



Assisted Non-Surgical Therapy of Periodontal Pockets Utilizing Diode Laser: A Randomized Clinical Trial

Fatin F. Dakhil¹; Ali S. Mahmood²; Tamara S. Al-Karadaghi³; Mohammed A. Al-Malki⁴

(1) Ministry of health, Baghdad, Iraq,

(2-4) Institute of Laser for Postgraduate Studies, University of Baghdad, Baghdad, Iraq,

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Abstract: Background: Periodontal diseases are inflammatory diseases, for which, scaling and root planning is the main approach. Diode laser therapy as an adjunct to non-surgical periodontal treatment has shown some beneficial effects. **Aim:** The objective of this single randomized controlled clinical study was to assess the effect of a 940 nm diode laser as an adjunct to SRP therapy in the treatment of periodontal pockets. **Methods:** In this study, twenty patients in need of periodontal treatment with periodontal pocket ≥ 4 mm were selected for this split-mouth clinical study. Test group treated by diode laser 940 nm as an adjunct with SRP, control group treated by SRP in contralateral quadrants. Clinical measurements (CAL and BOP) were performed before treatment at baseline and at 3 months. **Results:** CAL and BOP were significantly reduced after 3 months in control and laser groups. No significant differences were found between the control and laser groups in respect to CAL and BOP. **Conclusion:** The use of the 940 nm diode laser as an adjunct to scaling and root planing did not offer any superior clinical benefits over conventional scaling and root planning.

Keywords: Dental scaling; Diode lasers; laser therapy; periodontal pocket.

Introduction

Periodontitis is a bacterial related inflammatory disease causing destruction of tooth supporting tissues periodontal ligament and alveolar bone. Non- surgical treatment of periodontal pocket was based on the elimination of bacterial deposits adhered to tooth surfaces, primarily by means of root scaling and planning. This treatment therapy together with dental plaque control performed by the patient, is effective in the treatment of periodontal diseases (Akoi, M., 2008). However, nonsurgical therapy alone has its own limits and may fail to eradicate the pathogenic bacteria in the periodontal tissues and after scaling and root planing the root surface is consistently covered by a smear layer, containing remnants of calculus, contaminated root cementum, bacteria, bacterial endotoxin, and subgingival plaque (Andreana S, 2005). The

use of laser has been proposed as an adjunct to nonsurgical periodontal therapy by many studies (Schwarz, 2008). Laser therapy was proved by some studies to cause resolution of gingival inflammation this is due to some advantages of laser including bactericidal and detoxification effects, coagulation of the inner wall of the periodontal pocket and the capacity to reach deeper sites where mechanical periodontal instruments cannot (Cobb, C.M., 2002). Yilmaz et al. did not find additional benefits when using the high power diode laser together with conventional periodontal treatment. However, according to De Micheli (2011) the results of the two therapeutic procedures are similar with regard to plaque index and bleeding on probing, for which laser therapy does not lead to additional benefits. In a study performed by Nguyen et al, 2015 in periodontal maintenance

patients, adjunctive use of the 940nm diode laser to SRP did not enhance clinical outcomes compared to SRP alone in the treatment of inflamed sites with ≥ 5 mm probing depth.

Materials and methods

Study design and population

This study was a single randomized split mouth design controlled trial. The study was conducted at the dental clinic of the institute of laser for postgraduate studies, University of Baghdad. The total sample of the present study consisted of twenty patients with age ranged between 35 to 65 years old were selected for this study. The inclusion criteria included any adult who had one or more periodontal sites with ≥ 4 mm probing depth and bleeding on probing, had at least two quadrants with periodontal sites (ideally opposite side same jaw). Patients had received no active or maintenance periodontal therapy at least 3-months prior. Individuals had received no systemic antibiotic therapy in the previous 3 months. Exclusion criteria included: subjects who were uncontrolled diabetics, had used antibiotics within the prior 3-months, regularly used nonsteroidal anti-inflammatory medications, required antibiotic prophylaxis for therapy, pregnant women, individuals with severe systemic and psychological disorders or those taking anticonvulsant, anticoagulant.

Treatment Protocol

Quadrants were enrolled into either control group treated by conventional scaling and root planning or test group treated by diode laser 940nm as an adjunct with SRP in contralateral quadrants. Patients received oral hygiene instructions and periodontal parameters were measured and recorded before the treatment and 3 months after the treatment. Clinical indices that were measured were clinical attachment level (CAL) and bleeding on probing (BOP). CAL was calculated as the distance from the cemento-enamel junction to the base of the probal pocket. This was measured first by determination of cemento-enamel junction location. If the gingival margin location is at the level of cemento-enamel junction, then attachment loss is equal to probing depth in mm. If gingival margin location is apical to CEJ, then attachment loss is obtained from the addition of PD to the distance from gingival margin to CEJ. If gingival margin location is at tooth anatomical crown, then attachment loss is obtained by subtracting the distance between

gingival margin to CEJ from probing pocket depth. The level of CEJ could be determined by feeling it with prob. It was carried out on (midbuccal, midlingual/palatal, mesiobuccal, distolingual, mesiolingual, and distobuccal) (Armitage, 1999). At the same appointment following the data collection, the active study therapy was performed. Supragingival scaling was performed for patient using hand instruments (scalers), ultrasonic devices and polishing was done for both groups. Subgingival scaling and root planing under local anesthesia was performed in a single appointment for each patient using hand instruments (Gracey curettes). SRP and diode laser therapy was performed in the same visit. Laser treatment was performed by using a 940 nm indium–gallium–aluminum–phosphate diode laser (epic10, Biolase, USA). A 300 μ m fiber optic delivery system was used for irradiation and 0.8 W power was applied with continuous mode. Then the fiber was inserted into the base of the periodontal pocket 1mm less than the value of periodontal pocket depth obtained by clinical measurement at baseline. It should be introduced in parallel alignment with the root surface, the device was activated, and the fiber was slowly moved from apical to coronal in a sweeping motion during the laser light emission and moved around the tooth surfaces, roughly 20s for each tooth. The periodontal pocket was irrigated with normal saline solution before irradiation to rinse periodontal pocket from blood to prevent collateral damage to the root and periodontal tissues. The tip of the fiber was cleaned with humidified gauze in saline solution. Laser irradiation was done at first visit, at second week and third week. Oral hygiene instruction and motivation were repeated every recall visit.

Statistical analysis

After collecting all the data from patients who participated in all recall visits. Collected data from both control and experimental sites were tabulated in excel tables (Microsoft office 2010). For statistical analysis, Means, standard deviations and p values were calculated using IBM SPSS version 17.00 statistical package. To identify the changes between baseline and 3-months post-treatment in each group analyses were performed by paired t-test. To detect the differences between therapies (SRP + L or SRP alone) from baseline to 3-months post treatment

analyses were performed by paired t-test. The level of significance was set at $P \leq 0.05$.

Results:

Clinical attachment level (CAL) assessment

The mean CAL at baseline in laser group was 4.62 ± 0.71 mm. After 3 months the CAL in laser group was 3.15 ± 0.98 mm. The laser treated group had a mean CAL reduction of 1.37 ± 0.95 . The mean CAL at baseline in control group was 4.71 ± 0.70 mm. After 3 months

analysis was done and revealed that control treated group had a mean CAL reduction of 1.30 ± 0.99 mm. At baseline, the CAL mean was recorded for all test and control groups with no significant differences identified between the two groups. All groups (test and control) demonstrated significant reductions in CAL at 3 months. No statistical significant differences were detected between the laser and control treated groups in respect to CAL as shown in (Table 1.).

Table 1. Clinical attachment level (CAL) (Mean $\pm$ standard deviation) at baseline and 3 months after treatment in the laser and control groups

Treatment	Baseline	Three months	Difference	P-value
Laser	4.62 ± 0.71	3.15 ± 0.98	1.37 ± 0.95	< 0.001
Control	4.71 ± 0.70	3.30 ± 1.01	1.30 ± 0.99	< 0.001
P-value	(N.S) 0.1	(N.S) 0.08	(N.S) 0.3	

N.S: not significant

Bleeding on probing assessment (BOP)

The BOP for control group at baseline was (65.7) and was reduced to (32.3) at baseline so the reduction in BOP of control group was (33.4). The BOP for laser group at baseline was (64.5) and was reduced to (26.6) at baseline so the reduction in BOP of laser group was (37.9). No statistical significant differences were

observed when comparisons were made between test and control groups. After 3 months BOP improved in both groups with significant differences when compared with baseline. No significant differences were observed when comparisons were made between test and control treated groups at 3 months assessment (Table 2).

Table 2. BOP clinical parameters at baseline and 3 months after treatment in the laser and control groups

Treatment	Baseline	Three months	Difference	P-value
Laser	64.5	26.6	37.9	< 0.001
Control	65.7	32.3	33.4	< 0.001
P-value	(N.S) 0.5	(N.S) 0.1	(N.S) 0.3	

N.S: not significant

Discussion

The studies demonstrate the bactericidal effect of lasers in nonsurgical periodontal treatment due to its thermal energy (Gojko, 2013). When laser energy is absorbed by tissue a photothermal interaction occurs, which raise the temperature of the tissue (LeBeau, 2012). The results of this study reported that the adjunctive

use of a 940nm diode laser in non-surgical periodontal treatment did not improve clinical parameters over scaling and root planning alone. BOP represents inflammation of internal lining of periodontal pocket. In periodontal studies repeated BOP in one site represents continuous pattern of periodontal destruction. Also, it can be attributed to periodontopathogens in

subgingival microflora. So, not having BOP is an appropriate indicator for healthy periodontal tissue (Jensen J, 2010). According to the results of the study, both groups reported elimination of BOP and improvement of clinical sign of inflammation. BOP showed a significant improvement compared to baseline in both groups ($p < 0.001$). The laser group had shown a slight better improvement in BOP. This mechanism occurs when at least two conditions occur, tissue absorption and resulting in coagulation of blood proteins and sealing of small diameter vessels. The warming of tissue to more than 60°C will result in protein denaturation and coagulation, which are properties useful in controlling bleeding. Statistical analysis revealed no statistic significant difference between the control and laser groups in respect to BOP. The results of the present study showed significant gain in CAL in both groups ($p < 0.001$). This may be explained due to the removal of local stimulating factors and reduction of the severity of inflammation. This is consistent with the other studies confirming the importance of mechanical debridement as the cornerstone for control and prevention of periodontal disease. There were no significant differences between control and laser groups in respect to gain in CAL. These results are not in agreement with the results obtained by (Kamma JJ, et al., 2009) in his study the laser group demonstrates superior results over the control group. Kreisler, M., also stated that diode laser irradiation at 1 W for 20s did not have a beneficial and therapeutic effect to form a new attachment of periodontal ligament cells (Kreisler, M., 2005). In agreement with our results a clinical study by Yilmaz et al. reports laser assisted therapy provided no additional microbiological and clinical benefits over conventional therapy (Yilmaz, S., 2002). Systematic and literature reviews of the laser literature are consistent in noting that the evidence is inconsistent and there is little support for using a laser as a monotherapy or adjunctive to SRP in initial treatment of chronic periodontitis (Sgolastra et al, 2013; Slot et al, 2014; Cobb, 2006; Schwarz et al, 2008; Karlsson et al, 2008; Matthews, 2010; Zhao et al, 2014). One of the major problems in evaluating the laser efficacy is the determination of the optimal dosage and treatment schedule. With diode lasers, this remains an area of controversy and affects the clinical outcomes.

Conclusion

Within the limitations of the this study and after analyzing the clinical outcomes, the adjunctive use of a 940-nm diode laser with scaling and root planing did not show better clinical beneficial effects compared with conventional therapy alone at 3-months post treatment assessment. However, due to the limited sample size and relatively short timeframe for evaluation in the present study, it is difficult to make conclusions about the use of diode laser in the treatment of periodontal pocket.

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العلاج غير الجراحي المساعد للجيوب اللثوية بواسطة الدايدود ليزر: تجربة عملية عشوائية

فاتن فرحان داخل⁽¹⁾ علي شكر محمود⁽²⁾ تمارا سردار محمد⁽³⁾ محمد عبود قنبر⁽⁴⁾

(1) وزارة الصحة ، بغداد، العراق

(2) معهد الليزر للدراسات العليا، جامعة بغداد، بغداد، العراق

المقدمة: ان امراض الانسجة ما حول اللثة متعددة الاسباب وهي امراض التهابية وعندما تترك من دون علاج قد تتسبب في تدمير الانسجة المحيطة والداعمة للأسنان وكنتيجة نهائية تتسبب بخسارة الاسنان. ان استخدام ليزر الدايدود كعلاج مساند للعلاج الغير جراحي لجيوب اللثة قد تم تشيجه من قبل العديد من البحوث بالرغم من وجود تناقض وعدم وجود اثباتات مختبرية على فعالية استخدام الليزر. **اهداف الدراسة:** ان هدف الدراسة هو تقييم فعالية ليزر الدايدود 940 نانومتر في العلاج الغير جراحي لجيوب اللثة. **الطرق والمواد:** ان عينة الدراسة تتكون من عشرين مريض بحاجة لعلاج غير جراحي لجيوب اللثة < 4 ملم حيث تم تقسيم فم كل مريض الى مجموعة تعالج بالطرق العادية الغير جراحية و مجموعة المقابلة تعالج بالطرق العادية مع استخدام الليزر كعلاج مساند. ان المؤشرات السريرية لانسجة ما حول اللثة تم تسجيلها قبل العلاج وبعد ثلاثة اشهر بعد انتهاء العلاج وتشمل مؤشر فقدان الانسجة الرابطة و مؤشر النزف عند التسبير. **النتائج:** : التحليل الاحصائي للنتائج اظهر تحسن في المؤشرات الخاصة بامراض ما حول الاسنان والتي تشمل مؤشر فقدان الانسجة الرابطة و مؤشر النزف عند التسبير من بداية العلاج لغاية ثلاثة اشهر لكلا المجموعتين العلاجيتين و اوضحت النتائج عدم وجود فرق معنوي واضح بين المجموعتين ما يعني عدم وجود فرق في فعالية العلاج ما بين المجموعتين العلاجيتين. **الاستنتاج:** ان العلاج بالليزر الدايدود المساند للطرق التقليدية لم يجعل النتائج افضل بالمقارنة مع التجريف اليدوي وتسطيع جذور الاسنان بالطرق التقليدية لعلاج امراض ما حول اللثة.