

This review aimed to know the effects of diode lasers in gingivectomy. "Gingivectomy" refers to the removal of the gingiva. Gingivectomy allows vision and accessibility for total calculus removal and extensive root planing by eliminating the pocket wall. This produces an ideal environment for gingival healing and the restoration of a normal gingival shape.
The benefits of gingivectomy include its ease and simplicity, but it also comes with the drawbacks of increased postoperative discomfort and a higher risk of postoperative haemorrhage.

Lasers have proven to be beneficial in a number of professions, including orthodontics. Gingivectomy treatment became a standard aspect of orthodontic treatment after developing soft-tissue diode lasers, which may be more cost-effective and less painful than traditional procedures. Because their effective range is limited to soft tissue, diode lasers may ensure appropriate hemostasis, reduce infection risk, and prevent damage to teeth and bone. They may also promote soft tissue healing while increasing aesthetics.

Thebenefits of laser use in soft tissue management include less oedema, less swelling, and faster healing.
The diode laser is a type of laser system in which photons of wavelengths of 810, 940, and 980nm are produced by an electric current. The safety of using a diode laser in soft tissue oral surgery for face pigmentation and vascular lesions, as well as in oral surgery, has been studied.This systematic review found results of using diode lasers in gingivectomy.

Tony N.F.[18] reported that in both the test and control groups, intragroup comparisons revealed substantial changes in clinical measures over time. Significant changes inPeriodontal markers were found in the test group earlier—in some cases within a month. Furthermore, the test group patients experienced bigger and more frequent meaningful changes in periodontal health. After 1 and 3 months, the percentage of sites with gingival overgrowth in the test group increased significantly more than in the control group. This suggests that using a laser to treat gingival overgrowth can be done swiftly. Furthermore, at 3 and 6 months, diode laser gingivectomy was more successful than non-surgical periodontal therapy alone in decreasing gingival inflammation. At one month, the test group had a higher change in mean PPD than the control group, indicating that diode laser gingivectomy can

swiftly resolve and control this periodontal condition.

Farhan sobouti[19] reported that in comparison to diode laser gingivectomy and scalpel gingivectomy, the bleeding rate was significantly higher in the control group than in the experimental group. The patients in the control group suffered pain as compared to the experimental group, who had no pain, which suggests the effects of lasers when compared to conventional gingivectomy.

Elif oncu[20] reported that the bleeding rate and pin level in the diode laser group was significantly lesser than in the control group. The majority of the patients in the test group had surgery without anaesthetic, whereas practically all of the patients in the control group were given infiltrative anaesthesia.

Conventional surgery has resulted in issues such as surgical trauma, bleeding during surgery, postoperative discomfort and oedema, and low patient satisfaction. Lasers are better at dealing with these issues. With a minimally invasive technique, the use of laser lowers surgical trauma in soft tissue care.

Bhagyashree Rajendra kohale[21] reported that The use of low-level laser therapy (LLLT) could help to reduce discomfort.
The test group had a lower mean pain score on the third postoperative day, the seventh postoperative day, and at the end of one month than the control group, according to the findings. These findings explain why LLLT has a favourable effect on the pain response of patients who have had a scalpel gingivectomy. In comparison to the control group, patients in the LLLT test group had much less postoperative discomfort.

Shreya lingamaneni[22] reported that on the 3rd, 7th, and 15th postoperative days, test sites demonstrated considerably greater epithelialization than control sites. On the 14th postoperative day (P = 0.001), the data reveal a substantial difference in levels of surface keratinization between the two groups. Still, no significant difference was seen on the 3rd and 7th postoperative days.

CONCLUSION:

There is conclusive evidence that diode lasers show promising results in reducing postoperative pain bleeding, improving gingival health, improving wound healing, reducing the use of anaesthesia.

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