Dental Implants Placement Using an Er:YAG Laser - Two Case Reports

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Background

Since the first article by Bronemark about the modern state-of-the-art method of performing implant surgery, the accepted method of implant placement has been determining the location of the implant, raising a flap using a scalpel, elevating the full thickness flap using a periosteal elevator and then drilling a progressively larger opening in the bone using a very precise low speed drill with a progressively larger diameter, then placing an implant whose diameter slightly exceeds the opening prepared to accept it.

The LiteTouch Er:YAG laser (Syneron Medical, Ltd.) is a leader in the laser dental field. It uses a revolutionary direct delivery system method. The concept is a "laser in a handpiece" in which the laser chamber is located in the handpiece area, it eliminates the need for a delivery system and enables the laser to deliver a maximal amount of energy to the desired site without loss of energy or efficiency. This system simplifies the introduction of the laser into the oral cavity and eases its use on soft and hard dental tissues. The energy range is very flexible from 50-700 mJ and frequencies between 10-50 Hz. The laser can also be used with a variable pulse which enables increased efficiency in soft and hard tissues.

During a conventional implant placement, a pre-determined depth was performed by drilling to an indentation marked on the drill, allowing the surgeon to drill to a precise depth.

Numerous problems exist as a result of this implant placing method. Since the drill is a mechanical instrument, a significant conduction of vibration is transferred through the handpiece to the bone, making the implantation process very uncomfortable to the patient, especially in a Type I bone implantation procedure. In Type I bone, the drilling process is very hard and quite time consuming.

By using a mechanical instrument to drill the bone, there is also potential for contamination of the implantation site by the instrument.

An alternative method of implant placement will be presented here. We have performed numerous procedures using this method for some time now with a considerable success rate.

The method involves an Er: YAG laser which serves multiple purposes:

1. Creating the required incision.
2. Raising a flap.
3. Drilling an opening in the bone to house the implant.

Before we started to perform the method we had to make sure that there will be no damage to the bone using the laser. There is no possibility of damaging the bone during the soft tissue phase while using the laser.

This procedure is more comfortable for the patient and there is no increased morbidity to the patient.

The procedure goes as follows:

1. Using the LiteTouch Er:YAG laser (Syneron Medical Ltd.) with a direct delivery technology, an incision is performed with a sapphire 800 micron tip, using an energy level of 350 mJ at a frequency of 20 Hz.
2. Then, by inclining the tip towards the flap, the energy of the laser is used to deflect the flap on both sides of the incision.
3. This method allows raising the flap without using force and without using surgical instruments to raise a flap in the conventional method.

With the bone exposed, a cavity is prepared using a 1.3 mm tip with special serrations of up to 9-13 mm in order to determine accurate depth of preparation.

4. The drilling is performed using up-and-down motion to create a cavity of 2 mm diameter at the right depth, to enable the water spray of the laser to penetrate the cavity and to enable further drilling in order to prevent heat buildup inside the bone.
5. When the cavity is expanded to approximately 2 mm to the correct pre-determined depth, a conical implant is placed at a diameter of at least 3.5 in order to expand the bone circumferentially and to create a perfect bone-implant interface.
6. The expansion of the bone around the inserted implant enhances its stability and accelerates the osseo-integration process of the bone that envelopes it.

7. This method also helps to prevent bone fracturing during an implantation on a narrow ridge.
8. During laser drilling and raising a flap, no mechanical pressure and no vibration are transferred to the bone; a very a-traumatic procedure for the patient. Drilling with the laser is very fast and shortens the operation time, thus allowing multiple implants to be placed in a short time. No mechanical pressure during implantation assists in maintaining a parallel angle between the implants to maintain safety during the operation.
9. If the ridge is wide enough, a transmucosal implant method can be used. This process involves creating a cavity through the soft tissue with the Er:YAG laser in the implant site. The opening is 2 mm diameter without a flap raised.
10. Then, drilling in hard tissue in circular up-and-down motion, as described before.
11. The implant is placed through the opening in the soft tissue to the desired depth.
12. Instead of a cover screw, a healing cap is placed, protruding about 1 mm above the surface of the soft tissue, thus helping to avoid secondary soft tissue surgery later on (which has been necessary to expose the implant for further rehabilitation).

We now have several years of follow-up records of successfully performing this operation using a laser instead of surgical tools.

This method allows implantation to be performed with much less discomfort to the patient, decreased mobility and can become a commonly practiced method for implant insertion in the future. The method ensures increased safety during preparation and proven success.

Case Report No. 1

A 49 year old male patient presented to the clinic, needing 2 implants to be placed on the lower left quadrant of the mandible at the locations of teeth 36 & 37.

A CT was performed in order to determine the precise location of the inferior alveolar nerve and contour of the mandible.

The examination values were determined to be wide enough to perform a transmucosal implantation procedure.

The area was anesthetized using an infiltration technique with Articaine 3% 1:50,000 local anesthetic agent.

Two openings were then created in the soft tissue using the LiteTouch Er:YAG laser with a 1.3 mm sapphire tip in soft tissue mode, with the following parameters: energy of 350 mJ, frequency of 20Hz, and then the mode was changed to hard-tissue mode with parameters of 400 mJ and 20 Hz.

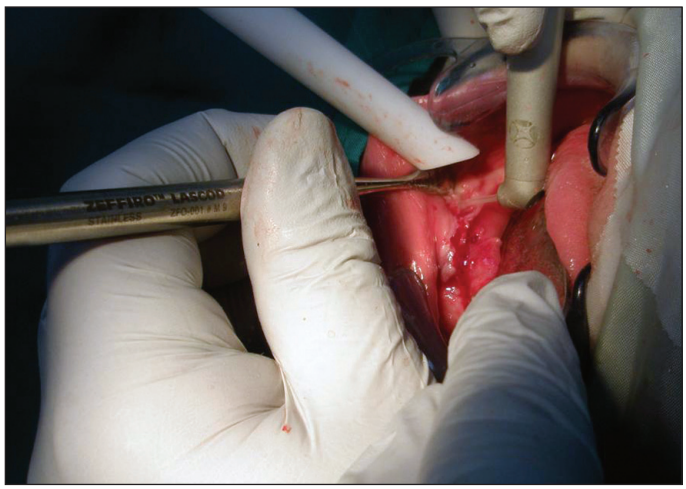

Figure 1: Using the LiteTouch Er:YAG laser to cut and deflect the periosteum to expose the implantation site without any use of a blade.

Two openings were made to a 10mm depth using circular up-and-down motions. The diameter of the openings was approximately 2 mm.

Then, two 3.5mm diameter implants were placed and two 3mm healing caps were screwed onto the implants, protruding 1mm over the soft tissue border.

Figure 1: Post-operative view of the implantation site. Notice the healthy, pink appearance of the soft tissue surrounding the healing caps.

The patient reported no pain and no sensitivity sensation during the course of the operation. No bleeding was observed. Since the healing cap is wider than the opening, it created a seal of the soft tissue which prevented bleeding. The implants were left without loading for a period of four months and then a reconstruction of the dentition of the site was completed.

CASE REPORT NO. 2

A 53 year old female patient presented needing implants placement in the lower left quadrant area of tooth 34. After clinical and radiographic examinations indicating a CT scan, the site was found suitable for implantation.

Anesthesia was performed in the local infiltration technique using Articaine local anesthetic agent.

An incision was made using the LiteTouch laser with an 800 micron sapphire tip.

Soft-tissue mode was used with parameters of 350 mJ and 20 Hz frequency. Then the beam was inclined in buccal and lingual directions in order to raise a flap in the implant's desired location with the same energy and frequency settings. After raising a 3-4 mm flap it was reflected with the periosteal elevator. No force was required to deflect the flap since the laser alone elevated the tissue. Then, with a 1.3 mm tip with a special design for implant cavity preparation, a 10mm cavity was created at a 2mm diameter. A conical ADIN 3.5mm implant was inserted and a cover screw was placed. The flap was sutured using Vycril 3/0 material. An antibiotic subscription was given for 875 mg Augmentin, twice a day for a 5 day duration.

The healing process was uneventful. The implant was uncovered four months later and the final restoration was placed.

CONCLUSION

In recent years the laser has become a valuable and indispensable tool in the dental armament for the performance of required surgical procedures with minimal discomfort to the patient, less operatory morbidity and safer to the patient. The clinical experience accumulated in our practice as well as recent studies indicate that the Er:YAG laser may be used clinically for implant site preparation with good osseointegration results and bone healing. The Er:YAG laser is slowly but surely establishing itself as an alternative to conventional treatment methods, with considerable success rate and many benefits to the patient.

REFERENCES

1. DP. Sarment et al, "Accuracy of Implant Placement with a Stereolithographic Surgical Guide", *Oral Maxillofac Implants*, 2003;18:571-577).
2. Kesler G, Romanos G, Koren R. "Use of Er:YAG laser to improve osseointegration of titanium alloy implants - a com parison of bone healing" *Int J Oral Maxillofac Implants*. 2006 May-Jun; 21(3):375-9.
3. Schwarz F, "Influence of implant bed preparation using an Er:YAG laser on the osseointegration of titanium implants: a histomorphometrical study in dogs", *J Oral Rehabil*. 2007 Apr;34(4):273-81.
4. Lubart R, "Er:YAG laser promotes gingival wound repair by photo-dissociating water molecules", *Photomed Laser Surg*. 2005 Aug;23(4):369-72.
5. Salina S, "Histological evaluation, in rabbit tibiae, of osseointegration of mini-implants in sites prepared with Er:YAG laser versus sites prepared with traditional burs". *J Long Term Eff Med Implants*. 2006;16(2):145-56.
6. Lewandrowski KU, "Use of the Er:YAG laser for improved plating in maxillofacial surgery: comparison of bone healing in laser and drill osteotomies". *Lasers Surg Med*. 1996;19(1):40-5.
7. el-Montaser M, "Osseointegration of titanium metal implants in erbium-YAG laser-prepared bone". *Implant Dent.* 1999; 8(1):79-85.
8. Sculean A, "Anti-infective therapy with an Er:YAG laser: influence on peri-implant healing". *Expert Rev Med Devices*. 2005 May;2(3):267-76.
9. Ishikawa I, "Potential applications of Erbium:YAG laser in periodontics". *J Periodontal Res.* 2004 Aug;39(4):275-85

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Lecture topic: A revolution in Hard Tissue Laser Dentistry.

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