

DIODE LASER TREATMENT OF ORTHODONTICALLY INDUCED GINGIVAL HYPERPLASIA. A RANDOMIZED CONTROLLED CLINICAL TRIAL

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Abstract

Gingival hyperplasia becomes a relatively frequent pathologic condition during orthodontic treatment. The aim of this study was to evaluate the effectiveness of diode laser gingivectomy as an adjunct to nonsurgical periodontal treatment in the management of gingival hyperplasia in orthodontic patients. Materials and Methods: Thirty eight orthodontic patients with gingival enlargement due to fixed appliances were divided randomly into two groups. The test group received diode laser (810-nm) gingivectomy as an adjunct to nonsurgical periodontal treatment. The control group received nonsurgical periodontal treatment only. For all patients, clinical periodontal parameters were assessed at baseline, 6weeks, and 12 weeks: Plaque Index, Gingival Index, bleeding on probing, probing pocket depth, and Gingival Overgrowth Index. Intra- and intergroup variations in the periodontal parameters were determined at time intervals versus baseline measurements. Results: Both groups showed statistically significant improvements in clinical periodontal parameters over the study period ($P < .05$). However, significant improvements in periodontal health were evident earlier in the test group as the extent of improvement in periodontal health compared to baseline was greater in the test group than in the control group for most of the clinical parameters. ($P < .05$)

Conclusion: The adjunct use of diode laser gingivectomy combined with meticulous oral hygiene can produce quicker and greater improvement in

gingival health, suggesting its beneficial use for orthodontic patients with gingival overgrowth

Keywords: Diode laser, Orthodontic treatment, Gingival enlargement, fixed orthodontics appliances

Introduction

Gingival enlargement or hyperplasia is one of the most common soft tissue problems associated with fixed orthodontics appliances , with a reported prevalence of almost 10% (Sinclair et al, 1987; Mavrogiannis et al, 2006). Gingival enlargement further impedes the maintenance of oral hygiene, can interfere with occlusion, mastication, phonetics and in some cases may cause aesthetic and psychological problems and has been reported to compromise orthodontic tooth movement (Romero et al,2000 ; Krishnan et al, 2007). Gingival hyperplasia (of inflammatory origin) affecting orthodontic patients is usually characterized by localized or generalized gingival tissue growth, starting at the interdental papillae 1 to 2 months into treatment (Ristic et al, 2007; De Oliveira et al ,2010).

In the management of gingival enlargement, patient motivation to maintain meticulous self-care oral hygiene with adjunctive use of mouth rinses is the first line of treatment, but this rely on patient compliance; that it can be inadequate with limited success in some patients (Kravitz et al,2008 ;To et al, 2013). Nonsurgical periodontal treatment (including oral hygiene instructions, scaling, root planing, and prophylaxis) is the conventional management approach for gingival enlargement but is not always effective when gingival enlargement is extensive and self-care is compromised (Adams et al, 2004).

This sequentially has led to surgical approach for management of gingival enlargement. However, this is considered by many as very invasive and may not be effective if self-care oral hygiene practices remain poor (Krishnan et al, 2007). The use of lasers in recent decades gain considerable attention with advantages of using laser over conventional surgical lines of treatment includes: superior homeostasis, less postoperative discomfort, pain or edema and subsequently better tolerance from the patient, less complicated procedures (suturing and dressing pack avoided), bactericidal effect (decrease chances of postoperative bacteremia) , better visibility and accessibility (Adams et al, 2004; Neal et al, 2008; de Paula et al, 2010; Prachi et al, 2011; Robert, 2011).

However, there are scarce studies evaluated the effectiveness of diode laser gingivectomy as an adjunct measure in orthodontic patients which prompted this study.

Aim of the work

The aim of this randomized controlled clinical trial was to evaluate the effectiveness of diode laser gingivectomy as an adjunct to nonsurgical periodontal treatment in patients with fixed orthodontic appliances and persistent gingival enlargement.

Materials And Methods

This study was conducted at the department of Oral Surgical Sciences, Division of Periodontology, Faculty of dentistry, Beirut Arab University-Lebanon after approval of the University Research Ethics Committee. Patients were first briefed about the study and written consent was obtained. The research was carried out in accordance with the World Medical Association Declaration of Helsinki on Ethical Principles for Medical Research Involving Human Subjects.

The study was a randomized controlled parallel clinical trial. Patients were recruited from those undergoing fixed orthodontic appliance therapies that had received ongoing nonsurgical periodontal treatment and instructions on oral hygiene but had persistent gingival enlargement. Participating patients were between 13 and 27 years of age healthy nonsmokers who displayed gingival enlargement on the labial side of the anterior teeth. Patients were excluded from the study if they were medically compromised or taking medications that may cause drug associated gingival enlargement or who were currently pregnant or lactating.

Initial therapy was performed on all patients and consisted of full mouth scaling and root planing, by hand and ultrasonic instrumentation, and oral hygiene instructions. The plaque score was assessed at each scaling and root planing session, and oral hygiene instructions were reinforced. The oral hygiene program pursued the following therapeutic model: educational and motivational speech on oral hygiene, oral hygiene guidelines, and professional dental prophylaxis for plaque and calculus removal and home oral hygiene for 30 days.

After completion of initial therapy, the patients underwent a re-evaluation examination. At this appointment, we repeated the periodontal charting to assess the response to initial therapy and to review the criteria for surgery which was persistent gingival enlargement.

Thirty eight patients were randomly assigned for treatment by the flipping of a coin into two treatment groups. The test group received diode laser gingivectomy (810-nm diode laser, Creation s.r.l, C-LD-5 White star, Verona, Italy) as an adjunct to nonsurgical periodontal treatment on sites with gingival enlargement. The diode laser gingivectomy was performed under topical anesthetic gel (Benzo-jel) 20 % Benzocaine, applied for 3 minutes prior to operation. Infiltration anesthesia was given when needed. The gingivectomy was performed with gentle, sweeping brush strokes with a

power output of 2.5 W, continuous wave (CW) using the laser fiber tip (400 µm in diameter). High-volume suction was used to evacuate the laser plume and charred odor. Hemostasis was checked and patients were given postoperative instructions. For pain control, acetaminophen (500-mg tablet) was prescribed to patients when needed. The control group received nonsurgical periodontal treatment only. Clinical periodontal parameters were assessed by the same periodontist to minimise variability and also who was unaware of the treatment modality to eliminate any bias and these included: Silness and Loë (1964) Plaque Index (PI), Loë and Silness (1964) Gingival Index (GI), bleeding on probing (BOP) (Lang et al ,1991), probing pocket depth (PPD), and Gingival Overgrowth Index (GOI) (Angelopoulos and Goaz, 1972) . These were evaluated at at baseline, 6 weeks, and 12 weeks.

Data were analyzed using SPSS Statistics software, version 19.0.0 (SPSS Inc, Chicago, Ill). Variations in the periodontal parameters over time were assessed using repeated-measures analysis of variance. Intragroup comparisons at 6 weeks, and 12 weeks, with baseline assessments were conducted using the paired t-test. Intergroup comparisons of the level of change in the periodontal parameters compared to baseline were conducted at each examination using Student's t-test. The significance level was set at $P < .05$.

Results

The mean age of the 38 participating patients was 17.04 ± 3.1 years, and 22 were female and 16 were male. There were significant changes in all clinical periodontal parameters over the study period ($P < .05$) (Table 1). Intragroup comparisons within the test group identified significant changes in the periodontal parameters compared to baseline (Table 2): percentage of sites with plaque at 6 weeks ($P < .05$), and 12 weeks ($P < .01$); percentage of sites with BOP at 6 weeks ($P < .01$), and 12 weeks ($P < .01$), and percentage of sites with gingival inflammation at 12 weeks ($P < .01$); mean PPD at 6 weeks ($P < .01$), and 12 weeks ($P < .01$), and percentage of sites with gingival overgrowth at 6 weeks ($P < .001$), and 12 weeks ($P < .001$),. There were also significant intragroup variations in the control group in the clinical parameters compared to baseline: percentage of sites with plaque at 12 weeks ($P < .05$); percentage of sites with BOP at 6 weeks ($P < .05$) and 12 weeks ($P < .01$); percentage of sites with gingival inflammation at 12 weeks ($P < .05$); mean PPD at 12 weeks ($P < .01$); and percentage of sites with gingival overgrowth at 12 weeks ($P < .05$).

Intergroup comparisons identified significant differences in the level of change in some periodontal parameters between the test and control groups (Table 3). Significant differences in the percentage change of sites with gingival enlargement versus baseline between the test and control groups were evident at 6 weeks ($P < .001$) and 12 weeks ($P < .01$).

The amount of change in the percentage of sites with gingival inflammation was greater in the test group compared to the control group at 12 weeks (P < .05). The amount of changes in mean PPD was greater in the test group than in the control group at 6 weeks (P < .05).

Table 1. Variations in periodontal parameters at different study time intervals.

Variable	Baseline Mean (SD)	6 weeks Mean (SD)	12 weeks Mean (SD)	P*
PI (% of sites)	94.7 (5.2)	81.5 (13.6)	77.1 (11.5)	.003
BOP (% of sites)	57.3 (11.6)	35.9 (12.4)	40.5 (15.7)	.001
GI (% of sites)	96.5 (3.5)	85.7 (13.9)	80.2 (14.9)	.012
PPD (mm)	0.79 (0.7)	0.31 (0.8)	0.17 (0.9)	.001
GOI (% of sites)	45.2 (11.5)	22.9 (15.3)	19.4 (12.2)	.001

* Repeated-measures analysis of variance.

Table 2. Intragroup Comparisons of Periodontal Parameters at different time intervals

Variable	Baseline Mean (SD)	6 weeks Mean (SD)	12 weeks Mean (SD)
Test group			
PI (% of sites)	93.4 (5.7)	74.6 (9.7)*	70.6 (6.6)**
BOP (% of sites)	50.5 (15.7)	25.3 (9.7)**	31.7 (12.5)*
GI (% of sites)	96.7 (3.1)	80.4 (7.8)	70.5 (6.5)**
PPD (mm)	0.90 (1.0)	0.22 (0.7)**	0.20 (0.9)**
GOI (% of sites)	35.7 (12.9)	5.9 (4.5)***	7.8 (7.8)***
Control group			
PI (% of sites)	95.3 (4.3)	85.4 (6.5)	83.8 (8.1)*
BOP (% of sites)	56.2 (8.3)	50.4 (15.7)*	48.7 (14.4)**
GI (% of sites)	97.6 (5.0)	88.5 (5.9)	87.7 (9.2)*
PPD (mm)	0.75 (0.9)	0.53 (0.7)	0.31 (0.7)**
GOI (% of sites)	37.6 (13.7)	33.3 (11.5)	30.8 (7.5)*

* P , .05; ** P , .01; *** P , .001 (paired t-test statistics).

Table 3. Intergroup Comparisons of the level of Changes in Periodontal Parameters over Time versus Baseline

Variable	Mean (SD) At 6 weeks	At 12weeks
PI (% of sites)		
Control	8.7 (15.5)	11.7 (17.7)
Test	16.9 (20.7)	21.9 (15.6)
P .	.425 .	.195
BOP (% of sites)		
Control	13.7 (20.5)	20.5 (21.7)
Test 21.7 (24.1)	24.6 (22.6)	15.5 (20.7)
P	.328	.655
GI (% of sites)		
Control	7.3 (20.8)	5.9 (13.7)
Test	14.6 (23.3)	22.7 (24.5)

P	.345	.012
PPD (mm)		
Control	0.16 (0.40)	0.48 (0.63)
Test	0.73 (0.88)	0.69 (0.71)
P	.029	.420
GOI (% of sites)		
Control	4.6 (11.6)	14.7 (17.3)
Test	27.5 (18.1)	22.0 (15.2)
P.	.001	.225

Discussion

The clinical efficacy of laser therapy is well known and proper understanding of its properties can help dentists use lasers in many fields and settings.

Hypertrophic gingival margins are often seen in orthodontic treatment secondary to marginal gingival inflammation. Laser is a good option for the removal of gingival hyperplasia, and affords multiple intra- and postoperative advantages. The use of lasers causes less discomfort and is well-accepted by young patients and their parents. Thus, lasers can reduce psychological trauma and fear during the dental visit (Robert, 2011).

This study results come in agreement to (To et al, 2013) findings that recognized significant changes in clinical parameters over time in both the test and control groups. At 12 weeks there were significant changes in all parameters compared to baseline in both groups, suggesting that nonsurgical periodontal treatment with or without the adjunct use of laser therapy can be effective in the management of gingival health problems in patients with fixed orthodontic appliances. However, in the test group, significant changes in the periodontal parameters were observed earlier in some instances at 6 weeks. Furthermore, the degree of significant changes in periodontal health was larger and more frequent among the test group patients.

Intergroup comparisons recognized significant differences between the test and control groups in the percentage of sites with gingival overgrowth as change was significantly greater in the test group compared to the control group after 6 and 12 weeks. In addition, the change in the mean PPD was greater in the test group than in the control group at 6 weeks, suggesting that diode laser gingivectomy can quickly resolve and control this periodontal problem.

The results of this research confirms the findings of previous studies that the use of laser can quickly resolve gingival overgrowth, although its long term effectiveness was not evident. (Fornaini et al, 2007; Schwarz et al, 2008 ; Karlsson et al, 2008 ; Cobb et al, 2010). In addition, the adjunct use of diode laser gingivectomy was more effective in controlling gingival inflammation than nonsurgical periodontal treatment alone at 12 weeks.

The early and sustained ability of diode laser gingivectomy to maintain gingival health has substantial clinical application for orthodontic patients, since appliances can be iatrogenic to periodontal health, particularly if treatment periods are long-lasting. Therefore, a treatment protocol including careful training in oral hygiene, combined with a valid surgical technique is therefore essential to resolve the problem of gingival overgrowth associated with orthodontic appliances.

Conclusion

Orthodontic patients are now looking for more than straight front teeth and a good bite. They want optimal results with minimal effort as quickly as possible. To be successful, dentist must not only provide the best dental and facial results possible but also deliver esthetics soft tissue results efficiently. The proper use of a soft tissue laser in orthodontic patients can improve the quality of results, decrease treatment time and reduce appointments. With diagnostics consideration properly addressed, these procedures can be completed quickly, painlessly, and infection free with minimal side effects to the patients.

Based on the present study results, it can be concluded that the adjunct use of diode laser gingivectomy can be a valuable tool for obtaining quicker and greater improvement in gingival health, suggesting its beneficial use for orthodontic patients with gingival overgrowth especially when oral hygiene is not sufficient to achieve normal healthy gum.

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