The effect of low-level laser on osseointegration of dental implants

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ABSTRACT

Background: The aim of this study to evaluate the effect of low-level laser on the Osseointegration of dental implant.

Materials and methods: Fourteen patients included in this study that needs dental implants in both sides of the jaw whether upper or lower jaw. One side of the jaw received dental implant and laser radiation, while the other side received dental implant only.

Results: Low-level laser application had stimulated osseointegration, that's bone formation and maturation around the implants was improved the site where laser application has been used than that bone around implants without laser application especially at 4-6 weeks after surgery.

Conclusion: Accelerated bone formation and maturation around the dental implant after application of low-level laser.

Key words: Dental implant, low-level laser.

INTRODUCTION

There are three types of dental implants: subperiosteal, Transosseous and endosseous implants. Endosseous dental implant which is used in this study is a device which is surgically placed into the jaw bone to replace one or several lost roots of the teeth (1). Titanium dental implant has suggested as a material of choice for implant fabrication due to its excellent abrasion and corrosion resistant, biocompatibility and non toxic properties (2). The success rate of dental implant depends on the amount of the osseointegration which is a direct bone anchorage to an implant body to provide a foundation to support prosthesis and to transmit occlusal forces directly to the bone (3). There are many factors affecting the osseointegration as: characteristic of the material, design of the fixture, bone quality, surgical technique and the implant loading conditions (4). There are many methods applied to stimulate the osseointegration to achieve excellent implant-bone bond for stable and fixed implant. Many studies done on low energy laser and stated that has a biostimulation mechanism that’s used for acceleration of soft tissue and bone healing (5,6). The aim of this study is to evaluate the effect of low energy 904 nm diode laser on the osseointegration of titanium dental implants.

MATERIALS AND METHODS

The study was done in the dental implantology center in Al-Karkh general hospital, from March 2006 to May 2007. Fourteen patients (9 males and 5 females), the patient's age range from 21-38 years old (mean age 29.5 years) included in this study that needs dental implants in both sides of the jaw whether upper or lower jaw.

Table 1 reveals the distribution of 34 dental implant fixture.

<table>
<thead>
<tr>
<th>No. of patients</th>
<th>14 patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>21-38 years (mean age 29.5 years)</td>
</tr>
<tr>
<td>Sex</td>
<td>9 males (64.28 %) 5 females (35.72%)</td>
</tr>
<tr>
<td>No. of fixtures</td>
<td>34 implant fixtures</td>
</tr>
<tr>
<td>Distribution of fixtures</td>
<td>6 implant fixtures in the anterior area 24 implant fixtures in the premolar area 4 implant fixtures in the molar area</td>
</tr>
<tr>
<td>Lengths and diameters of fixtures</td>
<td>In anterior area use: (Length 13, 15, 18 mm, diameter 3.8, 4.5, 5.5). In premolar area use: (Length 10, 11, 12 mm, diameter 3.25, 3.8, 4, 4.5, 5.5, 6). In molar area use: (Length 8 mm, diameter 3.75, 4.5, 5.5).</td>
</tr>
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</table>

All patients were examined under dental implantology committee for restoring the lost tooth or teeth by dental implants. All the patients in this study have good health condition and without any systemic disease. The surgical operation done under local anesthesia, by same
oral surgeon and all patients were given antibiotics postoperatively. The surgical procedure done by reflection of three-sided flap with slight curvature lingually or palatally from the crest of the alveolar ridge, then do drilling of the sockets in steps.

One side of the patients jaw received dental implants with laser application, the laser irradiation done in this manner; two minutes to the prepared socket prior to implantation, another two minutes after implant insertion in the bone and finally another two minutes of laser irradiation to the soft tissue covering the dental implant after suturing of the flap.

The other side of the same patient's jaw received dental implants using the same surgical procedure but without laser application.

Intra oral periapical and extra oral orthopantamograph x-ray films were taken for each patient for evaluation preoperatively and postoperatively (four weeks and six weeks).

The laser equipment used in this study was Optodent unit (figure1), the laser emission is low energy infra red gallium – arsenide (Ga-As) laser, wave length 904 nm, using continuous beam of radiation, average power is 5 mw, focal spot of 5.1 mm.

Almost the patients included in this study have reduction in pain and edema after surgical procedure of implantation of the laser irradiated side in comparison with the other side where surgical implantation without laser application.

In this study we depend on the x-ray for the evaluation of the amount of reparative bone by its radio opacity around the implants in laser irradiated side and compare it with the radio opacity of the bone around the implants in the non irradiated side of the same patient’s jaw.

The radiographs for the evaluation taken at intervals:

There is no difference in radio opacity of bone around the implants immediately after operation in both sides of the jaw (one side with laser radiation and the other side without laser radiation).

There is a slightly increase in radioopacity around the implant in laser radiated side in comparison to the non radiated side after four weeks (figure3, 4 & 5).

**RESULTS**

A total number of patients in this study were fourteen; each one of them had implantation surgery with laser application on one side of the jaw and implantation surgery without laser application on the other side of the same jaw.
After six weeks there is a marked increase in the bone radio opacity around the implant in laser radiated side in comparison to the other side (figure 6, 7, 8 & 9).

Figure 5: Four weeks postoperatively (the same patient of figure 4), (A) without laser application, (B) with laser application.

Figure 7: Six weeks postoperatively (the same patient of figure 6), (A) with laser application, (B) without laser application.

Figure 6: Six weeks postoperatively, right side with laser application, left side without laser application.

Figure 8: Six weeks postoperatively, right side without laser application, left side with laser application.
There is a slight increase in radio opacity around the implants from four weeks to six weeks in laser radiated implants (figure10).

**DISCUSSION**

Many methods have been tried to demonstrate clinically osseointegration of an implanted material, these tests have been used to indicate, not verify osseointegration, which is a concept defined at the histological level, performing a clinical mobility test as proposed by several authors, and finding implant mobility is definite evidence that it is not integrated\(^7\).

Success osseointegration is highly dependent on minimum surgical trauma and avoid thermal damage to the bone by using slow drilling speed, the use of successive incrementally large sharp drills and copious saline irrigation aims to keep the temperature below that at which bone tissue damage occurs (a round 47°C for 1 min.) \(^{8, 9}\).

Low energy laser therapy had been reported to reduce the period for bone fracture healing \(^{10}\). It is reasonable to assume that a similar period as for fracture healing is required for the bone surrounding the implant for healing because it should be mechanically strong enough to resist unlimited masticatory forces, thus it appears that the use of continuous beam of laser with a wave length 904 nm applied directly over the site of implantation for two minutes and for three session intervals found to increase the bone formation around the dental implants and had become mature in a short period of time than that around the non irradiated dental implants \(^{11, 12}\).

The results indicate that low level laser application had stimulated bone formation and therefore bone become mature in shorter period of time, these results in agreement with other studies \(^{13, 14}\).

The early bone maturation could be attributed to the stimulation of fibroblasts proliferation through the application of low level laser therapy \(^{15}\).

Thus the laser irradiated implants wound be able to withstand loading after a short healing period because the time required for the process of osseointegration to develop around titanium implants was reduced\(^5\).

The reduction in pain and edema of short term follow up as in agreement with other studies \(^{16, 17}\) who reported the influence of low energy laser therapy on pain, swelling and healing after oral implantation and surgical removal of impacted mandibular third molar.
REFERENCES
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