

EFFECTS OF LASER APPLICATION ON THE PERIODONTAL CONDITION OF THE PLATFORM SWITCH IMPLANT

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ABSTRACT

Objective: To evaluate the effect of low grade soft laser clinically and radiographically on platform switching implants supporting mandibular complete over dentures.

Materials and methods: Ten edentulous subjects were eligible for inclusion. Two platform switching implants were placed in canine area of all patients. After three months, locator attachments remained connected to the implants, and the denture delivered with the retentive components incorporated in the denture base. Application of low grade laser for the right side implant only. At the follow-up examinations gingival index, pocket depth and marginal bone loss were evaluated at 6, 9 and 12 months.

Results: The sample of ten patients, with a mean age of 51 years was included in this study. All patients attended the 12-month follow-up. Non-statistically significant difference was found between the two sides regarding the gingival index, pocket depth and the marginal bone loss.

Conclusion: Within the limitation of this study the platform switching implant design, and the application of low grade soft laser proved to be effective in preservation of alveolar crest bone height, gingival index and pocket depth.

KEYWORDS: Complete denture, dental implant, mandibular over denture, platform switching implant, low grade soft laser.

INTRODUCTION

Post restorative decreases in crestal bone elevation around dental implants have elongated been acknowledged to be a regular significance of implant treatment.

Several investigators found histological

evidence of inflammatory cell infiltrate adjacent to the implant abutment junction.⁽¹⁾

Platform switching refers to the dimensional mismatch between the implant seating surface diameter and the diameter of the prosthetic component.⁽²⁾

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Dental researches reported several advantages and clinical benefits of switched platforms as compared to conventional (matched) platforms.(3) Through the platform switching idea, the implant abutment interface (IAI) is moved horizontally to the center of the platform and divided from the marginal bone .It has been postulated that the abutment inflammatory cell infiltrate (ICI) moves away from the crestal bone and into a more confined area.(4)

On the other hand ,the result of low grade laser cure on the attachment and propagation of human gingival fibroblasts refined on titanium implant material was investigated.(5) Fibroblasts visible to laser irradiation had considerably greater percentages of cell attachment and proliferation on titanium implant material.(6)

Low grade laser directly stimulate the cellular function of irradiated cells. The physical and /or chemical differences, with the three dimensional variation in the surface topography play an important role in the initial implant biocompatibility.(7,8)

The purpose of this research is to assess the outcome of low grade laser on the platform switching implant as regard bone height, gingival index and pocket depth measurement.

MATERIALS AND METHODS

The study was designed to be a split mouth randomized controlled trial.

The study protocol was approved by Prosthodontic Department Board and Ethics Committee of Faculty of Oral and Dental Medicine, Cairo University.

Selection Criteria

Ten completely edentulous patients were selected from the outpatient clinic of the Prosthodontics Department, Faculty of Oral and Dental Medicine, Cairo University in the period between March 2015 and August 2016.

The inclusion criteria for this study include patients those were:

- Completely edentulous with ability to provide informed consent.
- Age ranged from 45-60 years.
- Free from systemic disease that could affect the implant osseointegration such as diabetes mellitus and osteoporosis.
- Free from any oral pathological lesions in the oral cavity such as; cysts, remaining root or residual infection.
- Free from Temporomandibular (TMJ) or muscular disorders.

Smokers, patients with history of bruxism or clenching and those with skeletal class II or class III relationship were excluded.

Patient Examination

An initial evaluation was conducted to determine whether the patient met the study inclusion criteria. This evaluation consisted of a medical history questionnaire, a clinical exam, and radiographic assessment.

Informed Consent

All patients were requested to sign an informed consent that was translated into Arabic language to be understood by the patients. The trial conducted in accordance with the Declaration of Helsinki (version 2008).

Interventions and Study Procedures

1. Surgical Procedure:

Every patient received two Legacy screw vent implants with platform switching 13mm length and 3.7mm (body diameter), 3.5mm (platform switching diameter)

The implants are placed in the mandibular canines area and left unloaded 3 months to osseointegrate.

The procedures done as follow; the surgical stent was placed and locator drill was used to determine the point of entry. Then, drilling of the osteotomy site was performed by surgical drills in a sequential manner following manufacture directions. The parallel pin was placed and the stent was repositioned to ensure proper alignment of the osteotomy site.

The drilling process was accompanied with copious sterile saline irrigation. After drilling with a final drill, the platform switching implant (Implant Direct LLC.CA.USA) was then removed from its sterile packing and installed into the osteotomy with torque wrench and the cover screw was placed. Flap was repositioned properly and sutured using 000 black silk in an interrupted manner.

After three months, second-stage surgery was carried out. The surgical stent was used to determine the position of the implant with the aid of the periodontal probe after giving infiltration anesthesia. A minimal crestal incision was made to uncover the dental implant.

The cover screw were removed by the aid of a hex instrument. The locator attachment carefully held and screwed on the implant.

2. Complete Denture Construction and Pickup Procedure:

A conventional complete denture was constructed for the patients, following the traditional steps. .

The metallic housing and white retentive caps were picked up intraorally using cold curing resin (Rebaron self-cured acrylic. GC. Cooperation. Tokyo. Japan) as follow:

The block out spacers were slipped around the abutments .The metal housing was placed directly over the abutments then the dentures were properly relieved opposite to the attachment sites and assured for proper seating as proved by the absence of rocking and proper occlusion.

A small hole was done at the lingual flange to allow for escaping of excess cold cured polymerizing resin. Cold cured resin was mixed according to manufacture instruction and then placed in the relieved two areas of the denture and the denture was seated in the patient mouth. The resin was left to polymerize while the patient was closing in the centric jaw relation.

The denture was removed, trimmed and polished with the metal housings picked up in its fitting surface. (fig1)

The adaptation on the residual ridges was then checked and adjusted if necessary and the patient dismissed.

The patients followed-up at six, nine and twelve months after implant loading to measure outcomes.



Fig. (1) Metal housing of locator attachments picked up in the fitted surface of the denture.

Soft Laser Application

Soft laser SL-202 machine 100mW was used. (fig. 2) The power is adjusted at 40mW with 800 wavelength at frequency of 90Hz. Only the right implant was subjected to the application of the soft laser. The laser beam was aimed at the area corresponding to the bone surrounding the right implant bed. The application process was done at intervals of time (30 seconds) at the buccal, lingual, mesial, and distal sides of the installed right implant, and repeated 15 times.

Therefore the total time for each side/direction (buccal, lingual, mesial, distal) was 15x30=450 seconds

The power adjusted was ;40mW. Therefore total Energy per side: PowerxTime=18Joules/cm²



Fig. (2) Soft laser machine

Assessment of the periodontal health and marginal bone-loss

Direct digital radiography (DDR) using Digora Computerized System was applied.

Standardized periapical radiography was performed using a XCP (extension cone paralleling) technique sensor holder with a customized personalized bite registration record, made from putty rubber base impression material.

All the periapical radiographic exposures were made with the same dental long cone x-ray unit with similar exposure factors (70 Kv), 6m A with focal distance of 35 cm) using the same sensor.

Imaging was performed for the all patients at the six, nine and twelve months to calculate the marginal bone loss.

Marginal bone loss measurements were as follows: a line tangential to the apex and perpendicular to the long axis of the implant was first drawn, another line was extended from the alveolar

crest to the first line and was drawn tangential to the flutes of the implant on the mesial and distal aspect. (fig.3)

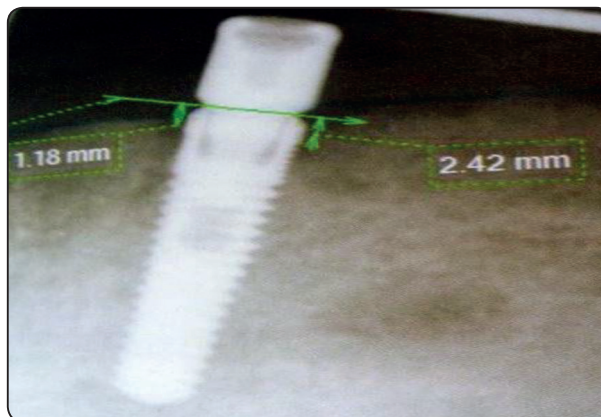


Fig. (3) radiographic evaluation of bone surrounding the implant

The mean values of the mesial and distal bone loss measurements for each implant during the follow-up intervals were calculated.

Biologic Evaluation:

- The gingival index(GI): the gingival index scores were recorded around the four implants surfaces using plastic probe. The degree of gingival index at each surface was recorded according to the “Modified Loe and Sillness” index within a 0-3 scale.
- Pocket depth: The level of epithelial attachment of the abutment was evaluated using graduated periodontal probe, It was inserted gently in the gingival crevice parallel to the long axis of the abutment at four locations(mid-buccal, mid-lingual, mid-distal, mid-mesial.)

The percentage of change in the levels of attachment between visits was calculated in the following manner:

$$\frac{\text{Epith attach (at time of delivery)} - \text{Epith attach (after follow up)}}{\text{Epith attach(at time of delivery)}} \times 100$$

RESULTS

The samples of ten patients with a mean age of 51 years were included in this study. A total of 20 implants were placed. All patients attended the 12-month follow-up.

The result showed no statistically significant difference in the bone level changes and periodontal health condition around the implants when laser therapy applied versus non-application of laser therapy. Table 1-4

TABLE (1): The mean bone loss, standard derivation (SD) values and results of paired t-test for comparison between both sides

Side Period	Right (with laser)		Left (without laser)		P.V
	Mean	SD	Mean	SD	
Baseline to 6	0.25	0.09	0.3	0.12	1.000
Baseh to 9	0.54	0.12	0.61	0.15	0.851
Bas to 12	0.59	0.12	0.66	0-15	0.621

TABLE (2): There was no statistical significant difference between the bone loss in both sides

Side Period	Right (with laser)		Left (without laser)		P.V
	Mean	SD	Mean	SD	
Baseline to 6	0.8	0.2	0.8	0.1	1.000
6 M	0.9	0.3	1	0.2	0.751
9 M	1	0.3	1.1	0.2	0.621
12 M	1.1	0.3	1.9	0.2	0.592

There was no statistical significant difference between mean gingival index in both sides through all periods.

TABLE (3): The mean, standard deviation (SD) values and results of paired t-test for comparison between pocket depth values in the two sides

Side Period	Right (with laser)		Left (without laser)		P.V
	Mean	SD	Mean	SD	
Mesial	1	0.3	1.1	0.3	0.58
Distal	1	0.2	1.1	0.3	0.63
Buccal	0.9	0.1	1	0.2	0.68
Lingual	1.1	0.2	1.2	0.3	0.74

Significant at P ≤ 0.05

At the mesial, distal, buccal and lingual surfaces there was no statistical significant differences in pocket depth values in both sides

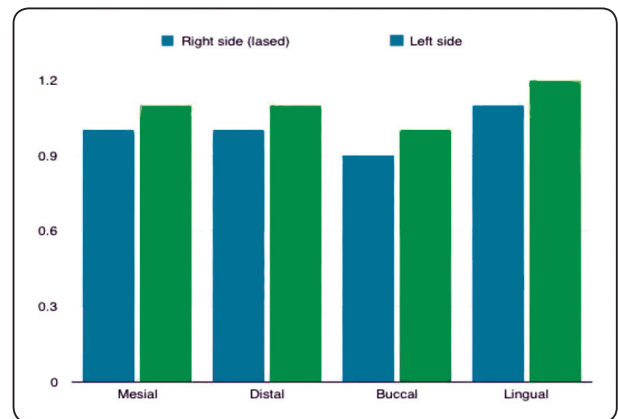


Fig. (4) Pocket depth changes for both sides

DISCUSSION

Ten Completely edentulous patients were selected from the outpatient clinic of the prosthodontic department. This research was limited to male patients to avoid any impact of sex hormone which could affect implant success⁽⁹⁾.

The patients were free of systemic diseases that might affect bone quality like diabetes, osteoporosis.

It was proved that the success rate for dental implant treatment in diabetic patient is low.⁽¹⁰⁾

Heavy smoker and patient receive irradiation are also excluded due to interfering with the tissue healing process⁽¹¹⁾.

To exclude the influence of implant design, length and diameter, only one type of implants were standardized in both groups.

Patients with bad oral hygiene were excluded as it is a predisposing factor to plaque peri-implantitis and implant failure.⁽¹²⁾

Low level laser Therapy (LLLT) semiconductor diode laser with specifications of 800 nm wavelength, energy output of 40mw and a frequency of 900Hz was administrated. This type of laser was in accordance with other researchers that concluded that most optimal wavelength lies in the optical window 500-1200nm for appropriate transmission through tissues and to attenuate pain, accelerate wound healing and treat soft tissue trauma.⁽¹³⁻¹⁴⁾

Computed radiology (digital periapical-radiology) using digora machine, was implemented in this study, as it produces excellent image quality, and facilitate proximal bone right measurements using the Digora software standardization of the marginal bone height measurements required that one line was drawn tangentially the apese of the implant and another line was drawn perpendicular to it and tangentially to the implant thread. The distance between them is the radiographic alveolar bone height.⁽¹⁵⁾

The unkind marginal bone loss above the follow-up period was 1 mm in both sides. This is measured to be in the normal restrictions of the normally used success criteria, therefore, similar through the results of comparable bone level variation after twelve months of function in a systemic review calculating implant loading protocols⁽¹⁶⁾.

There was a nonstatistically significant difference in decrease in bone height measurements at six, nine and twelve month follow-up periods, This may be due to the effect of the platform

switching implant which produce a biological sealing around the implant as well as the effect of laser application which stimulate osteoblastic activity, alkaline phosphatase activity and bone metabolism consequently minimizing the amount of bone resorption and better preservation of the alveolar bone^(17,18 19 20,21,22).

The results show non-significant differences in pocket depth and gingival indices for both sides. This agrees with many studies that found that laser radiation has a constructive weight on inflammatory regions as well as on wound curative and neoangiogenesis, by helping the making of endothelial cells as well as the plat form switching implant which promote easiness of maintenance of oral hygiene^(23,24).

CONCLUSION

The present investigation demonstrated that the platform switching implant significantly influenced bone height and peri implant soft tissue health as well as soft laser application.

Because of the limited model on human beings, and the minor amount of implants and follow ups, more clinical studies are required to show extended term results.

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