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The Adjunctive Use of the Er,Cr:YSGG Laser in Nonsurgical Periodontal Treatment

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Abstract: ***The aim of this study was to evaluate the effectiveness of a radial firing tip of an Er,Cr:YSGG laser as an adjunct to a nonsurgical periodontal treatment. Fifteen patients with chronic periodontitis were treated by conventional periodontal treatment using ultrasonic devices and hand instruments and fifteen patients with additional use of Er,Cr:YSGG laser. A radial firing tip (RFPT 14-5, Biolase) was used with 1.5 W, 30 Hz, 11% air, 20% water, and pulse duration 140 µs. Probing pocket depths, gingival margin and clinical attachment level were taken before treatment, a month and a half and three months after lasing. Both treatment modalities were effective in treating chronic periodontitis.***

Keywords: Erbium Lasers, Non-surgical periodontal therapy

1. Introduction

Different lasers, e.g. the diode, Nd:YAG, CO_2, Er:YAG and Er,Cr:YSGG have been proposed and are expected to serve as an alternative or an adjunctive treatment to conventional, mechanical periodontal therapy. Laser periodontal therapy is predicated on the concept of subgingival curettage and/or reattachment and regeneration of the attachment apparatus and is commonly referred to as 'non-surgical'. It allows for selective removal of sulcular or pocket epithelium while preserving connective fibrous tissues. It defines the tissue margins, preserves the integrity of the mucosa and aids in maintaining the free gingival crest. High patient comfort and acceptance has been reported with laser periodontal therapy. With thin and flexible fibres, laser device energy can be delivered to sites in the periodontal pocket that conventional mechanical instrumentation is unable to reach. The potential use of Er,Cr:YSGG laser as a tool for the non-surgical debridement of pathological periodontal pockets is related to its capacity to ablate soft tissue with minimal thermal side effects.

Therefore, the purpose of this study was to evaluate and compare the clinical outcomes of Er,Cr:YSGG laser-assisted periodontal pocket therapy versus scaling and root planing alone.

2. Literature Survey

Erbium lasers have two different wavelengths Er, Cr: YSGG (Yttrium Scandium Gallium Garnet 2790 nm) and Er: YAG (yttrium aluminum garnet 2940 nm). These lasers have a high affinity for hydroxyapatite, and high water absorption. Therefore they are a good choice for the treatment of hard tissues [1]. In addition to solid tissues, Erbium lasers may be used for removal of soft tissues, because the soft tissue contains a high percentage of water [2].

Due to the high absorption of both-water and the hydroxyapatite, the majority of recent research on laser-induced modification of the root surface is occupied by the Er: YAG laser.

This wavelength of the laser has been proven effective in the removal of the smear layer [3, 4], calculus [5, 6, 7, 8], cement [6, 9] and cement-linked - endotoxin [10]. When are used with low values of the energy and water cooled, the majority of studies show little or no heat-induced damage and smooth root surface [10, 11]. In addition, in vitro studies of fibroblast adhesion, showed that the resulting root surface is comparable with that after SRP [12, 13, 8]. According to Qu CN et al. [14] Er, Cr: YSGG laser can affect the microstructure of the cement and periodontal teeth affected and healthy teeth. The irradiation with it leads to less presence of smear layer and to an increased roughness of the root surface- biologically adaptive.

3. Material

The study included 30 male and female patients at the age between 32-59 years-in good health, non-smokers with presence of chronic generalized periodontitis – superficialis or profunda. Patients were divided into two groups - Group 1 (SRP) and Group 2 (SRP + Er, Cr: YSGG laser).

Supra and subgingival plaque and calculus have been removed (scaling) with ultrasound equipment and tips for supra/subgingival instrumentation. After cleaning supragingival, tooth surfaces are polished with rubber, brush and an abrasive paste. Patients were recruited anti plaque solution,containing 0.1% chlorhexidine 2 times a day for 2 weeks and toothpaste with plaque inhibitory effect.

Next visit we register the pocket depth, gingival margin, degrees of furcation involvement and mobility. Debridement of the root surfaces is performed within 24 hours (against the principle of complete disinfection of the oral cavity - full mouth disinfection) with hand Gracey curette with vertical, horizontal and oblique moves to the tactile sense of clean and smooth root surface. During the instrumentation washes are carried out with physiological saline solution (0,9% NaCl)

For Er,Cr:YSGG laser assisted periodontal pocket therapy (ELAPT; test group) no local anaesthesia was given. The patient and all operatory personnel were made to wear protective laser eyewear. The following settings were used

for Er,Cr:YSGG-group: power – 1,5 W, water – 20%, air – 11% and frequency – 30 Hz. A Radial Firing Perio Tip (RFPT5 14 mm length) 580 µm was used after hand instruments and inserted into the sulcus to the base of the pocket. The laser tip was then withdrawn 1 mm from the base and activated. The tip was moved apico-coronally (vertically) and mesio-distally (horizontally) in sweeping motions in the pocket. The tip was angled so that the energy was directed parallel to the root and towards the inner epithelial lining of the sulcus. The tip was kept constantly moving inside the pocket. The objective was to remove the epithelial lining of the pocket. Periodontal pockets with a depth of 5 mm was processed for 30 seconds and + 10 sec. for each additional millimeter.

The baseline data were recorded before treatment and at 1,5 and 3 months following treatment. Clinical measurements were taken at six points around each tooth: mesio-lingual, mesio-facial, facial, disto-facial, disto-lingual and lingual. The following clinical parameters were measured: Plaque Index (PI), Gingival Index (GI), Probing Depth (PD), Clinical Attachment Level (CAL), Gingival Margin (GM).

4. Results

4.1 Probing depth

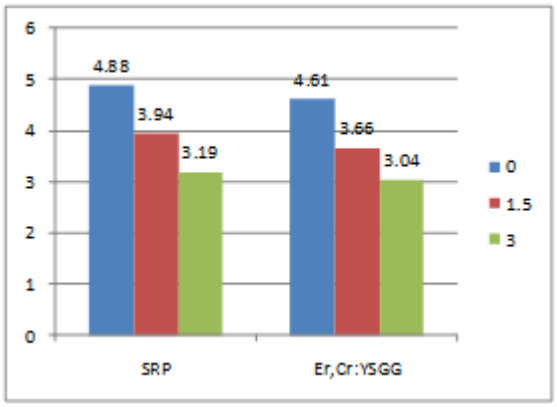

Figure 1: Pocket depth by groups and periods

The mean PD at baseline was 4.61mm, at 6 weeks 3.66 mm and at 3 months 3.04 among the laser treatment group. The mean PD at baseline was 4.88 mm, at 6 weeks 3.94 mm and at 3 months 3.19 mm among the SRP group. The comparison of mean PD at baseline, 6 weeks and 3 months for both the laser treatment group and the SRP group was found to be statistically significant

The mean PD reduction at 3 months was found to be 1.57 mm among the laser treatment group and 1.69 mm among the SRP group. This implies that although the PD decreased significantly in both treatment groups compared to baseline, SRP was insignificant more effective in reduction of PD compared to laser assisted pocket therapy at 3 months post-treatment interval.

4.2 Clinical attachment level

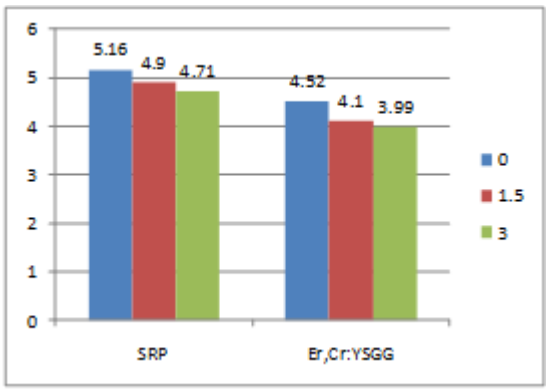

Figure 2: Clinical attachment level by groups and periods

The mean clinical attachment level (CAL) at baseline was 4.52 mm, at 6 weeks 4.1mm and at 3 months 3.99 mm among the laser treatment group. The mean CAL at baseline was 5.16 mm, at 6 weeks 4.90 mm and at 3 months 4.71 mm among the SRP group. The comparison of mean CAL at baseline, 6 weeks and 3 months for the laser treatment and SRP group was found to be statistically significant.

The mean CAL gain at 6 weeks was found to be 0.42 mm among the laser treatment group and 0.26 among the SRP group. The mean CAL gain at 3 months was found to be 0.11 mm among the laser treatment group and 0.19 mm among the SRP group. The comparison of mean CAL gain at 6 weeks and 3 months between the laser treatment and SRP was found to be statistically not significant.

This implies that there was significant gain in CAL in both treatment groups compared to baseline, and laser assisted pocket therapy was equally effective in producing CAL gain compared to SRP at both 6 weeks and 3 month post-treatment intervals.

4.3 Gingival margin

Figure 3: Gingival margin by groups and periods

The mean gingival margin (GM) at baseline was 0.09 mm at 6 weeks -0.44 mm and at 3 months -0.95 mm among the laser treatment group. The mean GM at baseline was -0.29 mm, at 6 weeks -0.96 mm and at 3 months -1.52 mm among the SRP group. The comparison of mean GM at baseline, 6 weeks and 3 months for the laser treatment and SRP group was found to be statistically significant.

The mean increase in gingival recession (GR) at 6 weeks was found to be 0.53 mm among the laser treatment group

and 0.67 mm among the SRPgroup. The mean increase in GR at 3 months was found to be 0.51 mm among the laser treatment group and 0.56 among the SRP group.

The comparison of mean increase in GR at 6 weeks and 3 months between the laser treatment and SRP was found to be statistically insignificant. Although not significantly sites treated with laser assisted pocket therapy show less GR when compared to sites treated with SRP alone.

5. Discussion

The results obtained in the present study with SRP in terms of reduction in PD and gain in CALs confirm those reported by Lindhe *et al*.,[15] Pihlstrom *et al*.,[16] Isidor and Karring,[17] and Sculean *et al*.[18] For the laser assisted pocket therapy, the reduction in PD and gain in CAL values are consistent with those of Watanabe *et al*.,[19] Schwarz et al.,[9, 20]Sculean et al.,[18] Tomasi *et al*.,[21]and Gaspirc and Skaleric[22]. Results from similar studies with Er:YAG have also indicated that due to the minimally invasive nature of laser treatment, trauma to hard and soft tissues is minimal, causing less GR.[9, 20] There is less collagen remodelling, faster healing and minimal scar tissue with laser assisted pocket therapy which might explain why less GR takes place.

The results of the present study showed insignificant differences between the SRP and laser assisted pocket therapy treated sites with regard to reduction in PD, mean increase in GR and gain in CAL. The greater pocket depth reduction in the case of SRP may also be attributed to the higher amount of GR seen postoperatively and it can be assumed that although difference was found in terms of PD reduction in favour of SRP but the change was at the cost of recession.

6. Conclusion

Within the constraints of this study, it can be concluded that the use of an Er,Cr:YSGG laser in the non-surgical treatment of periodontal pockets can result in similar CAL gains to that of SRP with less recession and can also result in statistically significant reductions in PD.

Both treatment modalities were effective in treating chronic periodontitis, but the added use of laser may have advantages in terms of gingival recession. Further research is needed on the effectiveness of Er,Cr:YSGG laser in non-surgical periodontal treatment.

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