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LASER IN PERIODONTAL TREATMENT: IS IT AN EFFECTIVE TREATMENT OR SCIENCE FICTION?

- DETAILS OF AUTHOR-

1. RENUKA NAGARALE, PROFESSOR, DEPARTMENT OF PUBLIC HEALTH, M.A RANGOONWALA DENTAL SCIENCES AND RESEARCH CENTRE, PUNE.
2. DR. NEETU KADU, READER, DEPARTMENT OF PUBLIC HEALTH, M.A RANGOONWALA DENTAL SCIENCES AND RESEARCH CENTRE, PUNE.
3. MALLIKA VILAS ADHAV- DENTAL GRADUATE, DEPARTMENT OF PUBLIC HEALTH, M.A RANGOONWALA DENTAL SCIENCES AND RESEARCH CENTRE, PUNE.
4. MRUNAL GAIKWAD- DENTAL GRADUATE, DEPARTMENT OF PUBLIC HEALTH, M.A RANGOONWALA DENTAL SCIENCES AND RESEARCH CENTRE, PUNE.
5. UZMA CHOUDHARY- DENTAL GRADUATE, DEPARTMENT OF PUBLIC HEALTH, M.A RANGOONWALA DENTAL SCIENCES AND RESEARCH CENTRE, PUNE.

- CORRESPONDING AUTHOR- MALLIKA VILAS ADHAV, DENTAL GRADUATE, DEPARTMENT OF PUBLIC HEALTH, M.A RANGOONWALA DENTAL SCIENCES AND RESEARCH CENTRE, PUNE.

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ABSTRACT

In the 1990s, dentistry entered a high-tech era. Laser treatment is a new option for periodontal disease treatment. Several studies have been conducted to examine the use of lasers in periodontal treatment, whether non-surgical or surgical. The purpose of this study is to present and critically review the amount of scientific evidence

regarding the effects of low-level and high-power lasers in periodontology. Er:YAG lasers are considered the most suitable for non-surgical periodontal treatment, providing the same clinical results as conventional treatment.

In periodontal surgery, DL, CO, Nd:YAG, Er:YAG, and Er;Cr:YSGG lasers can be used to vaporise gingival or mucosal tissue. Photobiomodulation (PBM) mediated by low-level lasers associated with non-surgical periodontal therapy offers additional benefits in the short term, promoting the repair process of bone and gingival tissue and post- periodontal surgery.

Key words- lasers, low level light therapy, surgical, non surgical,

photobiomodulation, periodontal treatment.

INTRODUCTION

Lasers are one of the most exciting technologies in dentistry. Dental lasers have revolutionized several areas of treatment in recent decades. The word laser is an acronym for light amplification by radiation stimulation (1) Photonic laser therapy has been used in periodontics since the 1980s, and the first reports of their use in periodontal surgery.

Introduced as an alternative to mechanical cutting tools, the laser has now become the tool of choice in many dental applications. Lasers used in periodontology are divided into two groups: high-power lasers and low-power lasers(2) Evidence suggests that its use in primary periodontal therapy, surgery and, more recently, implant salvage has opened up a wide range of applications (3) There have been several studies evaluating the use of lasers in non-surgical or surgical periodontal treatment(4) Due to the photo physical properties of lasers, laser irradiation exhibits strong ablation, hemostasis, detoxification and bactericidal effects(5) This effect can be useful in periodontal therapy, especially for soft tissue excision, as well as for the destruction of diseased tissue. Therefore, laser therapy in periodontal therapy can be an alternative or complementary treatment to the mechanical approach, using high power lasers such as CO2, Nd:YAG, and diode lasers among the many available lasers(6). In periodontology due to excellent soft tissue ablation and hemostatic properties. The use of lasers in periodontal therapy has several advantages. These advantages include hemostasis, postoperative swelling, reducing the number of

bacteria at the surgical site, less need for sutures, faster healing, and postoperative pain.(7) The purpose of this article is to discuss the basic scientific evidence regarding the use of different lasers in periodontics and to assess the level of scientific evidence in a systematic review aimed at evaluating the use of lasers in periodontics. Therefore, the aim is to explain to the scientific community the advantages and limitations of the use of photonic therapy in periodontal therapy, which can represent an alternative or complementary therapy with adequate parameters. The purpose of this article is to present and critically analyze the level of scientific evidence for the effectiveness of low-level and high-power lasers in periodontology.

HISTORICAL BACKGROUND

• 1917 Albert Einstein described the idea of inspired emission [1]. In 1959, the laser was first brought in a paper by Gordon Gould, a graduate scholar at Columbia college. In 1960, Theodore Maiman created the primary working laser at Hughes research Laboratories

• 1961, first gas laser and primary constantly operating laser: Javan et al.

• In 1964, Patel created the CO2 laser at Bell Laboratories

• In 1971, tissue reaction to laser light and wound healing: hall and Jako et al.

• In 1974 Nd:YAG laser: Geusic et al.

• In 1977 Ar laser: Kiefhaber.

• Within the 1980s, the laser was utilized in oral surgical procedure to get rid of tender tissue lesions.

• In 1987, a laser with neodymium and yttrium garnet (Nd YAG) became specifically developed for dental processes.

• In 1988 Er:YAG laser: Hibst and Paghdiwala.

• In 1989 Nd:YAG laser, soft tissue surgical procedure: Midda et al.

METHODOLOGY

As part of the search approach, various databases were examined. Databases such as PubMed, Medline and Cochrane Library were used. For this review, papers from 2015 to 2022 were used.

Initially, "Laser applications in periodontology," "Lasers in periodontal treatment," "Antimicrobial photodynamic therapy in periodontal treatment," and "Photobiomodulation applications in periodontal treatment," as well as "High- level lasers in periodontology" and "Low-level lasers in periodontology," in Medline and the Cochrane Library were found.

LASER APPLICATIONS IN PERIODONTOLOGY

- Soft tissue surgical applications: Diode, CO2, Nd:YAG, Er:YAG, and Er,Cr:HSG are widely used in soft tissue procedures, including dentures, dentures, frenectomy, benign tumors, or ablation.
- Pocket epithelial ablation: Nd:YAG is the first laser wavelength compared to the scalpel to treat periodontal pockets and control sepsis and gingival bleeding.
- Laser root conditioning: Root conditioning aims to detoxify the root surface by removing dust and mineralization, opening the collagen matrix to support cell motility, proliferation, adhesion and matrix synthesis involved in periodontal healing.
- Bacteria Reduction: A laser application that has been introduced in the past to reduce bacteria in vesicles due to the strong absorption of certain laser wavelengths by chromophores. Initially, the Nd:YAG laser was shown to reduce the bacterial burden of Porphyromonas gingivalis and Prevotella intermedia.
- Implant Therapy: There are applications for lasers in implant dentistry, including secondary surgery, peri-implant soft tissue resection, and sterilization of damaged implants. Applications for lasers in implant dentistry include secondary surgery, peri-implant soft tissue resection, and sterilization of damaged implants.
- Accelerate tissue repair and cell growth
- Laser can be used in focused beam (for excision and cutting) and non-focused beam (for ablation and coagulation). Some evidence suggests that lasers are used as an adjuvant in augmentation and root planning
- Heals muscles and improves blood circulation

DISCUSSION

HIGH POWER LASERS (HPL)

Non-surgical periodontal therapy:

Nd:YAG and Diode: The therapeutic application of HPL has greatly advanced with the invention of optical fibers, enabling its use in a variety of periodontal indications. One of these is the subgingival use of optical fibers, which are placed into periodontal pockets and, when used with appropriate irradiation settings, induce bacterial decrease. This is regarded as a minimally invasive procedure(8). For the purpose of sulcular debridement—the removal of the sulcular epithelium from the periodontal pocket—and to encourage the decrease of supra- or sub-gingival periodontopathogenic bacteria, both the Nd:YAG laser and the DL are recommended. Scientific evidence has demonstrated that in order to prevent pulp damage, DL application on a root surface should be done carefully, intermittently, and within the recommended ranges.(9)

Regarding the assessment of clinical parameters, research has shown that areas treate d with SRP in conjunction with DL (10) have greater reductions in probing depth and gains in clinical attachment.

When DL was used as a supplement to SRP, there was a greater reduction in alveolar bone loss andinflammation, and a greater promotion of periodontal tissue repair processes (11). A review study comparing the use of lasers in periodontal therapy reinforces these positive effects, with DL being the second best to HPL in improving clinical attachment level (CAL) when used incombination with SRP.(12)

As Er:YAG and Er,Cr:YSGG: A systematic review study that demonstrated the benefits of using Er:YAG and Er,Cr:YSGG lasers to remove dental calculus as well as their effects on topography and root surface roughness found that combining SRP with erbium lasers as an adjuvant therapy can be suitable to remove residual debris from the root surface while having minimal thermal effect on the root surface.(13) According to the study& findings, the Er:YAG laser appears to be the most appropriate for nonsurgical periodontal therapy. Combination of DL and Er,Cr:YSGG in sub gingival debridement in periodontal pockets deeper than 4 mm demonstrated greater clinical benefit and bacterial reduction compared to sub-

gingival debridement alone.(14) Several studies has shown that Er:YAG used as an adjunct increases the ability to reduce microorganisms and also promotes short-term clinical benefits and less painful sensations to the patients.(15)

Surgical periodontal therapy: The most suitable HPL lasers for soft tissue surgery are CO2, Nd:YAG, DL, Er:YAG, and Er,Cr:YSGG lasers. Its advantages include enhanced hemostasis and bacterial reduction through increased tissue temperature, and the fact that it is a very conservative procedure.

The most commonly performed surgical procedures include excisional biopsies, the removal of pathological soft tissue such as granuloma and fibroma, the insertion of muscle brakes or bridles, alterations to the gingival contours and the smile, the insertion of gingivoplasty, the removal of melanin pigmentation, the enlargement of the clinical crown, the insertion of a proximal wedge, the de-ejection of the flap during regenerative procedures, the reduction of sub-gingival fillage and the reduction of bacteria in the periodontal pockets.(16,17)

LOW-LEVEL LASER (LLL)

Photobiomodulation therapy

Non- surgical periodontal therapy: In non-surgical periodontal treatment, PBM treatment is used in periodontal treatment that affects soft tissue and bone tissue, and SRP treatment uses regenerative techniques to control inflammation and promote tissue repair during or during the surgical period. It is indicated as an adjunctive therapy. Connected or not.

Reduces oedema, postoperative pain, and treats dentin hypersensitivity. In the treatment of periodontal disease, laser-mediated PBM can be used as a light source to treat periodontal disease in two situations (18) as an adjunct to mechanical debridement to reduce the inflammatory process, or as an adjunctive therapy for postoperative periodontal disease in areas affected by periodontal disease. Surgery on the gum tissue (gingivectomy/gingivoplasty) is performed to speed up the repair process. The effectiveness of PBM in controlling inflammation has been demonstrated in several studies for the treatment of both gingivitis and periodontitis.(19) The benefits of PBM have also been seen in the treatment of periodontal pockets in patients with type 2 diabetes (20) There are few recent reviews

and meta analysis studies on PBM for the treatment of periodontal disease and the level of certainty varied from moderate to low.(21)

Surgical periodontal therapy:

PBM can be used in periodontal surgery for the following purposes:

Promotes repair of gingival and mucosal tissues. Promotes bone tissue repair. Reduces symptoms after periodontal surgery. (LLL) therapy to free grafts can speed up wound healing at the early healing stage of the palate. These benefits were more pronounced under conditions of delayed repair (e.g. smoking, uncontrolled diabetes or immunosuppression due to medication).(22) Regarding the treatment of gingival recession, a meta-analysis showed that the association of flaps to PBM increased keratinised tissue formation and improved probing depth parameters and clinical attachment, but did not increase root coverage.(23,24)

LIMITATIONS-

- Fairly high cost of the bias
- A need for fresh education(especially in introductory drugs)
- The need for perpetration of safety measures (i.e. goggle use, etc.)
- Laser use in cases who have cardiac leaders should be conservative.
- It's also not advised to use in cardiac cases with a history of anginal chest pain and arrhythmia.
- It should be used with precaution in immunocompromised cases as there's a chance of complaint transmission through aerosol during the ray procedure.
- Laser use in dentistry necessitates expansive training and definitiveness.
- The effectiveness of laser remedy in terms of cost is debatable, also, spotlights of different wavelengths are needed for different oral and dental procedures.

CONCLUSION-

In nonsurgical periodontal remedy there's an fresh clinical benefit when using DL associated with SRP in cases with moderate to severe periodontitis. ErYAG ray aids the same clinical goods as conventional SRP remedy. The osteotomy using ErYAG or Er, CrYSGG established to be a safe, secure and precise procedure. Grounded on the analysis of data set up in the composition, it can be observed that PBM intermediated by LLL is effective in controlling inflammation, in accelerating natural form of towel and in reducing pain in bothnon-surgical and surgical remedy.

The goods of APDT intermediated by LLL are material and relatively egregious It has been observed that photonic goods of the APDT intermediated by LLL remedy last only as long as there's irradiation of the apkins by the light source and in the presence of the photosensitizer, when reactive oxygen species are formed and can be considered as a reliable confirmation. This substantiation should neither be considered low, nor as a disadvantage or reason for contraindication of this remedy. In point of fact, it has multitudinous advantages when compared to other adjunct curatives, similar as the possibility of use in colorful operations, its low cost effectiveness, non appearance of any side goods and conformation of resistant bacterial strains are strong and ineluctable reasons of consideration. still, studies have shown controversial results of use of spotlights in periodontics, and this fact can be considered as to the lack of standard parameters of irradiation in each clinical operation, and inferior knowledge of introductory principles of photonic curatives by the professionals.

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