Role Of Diode Laser In Preservation Of The Marginal Bone Around Early Loaded Endosseous Implant

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Abstract: Aim: Evaluation of the effect of diode laser irradiation on crestal bone preservation around early loaded dental implants (used for single tooth replacement) clinically and radiographically. **Patients and Methods:** Eight patients need a bilateral implant placement were included in this study. Implant placed in one side was exposed to diode laser immediately; 4 days and 7 days after insertion of the implants. The other side was not exposed to the laser. The implants were loaded for 6-8 weeks. The patients were followed up clinically and radiographically at time of abutment placement and then at three, and six months. **Results:** Minimal amount of marginal bone resorption around the implants was noticed in the lased side more than in the non-lased side. **Conclusions:** The application of the diode laser to the endosseous implant can preserve the bone around the implant and may aid in improving the longevity of the implants.

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***Key words*:** diode laser, implant, marginal bone loss, early loading.

1. Introduction:

Nowadays, laser has been widely used in medical and dental applications. The laser used in dentistry included lasers with high power density commonly known as high-level lasers; that are commonly used to produce a thermally destructive effect and selective photocoagulation. The other class of laser is known as low-level lasers or described as therapeutic lasers. The therapy performed with such lasers is often called low-level laser therapy (LLLT), Kahraman(2004). In dentistry, LLLT is effectively used to accelerate healing or improving recovery in cases of aphthous ulcers, mucositis, traumatic ulcers, herpatic lesions, Colvard and Kuo (1991); Lima et al.,(2010) , nerve injuries, Midamba and Haanaes (1993) and treatment of temporo-mandibular joint disorders, Mazzetto et al.,(2010).

For acceleration or improving the healing of the bone tissue, LLL has been tried in different situations. In orthodontic field, LLL was investigated to accelerate healing and to decrease recurrence after palatal expansion and a good results was obtained, Saito and Shimizu(1997). In oral and maxillofacial surgical procedures, low level laser has been tested to enhance bone growth both in alveolar bone healing after tooth extraction and in bone fracture healing, Takeda (1988); Luger et al.,(1998). Trell and Mayayo(1987) conducted an experimental study and showed that low level laser irradiation can speed up vascularization and increase the number of trabeculae in fractured mouse tibiae. In another study, it was found that low level laser therapy significantly increased the count and activity of osteoblasts, Dortbudak et al.,(2000).

In dentistry, the use of dental implants for tooth replacement became state of the art in dental prosthetic therapy. The success of the endosseous dental implant depends largely on the osseointegration of the implant in the bone. Several treatment have been proposed to improve and accelerate bone formation onto implant surface, among which low level laser therapy, Petri et al.,(2010).

The studies on use of low level laser to stimulate the osseointegration of the implant are few especially the clinical studies. Two recent studies conducted to evaluate the effect of low intensity laser irradiation on immediately loaded implant supporting over denture. The studies showed the alveolar bone height was preserved while the bone density was increased in the side exposed to low level laser and depending on the good results obtained, the researchers concluded that application of laser to immediately loaded implants preserve the supporting alveolar bone and increase bone density compared to the unlased implants, El-Talawy et al.,(2011); Rizk and El-din(2011) .

In another study, the effect of diode laser application on osseointegration of dental implant was evaluated and it was found that low level laser application had stimulated bone formation and maturation around the implants, Ismaeel and Abbas(2011). Lastly, El-Desouky et al.,(2007) assessed the effect of low level laser irradiation on bone density following loading of previously lased implant after insertion and they found that the bone

density increased more when the implants were lased before and after their loading thus positively affecting the longevity of those implants.

In Alice et al.,(2010) study to investigate the effects of low level laser by application of diode laser on human osteoblastic cell grown on titanium discs, they found that LLLT stimulates the expression of osteoblastic phenoytype in cells cultured on titanium suggesting possible benefits on implant osseointegration despite a transient deleterious effect immediately after laser irradiation. In another experimental study conducted byEl-Din et al.,(2008)to assess effect of short term administration of vitamin C, associated with low level laser irradiation of the implants, They found that, bone osseointegration had been enhanced when laser irradiation was used. Researchers expected that laser application would reduce healing time and speed up osseointegration of the implants,Dortbudak et al.,(2002).

2. Mateials and Methods

2. 1. Materials:

2.1.1. Studied subjects:

Eight patients (7 females and one male) free from any systemic disease, with age range from 27 to 40 years, were selected to participate in this study.
Insertion of implants in both sides of the patient's jaws was a part of the treatment plan of those patients.

2.1.2. Implants

The implants used in this study were root form implant (Root form implant, Vitan, France). A total of 16 implants were inserted in the patient's mandible. They were placed in the premolar-molar area of their mandible.

2.2. Methods:

2.2.1. Study design:

The technique was 2 stage surgery technique and all the patients were managed under local anaethesia in the IbinSin dental college, Jedhha, Saudia Arabia by the same surgeon and according to the recommendation of implant's manufacture. After insertion of the implants, one side was ascertained to be the study side and the other served as control.

Laser irradiation was done to the selected side immediately;4th day and 7th day after implant insertion. The total time of laser application was 2 minutes each cession divided equally on buccal, occlusal and lingual aspect of the implant site. The laser used in this study was 970 nm diode laser (SIROlaser, Sirona dental systems GmbH, Germany). The power was adjusted using the manual mode to be 0.6 watt and frequency was 75 Hertz. The laser delivered to the area by an optic fiber 200 Um in non contact mode. After 6-8 weeks of healing, the implants were exposed and the prosthetic part completed. Fig 1 shows the device used in this study.

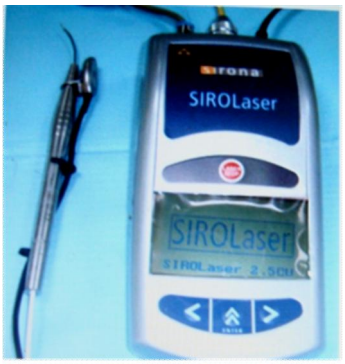

Fig 1 shows the device used in this study

2.2.2. Clinical follow up

The clinical evaluation included two parameters. Loose and lost implants were scored any time after placement and probing depth was measured at four sites of each implant (mesially, Distally, Buccally, and lingually) by using a periodontal probe (Merit B, Hu Friedy, Chicago, IL, USA).

2.2.3. Radiographic follow up

To evaluate the amount of marginal bone loss, a combination of panoramic views and standard periapical radiographs were taken at abutment connection and then at three, and six months after. The change in the crestal bone level on the mesial and distal aspects of the implant was evaluated on the images of the periapical films by using the Adobe Photoshop extended software, where the distance from the implant abutment interface to the level of bone contact with the implant was determined. The data were presented as mean and standard deviation (SD) values and the significance level was set at $P \leq 0.05$.

3. Results

In this study, eight patients received a total of 16 implants in the premolar-molar region of the mandible. In each patient, one implant was exposed to laser irradiation immediately, at the 4th day and at 7th day after implant placement. To evaluate the effect of the laser irradiation on the preservation of the marginal bone around the implants, the patients were followed up radiographically to determine the amount of marginal bone loss. For the implants that were exposed to laser, the mean of marginal bone loss was 0.19 mm at 3 months, and 0.35 mm at 6 months. For the implants in the other side, which did not exposed to any laser, the mean of marginal bone loss was 0.45 mm at 3 months and 0.62 mm at 6 months.

In addition, statistical significant difference was found between the MBL in the two sides, the p. value was 0.04 at 3 months and 0.02 at 6 months.

Regarding the peri-implant probing depth, there was no significant difference between the two sides. The probing depth ranged from 2-2.5 mm with a mean of 2.2 mm in the side exposed to laser and for the other

side it ranged from 3-3.5 mm with a mean of 3.27 mm at 3 months. At 6 months, the mean of probing depth was 1.22 mm for the study side and 2.44 mm for the control side. No implants in the study side or control side were lost or become loose.

Table (1): The mean and standard deviation of the marginal bone loss and probing depth as a function of time for both sides (study and control sides)

Time/Side		Marginal bone loss			Probing depth		
		Mean	SD	P. Value	Mean	SD	P. value
At 3 months	***Study side***	0.19	4.183	0.04	2.22	0.259	1.000
	Control side	0.45	0.112		3.27	0.288	
At 6 months	***Study side***	0.35	3.536	0.02	1.22	0.228	0.24
	Control side	0.62	0.110		2.44	0.329	

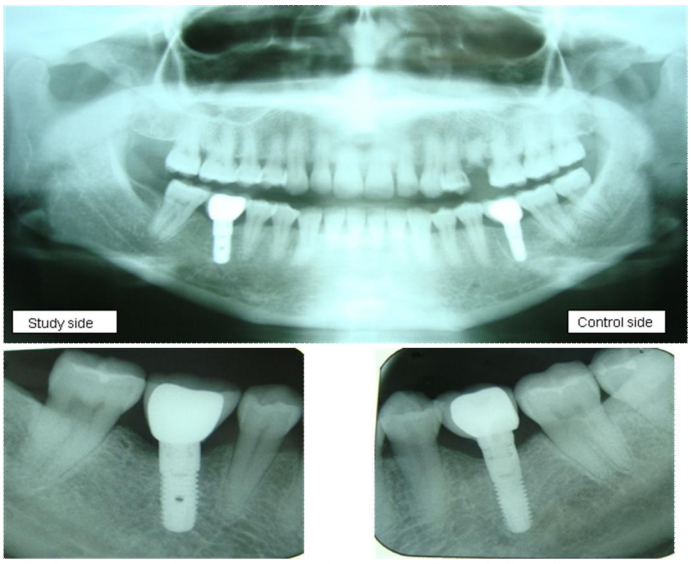

Fig 2 the panoramic view done at insertion of the crowns and the periapical radiographs at 6 months after delivery of the crowns for one case.

4.Discussion:

Mester et al.,mentioned in (1971) the first report concerning biological stimulation of lasers and whether low level laser therapy accelerates the ossification or not. There have been several reports that use of a low level laser after implant insertion promoted osteointegration due to rapid bone turn over. Diode laser has excellent transmission efficiency to tissue compared to other laser systems. This laser has been used to promote ossification. Low level laser therapy had been reported to reduce the period of bone fracture healing,Khadra et al.,(2004); Khadra et al.,(2005).

In the implant dentistry, the good effect of low level laser irradiation on increasing bone density and preservation of crestal bone around implants had been reported, El-Talawy et al.,(2011); Rizk and El-din (2011); Ismaeel and Abbas (2011); El-Desouky et al.,(2007).These studies showed that the alveolar bone height was preserved while the bone density was increased in the side exposed to low level laser and depending on the good results obtained, the researchers concluded that application of laser to immediately loaded osseointegrated implants preserves the supporting alveolar bone and increases bone density compared to the unlased implants.

In the present study, the implants in one side were exposed to diode laser irradiation and the implants in the other side in the same patient were not exposed to any laser therapy, then both implants were early loaded and followed up for 6 months to evaluate the marginal bone around the implants. The results showed that the bone loss around the implants exposed to the diode laser was less than the marginal bone loss around the implants in the control side. The difference was significant at 3 and 6 months times. Regarding, the peri-implant probing depth, there was no significant difference between the two sides.

The results obtained in the present study is consistent with the results in other studies that showed that the bone around the implants could be preserved better, if area exposed to low level laser irradiation

than in the areas with no laser irradiation El-Talawy et al.,(2011); Rizk and El-din (2011); Ismaeel and Abbas (2011); El-Desouky et al.,(2007).

The early bone maturation and osseointegration after laser irradiation may be attributed to increase in number of viable osteocytes in the irradiated tissues that suggests that more vital bone tissue present in the irradiated area than in the non-irradiated atrea and that wound healing can be expected to be accelerated. In view of this data, low laser therapy appears to produce highly reactive and vital peri-implant bone tissue that can be expected that it could reduce healing times and speed up osseointegration of the implants, Dortbudak et al.,(2002). Kim et al.,(2007) suggested that application of the low level laser influenced the expression of certain cell activating factors and resulted in the expansion of metabolic bone activity and increased the activity of bone tissue cells.

Conclusion: Although, the number of the cases was few, we can conclude that the application of the diode laser to the implant can preserve the bone around it and may aid in improving the longevity of the implants.

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