The Dr Mir laser-assisted dental implant technique

A novel clinical approach

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Since the 1970s, implant dentistry has revolved around the key idea that an incision in the gingiva has to be made in order to successfully place an implant. However, many surgical kits today feature a punch tool and many clinicians recommend punching a hole into the gingiva, in which the implant should subsequently be placed. Yet, there are also many clinicians who do not believe in the clinical benefits of this technique, since they believe that this method results in too large an amount of soft tissue in the implant bed, reducing the possibility of successful osseointegration as a consequence. Moreover, many do not believe in laser-assisted dental treatment because of the high risk of inducing tissue necrosis. Between 2003 and 2006, the author of this case report researched modalities for efficiently ablating hard tissue. In several projects, he and his team observed the interactions of the Er:YAG laser with hard tissue[1] and found that the Er:YAG laser is able to efficiently ablate both soft tissue and bone using laser-induced shock waves and photoacoustic interactions with short-pulsed laser light (Figs. 1a & b). Based on these findings, the author of this article developed the Dr Mir laser-assisted dental implant technique.

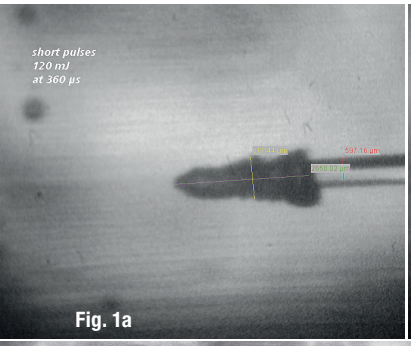


Fig. 1a

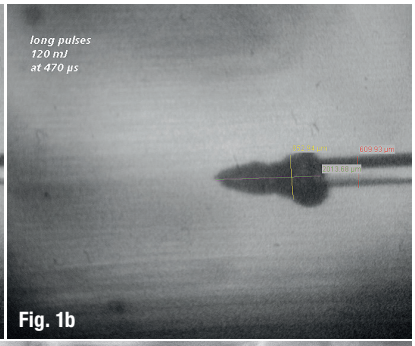


Fig. 1b

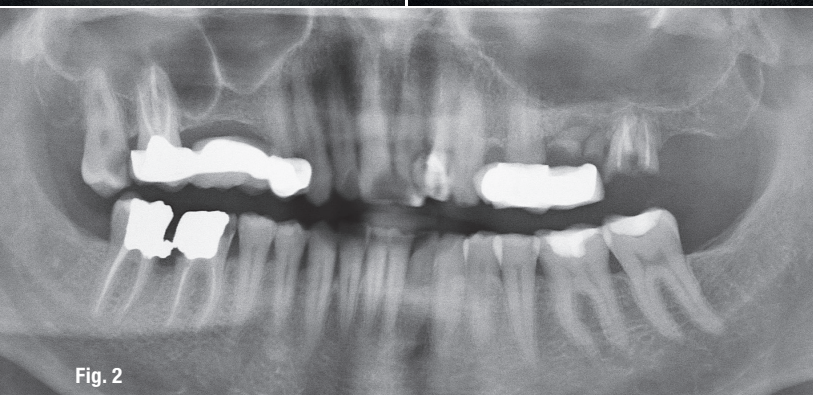


Fig. 2

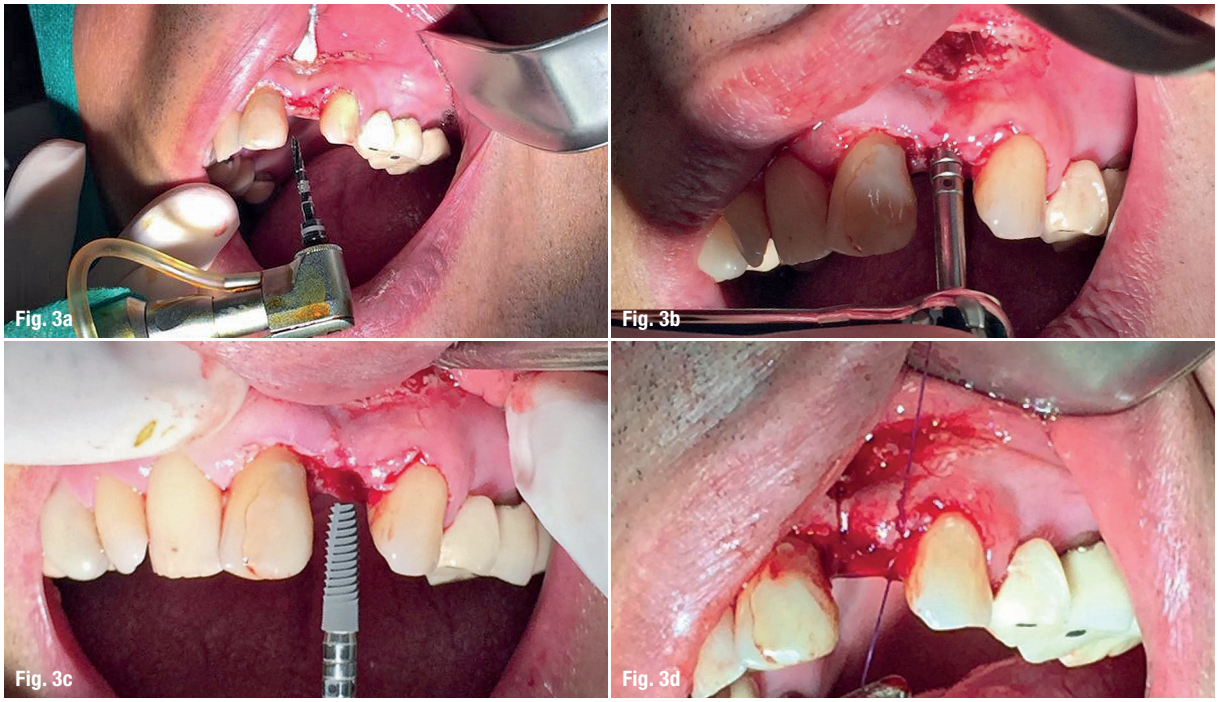
Figs. 1a & b: Samples of laser–water interaction captured by high-tech camera: water absorbs Er:YAG laser light and a bubble is formed. Its collapse leads to a shock wave, which is the basis for cutting water-containing tissues.
Fig. 2: Radiograph taken prior to the surgery.

On the technique

The Dr Mir laser-assisted dental implant technique is used for implant restorations. It uses very low amounts of laser energy and can be combined with incision techniques, punch techniques and a modified vestibuloplasty in order to achieve optimal soft-tissue management during surgery. The technique requires two surgical appointments. At the first appointment, a laser with an energy density of 9 J/cm^2 is used for semi-punching the soft tissue and the bone in order to create the implant bed. The implant is then inserted into the osteotomy. At the second appointment after two months, the definitive restoration is done. During this appointment, a laser with a lower energy density of 4 J/cm^2 is used in order to promote immediate healing. When the author of this article was in the early stages of developing this unique technique, he usually punched the gingiva with any laser he had at his disposal, which is why he argues that his method can be used with any dental laser type on the market, as long as low energy density is used in order to reduce the risk of creating irreversible changes to the tissue. The author recommends his technique being used for restorations in the aesthetic zone.

Case report

A 45-year-old male patient presented who had previously lost the crown of his maxillary left lateral incisor. It is for this reason that the patient requested a single-tooth implant restoration. However, it was important to him that there would not be any pain involved. Suffering from dental phobia, he had not been to a dentist to have his

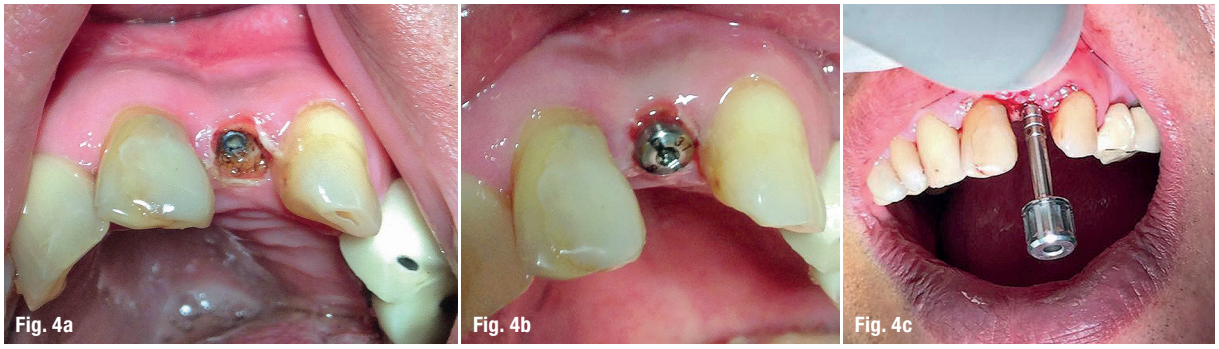


Figs. 3a–c: The osteotomy was prepared and the implant was placed using the Dr Mir laser-assisted dental implant technique. **Fig. 3d:** The surgery site was closed with aesthetic sutures in order to increase the attached gingiva and to support the formation of interdental papillae.

teeth checked in more than 20 years. At the beginning of the treatment, a radiograph was taken and the surgery was digitally pre-planned (Fig. 2). The bone was then prepared using laser-induced shock waves. In addition, soft-tissue management proved to be the key to success for achieving highly aesthetic results. The final drilling was done, and the Dr Mir laser-assisted dental implant technique was then employed for surgery using 9 J/cm^2 laser irradiation. The implant was placed according to the recommendations of the implant manufacturer (Figs. 3a–d). At the second treatment session, which was carried out two months after the initial appointment, the healing cap was removed and the abutment was seated (Figs. 4a & b). A laser set to 4 J/cm^2 was used to form the gingival margins and an impression was taken of the same area (Fig. 4c). The laser was used in a sweeping motion around the cover screw in order to promote immediate healing. After a few days, the digitally designed crown was placed (Fig. 5). After five years, the patient came to the follow-up appointment fully satisfied with his implant (Fig. 6). He even considered undergoing further implant surgeries in the posterior area in the future.

Discussion

The technique introduced in this article can be carried out using various lasers. If an Er:YAG laser is used, however, it should be set to SWEEPS mode, as this has proven to be the best setting for removing the debris of soft tissue from the extracted tooth socket in order to increase the success rate of immediate implantation. The SWEEPS mode (shock wave enhanced emission photoacoustic streaming) uses the power of the Er:YAG laser to create non-thermal photoacoustic shock waves



Figs. 4a–c: After a successful healing period, the abutment was placed and an impression was taken at the second appointment.

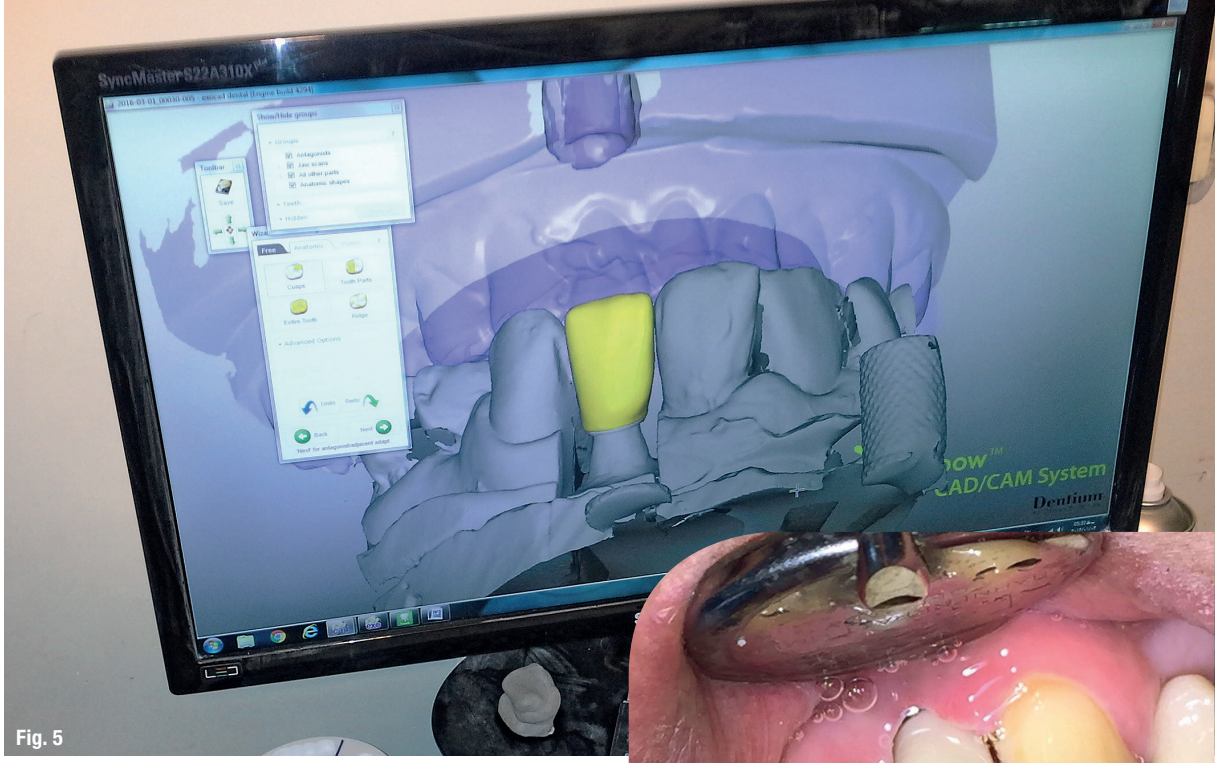


Fig. 5

Fig. 6

Fig. 5: The crown was digitally designed using CAD/CAM software.
Fig. 6: The result at the follow-up after five years was highly aesthetic.

within the cleaning and debriding solutions introduced in the bone that is prepared for implant insertion by QSP (Quantum Square Pulse). It is suggested that preparing bone with QSP mode is safer, for it achieves five shorter pulses with the same energy but with significantly higher peak powers. This makes it possible to work with low energy but with high peak powers, higher precision and higher speed, compared with other hard-tissue pulsing modes for other lasers. Higher energy density and higher peak power ensures cold, effective ablation, resulting in less thermal damage and less pain. Moreover, a common problem that might lead to implant failure is that microscopic particles of soft tissue can be pushed inside the prepared bone. With SWEEPS mode and the PIPS protocol (Photon-Induced Photoacoustic Streaming), soft tissue particles can be removed from the prepared bone area with the Er:YAG laser before the implant is inserted. In this case, the procedure was carried out with an energy density of 9 J/cm^2 for semi-punching both the soft tissue and the bone during the first surgery session. At the second appointment, the laser was set to a lower energy density of 4 J/cm^2 in order to aid immediate healing. Dental lasers have a variety of clinical benefits, not only for the clinician but for the patient as well. Laser irradiation with a low energy density has proven to have analgesic effects. In addition, it decreases inflammation and accelerates the healing process owing to its biostimulating properties.

Conclusion

When it comes to single-tooth implant restorations in the anterior area, the Dr Mir laser-assisted dental implant technique can be considered a convincing alternative to conventional treatment methods for achieving aesthetic results.

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Literature

about the author

Dr Maziar Mir (DDS, M.Sc.) is a dentist from Iran. He obtained his DDS in Iran in 2000 and his M.Sc. at RWTH Aachen University in 2006. He completed his postdoctoral fellowship at the University of California, Irvine, in the US in 2009. In addition, he obtained his PhD from RWTH University in 2012, qualifying for habilitation. He won two prizes for his works on SWEEPS and PIPS. He currently runs a private clinic in Tehran in Iran.

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