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REVIEW ARTICLE

Use of Lasers in Nonsurgical Periodontal Therapy

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ABSTRACT

The use of dental lasers for treatment of periodontal diseases has been the area of interest in the recent years. Current evidence indicates that the use of lasers for the treatment of adult chronic periodontitis—either used solely or as an adjunct to traditional scaling and root planning therapy—offers minimal benefit. This article which is a peer review of various articles provides a brief explanation of the mechanism behind soft tissue lasers. The use of laser therapy in addition to traditional nonsurgical periodontal treatment in the management of periodontal diseases is reviewed. Lasers have been applied for hard and soft tissue debridement, as also for the bacterial load reduction from the periodontal pocket. Although, subgingival application of few of them during nonsurgical periodontal therapy can result in undesired outcomes, even when using manufacturer-recommended parameters. Over the past 20 years the research conducted regarding the clinical application of lasers is very limited. This article tries to fill in the void by reviewing the current and potential application of laser therapy. It has in turn proven to be a promising field in nonsurgical periodontal treatment of diseases.

Keywords: Lasers, Chronic periodontitis, Nonsurgical, Bacteria, Periodontal therapy.

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INTRODUCTION

Lasers have been used in the treatment of periodontal disease since 1992.[1,2] Lasers have been used as an adjunct painless alternative for surgical treatment of periodontal disease and debridement of subgingival root surfaces and periodontal pockets. Conventional mechanical debridement using hand and curettes is time consuming and tiring and power scalers are uncomfortable due to their noise and vibration.[3] Also systemic and topical antibiotics have the risk of producing resistant microorganisms. Lasers can achieve good tissue ablation with strong bactericidal effects and thus it is one of the most promising approaches for nonsurgical periodontal treatment.

Regeneration of the tissues lost as a result of inflammation leading to periodontal disease, is the prime focus of a successful periodontal treatment. This relates to the formation of a new connective tissue attachment and if possible, the regrowth of alveolar bone. Epithelial migration on the treated root surface must be prevented to support the new connective tissue attachments a benefit over traditional methods of therapy. Over the years, various modes of therapy have been suggested to avoid this, which includes soft tissue curettage, various types of flap procedures including modified Widman flap, guided tissue regeneration and more recently lasers.[4]

Due to the lack of an effective tool for soft tissue debridement, gingival curettage has no super-added benefit over the normal scaling and root planning procedure.[1] Also, the healing after modified Widman flap with excision of sulcular lining is not by means of connective tissue attachment but it heals by the long junctional epithelium.[2] In contrast to these conventional treatments, a laser promotes periodontal regeneration by retarding the epithelial migration. It ablates the inflamed lesions and epithelial lining of the soft tissue wall within the periodontal pockets. At this time, part of the laser energy scatters and penetrates into the periodontal pockets which might then stimulate the cells of surrounding tissue, resulting in reduction of the inflammation, increased flow of lymph, improving the periodontal tissue attachment and hereby leading to reduction of the postoperative pain.[3] It is always advisable to use a less invasive procedure for the treatment of periodontal diseases as compared to periodontal surgeries. Hence, in many cases laser-assisted periodontal therapy is a good alternative.

This paper presents the most current clinical evidence on the use of soft tissue lasers in order to aid the clinicians, in the nonsurgical treatment of patients with periodontal diseases. The purpose of this review is to analyze the peer-reviewed research literature on the methodology behind the application of lasers to common oral soft tissue problems. It was also to evaluate its effects on root surface detoxication, and a painless option for the treatment of chronic periodontitis.[5]

MATERIALS AND METHODS

We utilized lasers in nonsurgical periodontal therapy search words in Medline (PubMed), Cochrane database and also hand search. We searched PubMed for articles relevant to our topic of study activating limits like date range (1992/10/10 to 2012/10/10), and the type of articles were Clinical Trial, Journal Article, Randomized Controlled Trial, Review, Comparative study and English was chosen as the language and humans as the species. All authors reviewed the literature separately, and any conflict in terms of article inclusion was resolved by discussion.

We had 16 articles in all and out of which articles were shortlisted by us.

RESULTS

We went through umpteen literature regarding lasers, out of these 16 articles were found to be relevant as per to derive at our results.

Our results were summed up dividing the study sample into two major groups namely scaling, root planing and scaling, root planing along with lasers. There were no significant post-treatment differences observed both microbiologically as well as clinically. Although use of lasers alone had limited benefits similar to that of just oral hygiene precautionary measures taken. It was noticed that, in patients with chronic periodontitis, conventional subgingival debridement along with adjunctive periodontal therapy like laser irradiation stimulated fibroblast proliferation without impairing procollagen synthesis.[6]

Research studies conducted on animals have shown that low level laser therapy (LLLT) accelerates wound healing by stimulating the biological cells and thus proliferating fibroblast production. There is not sufficient evidence concluded as to support the application of lasers clinically, either CO_2, Nd:YAG, Er:YAG, or different diode laser wavelengths. However, subgingival curettage carried out by diode laser have demonstrated improvements in gingival index, sulcus bleeding index, plaque index and also pocket depth as well as clinical attachment level.[7] The characteristics of the Er:YAG lasers are noticed to be quite suitable for the nonsurgical treatment of chronic periodontitis. Research conducted so far has indicated its safety, less patient discomfort and treatment time as compared to the mechanical use of hand instruments. However, the evidence from the evaluated studies is weak.

DISCUSSION

The use of lasers as an adjunct or alternative to conventional mechanical therapy is based on the claim that subgingival curettage and eradication of pathogenic bacteria will produce a sterile field, leading to elimination of periodontal pockets. Subgingival curettage was used with a view to promote new connective tissue attachment.[8]

Scaling and root planing is often performed in conjunction with subgingival curettage. However, there is no strong evidence of advantage of subgingival curettage over scaling and root planning for the treatment chronic periodontitis.[9] There is weak evidence to prove that lasers sterilize periodontal pockets.[10]

The basic mechanism behind irradiation of lasers waves is that, the absorbed energy causes the target tissue to react in any one of the following ways: It causes the soft tissues to either warm up and coagulate or vaporize after heating up. And in the case of hard tissues, it causes the tissue to melt and recrystallize. Hence, particular clinical treatment goals always have to be kept in mind while selecting the desired frequency or wavelength of laser which would be best suited to achieve the desired outcome level.[5]

Mineralized deposits from the root surfaces are very effectively removed by CO_2, Nd:YAG and diode lasers.[11,12] The subgingival calculus is removed by Er:YAG lasers, showing similarity to that provided by conventional scaling and root planning. However, it is difficult to say without enough clinical studies that Er:YAG laser can be substituted for conventional scaling and root planing. The Er:YAG lasers have been successful in removing calculus[12] and also they help in negating endotoxin.[12-15] A recently devised technique is the use of 655 nm indium gallium arsenide phosphate diode laser added to the Er:YAG device to induce fluorescence in subgingival calculus. This experimented system improves the ability to remove calculus with very less of heat transferred to the root surface.

Nd:YAG laser have been successful in dislodging biofilms from hard surfaces.[16] Soft tissue response to UltraSpeed CO_2 lasers during nonsurgical periodontal therapy has been good. Although there is not enough research to support the results. Clinical applications of CO_2, Nd:YAG and diode lasers are as follows: The laser is a viable alternative to the scalpel for many intraoral soft tissue surgical procedures like frenectomy, gingivectomy, gingivoplasty, gingival depigmentation and de-epithelization of reflected periodontal flaps. It has also been used for removal of granulation tissue and aphthous ulcer, incisional and excisional biopsies of both benign and malignant lesions, coagulation of free gingival graft donor sites.

However, lasers do eliminate bacterial calculus compiled with probing depth and the content microbes and create a harmonious environment for reattachment procedures.[3] Their use in the treatment of chronic periodontitis is by the benefits offered like improved attachment leading to regeneration of cementum, periodontal ligament, and supporting alveolar bone, and also declivity in subgingival pathogenic bacteria. Thus, lasers have shown upper hand than scaling and root planing treatment.[17-20]

Laser-assisted modified Widman flap has demonstrated many benefits. One of the primary advantages of this therapy over conventional scalpel surgery is its superior hemostasis.[4] It helps in delaying the epithelial migration on root surface and thereby offering good postsurgical adaptation of healthy connective tissue to the root surface. This is how it enhances the potential for new attachment. By retarding the reformation of subgingival biofilm, this laser-assisted technique aids in reducing the bacterial load in the operated site. In addition, it maintains the advantages of originally

modified Widman flap of optimal soft tissue coverage of root surfaces, which is both esthetically desirable and amenable to oral hygiene procedures.

Another important use of lasers in nonsurgical periodontal therapy is photodynamic theory. Its basis lies on the fact that there is excitation of photosensitive dyes by light which promotes destruction in biological systems. Thus, bacteria are killed by visible light (i.e. lasers) in the presence of a sensitizing dye. Photodynamic therapy, too, has demonstrated a high bactericidal effect, but like other laser application technologies, there is insufficient evidence of superior results when compared to conventional mechanical therapy.[11] Photodynamic therapy can be a good substitute for chemotherapy or radiotherapy in years to come in.

Many dentists in and around the United States are now using lasers adjunctively with conventional, mechanical periodontal debridement. Still evidence is lacking to support adjunctive laser therapy on issues, such as calculus ablation, root surface alterations, hemostatic effects, bactericidal effects against periodontal pathogens and gingival inflammatory response, financial cost of laser equipment and undesirable thermal side effects.

CONCLUSION

A study comparing use of laser to hand instruments indicated that the use of diode laser followed by disinfection with chlorhexidine gluconate (1%) proves to be an effective alternative nonsurgical treatment of periodontal disease. This is mainly useful for patients who have pain sensitivity, resistance to local anesthetic drugs or blood coagulation problems.[7] Research says that lasers provide advantage depending on their application and goals of treatment. Use of lasers as an adjunct therapy along with conventional scaling and root planing enhances the effectiveness of the procedure.[21] Also, it lessens patient discomfort during the surgery by reducing the bleeding and swelling. Although more clinical and histologic trials using large population are needed to assess the role of lasers along with surgeries like modified Widman flap, but they seem to be quite promising for the future.[4] Currently there is less evidence to support the use of lasers alone or with scaling and root planing to treat adult chronic periodontitis. In fact, of the 10 clinical trails articles published only two showed positive result in the reduction of subgingival microbes, four did not measure any reductions and other four reported no difference.[11-13,22-31] Thus, we can see there is limited evidence regarding the beneficial use of lasers in the treatment of chronic periodontitis. Also, this therapy may add up to the patient's cost.[5] For further use of laser therapy, a strong evidence based on randomized, controlled, longitudinal clinical trails will be required. This collaborative study would also preclude the need for adequate time, expense and number of clinicians required to conduct the research.

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