Er:YAG Garnet in laser-assisted crown lengthening

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Fig. 1

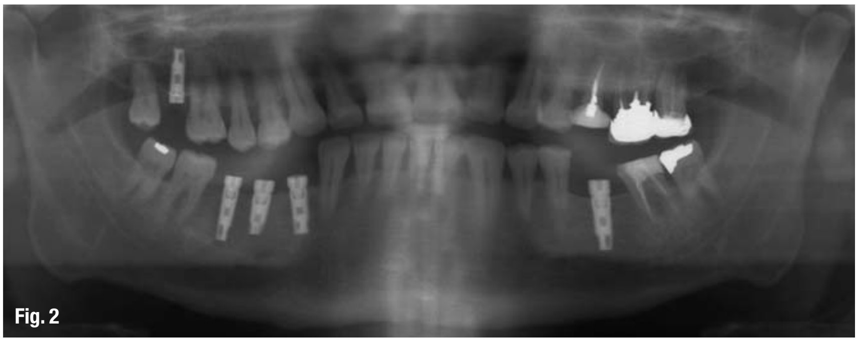


Fig. 2

Fig. 1_Patient presentation.
Fig. 2_Insertion of five implants.

_Introduction

This article describes and demonstrates the use of the Erbium:YAG 2,940 nm laser system (LiteTouch, Syneron Medical Ltd.) as a central tool in the treatment of osseous crown lengthening, and the advantages this wavelength offers versus the use of conventional methods.

_Objectives and methods

Crown lengthening is a surgical procedure employed for the removal of periodontal tissue, in order to increase the clinical crown height. It is the most frequently used and valuable periodontal surgical procedure related to restorative treatment.[1-4]

The objectives of clinical crown lengthening include

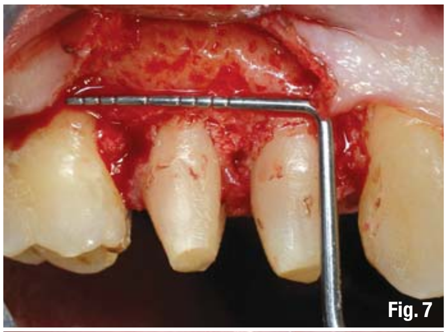
- Removal of subgingival caries
- Preservation and maintenance of restorations
- Cosmetic improvement
- Enabling restorative treatment without impinging on biologic width
- Correction of the occlusal plane
- Facilitation of improved oral hygiene

Fig. 3_Teeth #14 and 15 in occlusion.
Fig. 4_Use of the diode laser to mark the border for incision of the soft tissue.
Fig. 5_Incision border.

Fig. 3

Fig. 4

Fig. 5



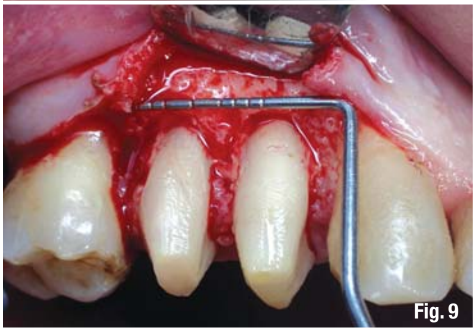


Fig. 6_Incision.
Fig. 7_Lifting the mucoperiosteal.
Fig. 8_Bone ablation.
Fig. 9_Bone level after ablation.
Fig. 10_Immediately post-op.
Fig. 11_One week post-op.

There are two methods of crown lengthening:
- Orthodontic—coronal extension
- Surgical—apical extension.

Clinical considerations
- Importance of the tooth
- Subgingival caries
- Clinical crown/root ratio
- Root length and morphology
- Residual amount of bone support
- Furcation involvement
- Tooth mobility
- Aesthetic demands
- Post-op maintenance and plaque control.

_Biologic width and aesthetic dentistry

The clinician must create a symmetrical and harmonious relationship between lips, gingival architecture and positions of the natural dentate forms. Spear et al.[5] have referred to this diagnostic methodology as facially generated treatment planning, where the maxillary central incisal edges determine where the soft tissue, i.e., gingiva, and bone should be positioned.[6]

To utilize crown lengthening, it is important for the restorative dentist to understand the concept of biologic width, indications, technique and other principles.[7-9] To maintain healthy periodontal tissue, the attached gingival and biologic width must be considered. Biologic width is measured from the bottom of the gingival sulcus to the alveolar crest and is maintained by homeostasis.[10,11] This width consists of the epithelial attachment to the tooth surface and its connective tissue. The average width is 2.04 mm. Impinging biologic width may cause periodontal tissue destruction; therefore, in crown lengthening, the position of the margin is important.

_Methods of clinical crown lengthening

As mentioned above, there are two methods to lengthen a crown: coronal extension and apical extension. Apical extension of the crown is achieved by surgery, with or without osseous resection. In apical extension there are two methods:

- Open technique—patients who exhibit asymmetrical gingival levels, those with greater than 3 to 5 mm of maxillary gingival display, or both may be candidates for surgical gingival and/or alveolar bone repositioning to improve their aesthetics.
- Closed technique—for minor localized biologic width and/or aesthetic gingival zenith corrections. Can be used in lieu of a flap procedure to make the correction and complete the restorative process without the necessary healing time required for open crown lengthening surgeries.[12]

_Case presentation

This clinical report describes a situation in which a crown lengthening procedure was successfully performed with the Er:YAG laser (LiteTouch, Syneron Medical Ltd.) as a principal auxiliary tool, and the advantages of the 2,940 nm wavelength versus conventional methods.


Fig. 12


Fig. 13


Fig. 14

Fig. 12_Four months post-op.
Fig. 13_Nine months post-op.
Fig. 14_Nine months post-op X-ray image.

Examination

Clinical examination of a 57-year-old male revealed missing teeth at the locations #17, 36, 44, 45 and 46 with overeruption of teeth # 14 and 15 (Fig. 1). Radiographic examination of the area showed overeruption of teeth 14 and 15 with the alveolar bone.

Treatment options

The treatment options available in this case were:

- Insertion of implants and metal-ceramic crowns at the locations of teeth #17, 36, 44, 45 and 46.
- In addition to option one above: crown lengthening for teeth #14 and 15 and covering them with metal-ceramic crowns.

Following discussion with the patient and evaluation of the possibilities for success, it was decided to perform crown lengthening. Treatment would involve the use of the Er:YAG laser to perform the following steps, based upon accepted research:

- Flap incision[13-15]
- Ablation of soft tissue around the teeth after raising a flap[16-18]
- Remodelling, shaping and ablating of the bone.[13,15,19,20]

Treatment

All five implants were placed in one sitting (Fig. 2). Crown lengthening was performed three weeks postop (Fig. 3). Laser operating parameters employed for the various surgical stages were as follows:

- Flap Access: Wavelength: 2,940 nm (Er:YAG), 600-micron sapphire tip, contact mode; 200 mJ per pulse at 35 Hz. Total power: 7 Watts.
- Soft Tissue Removal: Wavelength: 2,940 nm (Er:YAG), 1,300-micron sapphire tip, non-contact mode; 400 mJ per pulse at 20 Hz. Total power: 8 Watts.
- Bone Surgery: Wavelength: 2,940 nm (Er:YAG), 1,300-micron sapphire tip, non-contact mode; 300 mJ per pulse at 20 Hz. Total power: 6 Watts.

With the assistance of a diode laser operating at a power setting of 2.4 W in contact mode, the location of the incision was marked (Figs. 4 and 5). An incision was made with the laser (after anaesthesia) at the buccal and palatal side of teeth #14 and 15 (Fig. 6) and a vertical incision was not required. The buccal and palatal flaps were lifted and the area was explored (Fig. 7); there was soft tissue around the neck of the teeth. The soft tissue was ablated using the laser. Vaporization of soft/granulation tissue (if any exists) after raising a flap is efficient with the Er:YAG laser, offering a lower risk of overheating the bone than that posed by the diode or CO_2 lasers[23] and often obviates the need for hand instruments. Results from both controlled clinical and basic studies have pointed to the high potential of the Er:YAG laser and its excellent ability to effectively ablate soft tissue without producing major thermal side effects to adjacent tissue have been demonstrated in numerous studies.[16-18]

The Er:YAG laser was aimed at the surface of the exposed bone which was ablated in non-contact mode (Fig. 8). Studies have shown that Er:YAG laser energy effects on bone include bacterial reduction.[22] Following this, all accessible bone surfaces were exposed to laser energy to ablate necrotic bone and to shape and remodel the surface in accordance with established clinical protocols.[13,15,20]

The bone level around teeth #14 and 15 fits to the bone level of teeth #13 and 16 (Fig. 9). The mucoperiosteal flap was re-positioned and sutured with silk 3-0, paying particular attention to primary closure of the flap (Fig. 10).

Postoperative instructions

The patient was prescribed antibiotics to avoid infection and painkillers for pain. Instructions were given to rinse with Chlorhexidine 0.2 %, starting the next day for two weeks, three times per day.

Management of complications and follow-up

The following day the patient reported moderate pain and moderate swelling. There was no tissue bleeding and the site was closed. The flap was showing signs of attachment and was healing nicely. At seven days post-op, the patient returned for inspection and removal of sutures. The swelling had resolved and healing was progressing well (Fig. 11). After five months, the soft tissue was healed completely without complications (Fig. 12). The soft issue had healed over the bone and there were no bony projections observed under the soft tissue. The prognosis is excellent. An impression for two metal-ceramic crowns was taken five months post-op (Fig. 10). An aesthetic result was achieved (Figs. 13 & 14).

_Conclusion

The Er:YAG laser system (LiteTouch, Syneron Medical, 2,940 nm) can be employed as an auxiliary tool for the purpose of crown lengthening and has been shown to be effective and safe. The use of the LiteTouch wavelength for these procedures presents many advantages as opposed to conventional methods, including enhancement of the surgical site and less bleeding during the operation, providing the surgeon with a better field of visibility and reducing patient discomfort during use. In addition, anecdotal claims have been made that postoperative effects such as pain and swelling are less pronounced. Finally, the laser offers the dental surgeon enhanced ease of use with the hand piece's 360° swivel capability._

Editorial note: A complete list of references is available from the publisher.

_contact laser

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