

To Assess the Efficacy of Supraperingival Debridement by Er:YAG Laser versus Ultrasonic Scaler as Adjunctive Treatment in Patients with Chronic Periodontitis: A Randomized Split Mouth Study

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ABSTRACT

Introduction: The primary aim of non-surgical periodontal therapy is to arrest disease progression by eliminating bacterial infection, reducing inflammation and reattachment of periodontal tissues to the root surface infected previously scaling and root planing (SRP) is one of the most commonly adopted non-surgical periodontal therapies for the treatment of periodontal disease and has been considered as the “gold standard” therapy against which other modalities have been compared. Erbium:yttrium, aluminum, garnet (Er:YAG) laser studies have shown to remove calculus even more efficiently than ultrasonic devices. **Aims and Objectives:** The present study aims to assess the efficacy of supraperingival debridement by Er:YAG laser versus ultrasonic scaler as adjunctive treatment in patients with chronic periodontitis in a split mouth design. **Materials and Methods:** A total of 15 systemically healthy patients which were diagnosed with generalized moderate chronic periodontitis were included in this study and maxillary quadrants were randomized for either of two procedures during Phase I therapy. Clinical assessments of plaque index, gingival index, OHI, bleeding on probing, probing pocket depth (PPD), clinical attachment level, and patient compliance were recorded at baseline and 3 months. **Results:** Both groups showed significant reduction of extent of PPD and severity of symptoms after 3 months. However, better patient compliance was seen with Er:YAG laser. **Conclusion:** Both the treatment modalities were effective in performing SRP in management of patients with chronic periodontitis and both the groups showed promising results individually. Long-term studies with larger sample size need to be carried out to come to a definitive conclusion.

Key words: Aluminum, chronic periodontitis, erbium:yttrium, garnet laser, supraperingival debridement

INTRODUCTION

Periodontitis is a chronic inflammatory and infectious disease caused by complex polymicrobial infection that leads to progressive destruction of

alveolar bone and teeth characterized by gingival inflammation, pocket formation, and bone resorption.^[1] Studies suggest that mechanical root debridement significantly improves periodontal health by halting the progression of periodontal tissue breakdown. The standard mode of debridement, scaling and root planing (SRP), is carried out with curettes, scalers, or ultrasonic instruments, which mechanically remove the supraperingival and subgingival biofilm and dislodge calculus from the affected roots.

Recently, different types of lasers have been used for the treatment of periodontal diseases because

Quick Response Code	Article Info:
	doi: 10.5866/2021.12.10016
	Received: 04-02-2021
	Revised: 28-02-2021
	Accepted: 27-03-2021
	Available Online: 08-04-2021, (www.nacd.in) © NAD, 2021 - All rights reserved

of numerous advantageous such as hemostasis, ablation, bactericidal effect, as well as photo-bio-modulation, making it suitable for treating inflammatory and infectious conditions. Carbon dioxide (CO₂), neodymium:yttrium, aluminum, garnet (Nd:YAG), argon, gallium arsenide (diode), and erbium:yttrium, aluminum, garnet (Er:YAG) were found to be effective for soft-tissue surgery.^[2] It is well established that the Er:YAG laser, emitting at a wavelength of 2.94 μm, possesses suitable properties not only for soft tissue but also for hard tissue treatment including periodontal and peri-implant therapy due to its characteristic wavelength that is highly absorbed by water.^[3]

Many studies have shown that Er:YAG laser removes calculus more effectively than ultrasonic scalers and have no destructive or negative effect on root surface.^[4,5] Because of the anti-infective property and able to remove both plaque and calculus, hard issue lasers have been used as adjunct to standard or conventional periodontal therapy. Feedback system incorporated with Er:YAG lasers has additional benefit of identifying subgingival calculus over ultrasonic scaling which is missed in both manual and ultrasonic scaling.^[6]

The clinical studies that have been done to find out efficacy of Er:YAG lasers have conflicting results compared with the conventional debridement by SRP. Effect of Er:YAG laser has been studied as a monotherapy as well as adjunct for the treatment of chronic periodontitis. In most studies, the use of Er:YAG lasers did not provide an added benefit to the conventional treatment. However, the clinical application of Er:YAG laser in periodontitis has not been sufficiently analyzed. This study aims to assess the efficacy of supra gingival debridement by Er:YAG laser versus ultrasonic scaler as adjunctive treatment in patients with chronic periodontitis.

MATERIALS AND METHODS

Study Population

The present study was conducted in the department of periodontology, of a tertiary level health care center. The participants included in the study were interviewed to obtain medical and demographic information and were screened for periodontal examination. All periodontal clinical parameters were evaluated by a single investigator, who was blinded to the procedure. A total of 15 systemically healthy patients (9 males and 6 females) who were diagnosed with generalized moderate

chronic periodontitis were included in this study. The nature and purpose of this study was explained to the patient on enrolment and an informed written consent was obtained. Institutional Ethical Committee clearance was obtained.

Inclusion Criteria

The following criteria were included in the study:

- Systemically healthy patients with chronic periodontitis with 2 mm average clinical attachment level (CAL).
- Patients not taking any medications such as antibiotics, systemic steroids, or anti-inflammatory drugs.
- Patients who have not undergone any periodontal therapy or surgery 6 months before the study.

Exclusion Criteria

The following criteria were excluded from the study:

- Patients with any systemic diseases.
- Habits such as smoking, alcohol consumption, or drug abuse.
- Consumption of oral contraceptive for the past 6 months.
- Pregnant and lactating women.

Methodology

Data collection

All relevant data including demographic factors, social history, and medical and dental history were recorded and periodontal examination was performed in each subject. The following parameters were measured in the study:-

- Bleeding on probing (BOP),
- Probing pocket depth (PPD)
- CAL and
- Periodontal disease index (PDI) (Ramfjord).

Pain, erythema, and patient compliance

All clinical parameters were recorded using UNC-15 periodontal probe. Pain was measured by visual analog scale.

Treatment Procedure

The design of this study was a split mouth study. Randomization of the groups was done using a coin toss method, which decided the side of the mouth to be Group A (test group) and the contralateral side being Group B (control group). Local anesthesia was used in both the groups according to the patients need.

Group A (test group) received scaling and root planing with Er:YAG laser (Syneron Dental Lasers, LITETOUCH™). Er:YAG laser was used at an energy level of 150 mJ/pulse and a repetition rate of 15 Hz with water irrigation. Chisel type fiber tips of 17 mm were used in coronal-apical strokes with parallel paths at an inclination of 15–20° to the root surface [Figures 1 and 2].

In Group B (control group), supragingival scaling and root planing was done using ultrasonic scaler (EMS™) [Figure 3].

All subjects were given similar oral hygiene instructions and post-procedural care. Moreover, all parameters were recorded after 3 months by the same investigator.

The data collected were tabulated compared with Fisher's exact test and Student's *t*-test using SPSS version 23.

RESULTS

Demographic Parameters

There were nine male and six female patients in the study. The average age ranged between 22 and 55 years and the mean age was 37.50 (± 7.04). Intergroup comparison of all parameters at baseline was insignificant ($P > 0.05$).

Clinical Parameters

Mean probing depth (PD) in Group A at baseline was of 5.83 ± 1.56 mm and in Group B patients was 5.45 ± 1.90 mm. Mean reduction in PD at 3 months in Group A and Group B was 3.45 ± 0.61 mm and 3.40 ± 0.64 mm, respectively. Intragroup reduction in PD was statistically significant [Table 1].

At baseline, mean CAL for Group A subjects was 2.79 ± 2.20 mm and Group B mean CAL was 2.88 ± 1.70 mm which reduced to 1.95 ± 2.16 mm and 1.92 ± 2.23 mm, respectively. Intragroup and intergroup comparisons were statistically insignificant.

PDI

Intragroup

The mean PDI of Groups A and B was 5.27 ± 0.15 and 5.25 ± 0.16 , respectively, at baseline. The mean % change of PD of Groups A and B was 13.9% and 13.1% [Table 2].

Patient Parameters

Pain perception by patients was found to be similar for both groups with significant improvements at 12 weeks as compared to baseline. A similar pattern was observed with a dichotomous



Figure 1: Er:YAG laser unit



Figure 2: Scaling and root planing using Er:YAG laser



Figure 3: Scaling and root planing using ultrasonic scaler

scale of the presence or absence for erythema. Patient compliance with the protocol as measured with a 5-point scale was found to be statistically insignificant within groups but significant for Group A at 12 weeks [Table 3].

Table 1 : Intragroup comparison of PD in Groups A and B

PD	Group A	Group B
Pre-treatment	5.83±1.56	5.45±1.90
3 months post-treatment	3.45±0.61	3.40±0.64
Intragroup comparisons		
Pre-treatment versus 3 months	0.001	0.001

PD: Probing depth

Table 2: Intragroup comparison of PDI in Groups A and B

PDI	Group A	Group B
Pre-treatment	5.27±0.16	5.26±0.15
3 months post-treatment	4.53±0.15	4.57±0.15
Change (%)	13.9	13.1
Intragroup comparisons		
Pre-treatment versus 3 months	0.001	0.001

PD: Probing depth

Table 3: Patient parameters Groups A and B

S. No.	Variable	Baseline	3 months					
1.	Pain perception (VAS)							
					Group A	6.59±1.906	2.57±1.233	<0.001
					Group B	5.8±1.609	2.99±1.725	<0.001
2.	Erythema (present/absent)							
					Group A	18.58±0.870	8.24±1.238	<0.001
					Group B	19.60±0.754	11.24±2.270	<0.001
3.	Compliance with protocol (Likert scale)							
					Group A	-	3.398±1022	-
					Group B	-	4.398±0.575	-

DISCUSSION

Periodontitis is a polymicrobial inflammatory disease caused by local factors such as presence of plaque and calculus. The primary cause of periodontal destruction or breakdown is infiltration of bacteria and bacterial endotoxins in cementum.^[7] Formation of biofilm on root surface prevents action of antimicrobials, thus, mechanical removal of this biofilm is important for favorable outcome of periodontal therapy. For effective healing of periodontal tissue, mechanical debridement of root surface from plaque, calculus, and necrotic cementum is essential.^[8]

The primary aim of periodontal therapy is mechanical debridement of root surface to

provide favorable environment for regeneration of connective tissue. Mechanical debridement of root surface is conventionally achieved by scaling and root planing using hand and powered instruments. Manual debridement by scalers, curettes is effective but demands lot of technical acumen and time. With introduction of sonic and ultrasonic scalers, mechanical debridement has become fast, effective and requires less technical acumen. Sonic and ultrasonic scalers cause lot of vibration, noise, and sensitivity to teeth, which cause lot of discomfort to patient. Both manual and powered debridements fail to remove biofilm effectively in less accessible areas such as furcations, grooves, and concavities on root surfaces.^[7]

Diode lasers and Nd:YAG lasers provide effective wavelength for bactericidal effect which effectively and efficiently deliver laser energy in periodontal pocket. Both diode and Nd:YAG lasers cause severe damage to the root surface causing craters Like defects and diode lasers do not remove calculus or diseased cementum.^[9,10] The American Academy of periodontology has concluded that neither diode nor Nd:YAG lasers are alternative to root planing.^[11]

Overcoming the disadvantages of diode and Nd:YAG lasers, Er:YAG lasers provide significant improvement in patients who had conventional scaling combined with Er:YAG laser therapy. Er:YAG laser provided selective subgingival calculus removal equivalent to scaling and root planing with no craters on root surfaces. It also provided smooth root surface removing biofilm or smear layer.

Studies by Schwart *et al.* suggest Er:YAG laser facilitates attachment of periodontal ligament by providing favorable condition for adherence of periodontal ligament fibroblast on previously diseased root surface.^[12] Thus, Er:YAG lasers provide with excellent tool for periodontal therapy, which can be safely and effectively used on root surfaces. This study shows that both groups showed clinically and statistical significance in a 3-month follow-up and thus both treatment protocols were effective in the treatment of chronic periodontitis by reduction in PD, CAL, PDI, and BOP.

The result of this study was consistent with other study by Yilmaz *et al.*, 2012, in which comparison between SRP alone and with Er:YAG in chronic periodontitis shows that the use of Er:YAG laser for debridement resulted in significantly higher CAL gains and PD reductions at 3 months post-therapy.

However, this significant effect was lost to follow-up in some time.^[13]

However, split mouth study by Rotundo *et al.*, 2010, and Lopes *et al.*, 2010, failed to demonstrate adjunctive benefits of lasers.^[14,15]

Study by Schwarz *et al.* has compared Er:YAG versus scaling and root planing by hand instruments, which have shown significantly better results in chronic periodontitis by Er:YAG lasers.^[16]

However, other clinical studies have failed to report significant differences comparing the use of Er:YAG laser to standard root debridement or even inferior results for the laser therapy.^[13,17,18] The systematic reviews failed to show additional adjunctive role of Er:YAG lasers over conventional SRP.^[19,20]

Due to the small sample size of the study population, clear advantage of Er:YAG laser over ultrasonic scaling cannot be demonstrated or proved in this study. Further, controlled prospective trials with larger sample size and microbial evaluation with definite time frame are required to be carried out to prove efficacy of supragingival debridement by Er:YAG laser over ultrasonic scaler as adjunctive treatment in patients with chronic periodontitis.

CONCLUSION

The present study was conducted to find out efficacy of supragingival debridement by Er:YAG laser versus ultrasonic scaler as adjunctive treatment in patients with chronic periodontitis. Beneficial effect of both treatment modalities was seen in all clinical parameters with significant reduction of PD, CAL, and BOP. Both groups showed significant reduction of extent of PD and severity of symptoms after 3 months. Effectiveness of Er:YAG laser was seen in supragingival calculus removal and improvement in patient parameters comparable to ultrasonic scaling. However, a cost-benefit analysis should be carefully considered in light of the high investment needed for the laser application, which may not justify this limited added benefit.

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