Blue light laser assisted crown lengthening in restorative dentistry

By Dr. Philipp Skora, Dr. Dominik Kraus, PD Dr. Jörg Meister & Prof. Matthias Frentzen, Germany

Abstract
Basic investigations of the laser-tissue interaction of a new type of laser device with a wavelength of 445 nm—the blue light spectrum—promise considerable advantages in comparison with infrared laser systems due to the known optical parameters of oral soft tissue. The procedure for a comprehensive laser-based gingivectomy before restorative treatment using this new type of laser is presented in the following case report. Due to the outstanding haemostasis with the blue light laser, both gingivectomy and adhesive filling treatment were possible in only one session.

The follow-up examination showed the rapid healing of the wound with no complications and with no postoperative gingival recession. The treatment led to a very good aesthetic result at a moderate effort.

Introduction
Blue light emitting diode lasers present an innovative alternative to the already established diode laser systems with wavelengths within the infrared spectrum.

Due to the strong absorption of blue laser light in oral soft tissue, the cutting capacity is improved when comparable laser parameters are used. Blue light lasers have very powerful coagulation effects that enable blood-free work. In addition, the high antimicrobial effect of blue light has been demonstrated in many fundamental studies. Due to these specific characteristics, blue light lasers are extremely suitable for corrective periodontal surgery in terms of gingivectomies. In contrast to electrosurgery, laser assisted plastic-aesthetic periodontal surgical procedures do not cause problems of electro magnetic interactions that could in turn present a contra-indication in the case of patients with symptoms of cardiac disease. In the case of multi-morbid patients who are frequently prescribed anti-coagulants, the danger of secondary haemorrhage can be minimised. In addition, in these cases, a bloodless surgical field can be created ad hoc, so that moisture-sensitive restorative measures (adhesive dentistry) can be carried out. In general, for multi-morbid patients, it is important that restorative procedures can be carried out in a short time and that the use of anaesthetics should be reduced to a minimum. Excision wounds should heal in a short time period. A dry environment is advantageous, in particular when a dental rubber dam cannot be used.

In case of extended subgingival loss of dental hard tissue, e.g. as a result of carious defects, it is always necessary to enable a visual inspection of the preparation margin before the restoration can be placed.

Furthermore, a bloodless, clean, and dry adhesive surface must be guaranteed before application of...
Case report

A 72 year old patient visited the Dental School of the University of Bonn to obtain a dental consultation regarding periodontal aspects. The medical history was unremarkable. The patient did not suffer pain. Among other things, insufficient composite restoration in the anterior tooth region of the upper jaw was noticeable at the initial examination. In addition, subgingival carious lesions in the anterior tooth area were found in the vestibular marginal area in the X-ray image (Figs. 1a–e). Teeth 11 and 21 reacted positively to a sensitivity test, in contrast to tooth 11. The probing depths of the teeth 11 and 21 were 4–5 mm. The treatment plan was explained thoroughly to the patient. In the first session, tooth 11 was trepanated as part of an emergency procedure. After exposure of the root canal, it was rinsed with sodium hypochlorite and calcium hydroxide paste. After the primary healing, approximately two weeks after treatment or at the follow-up inspection after three months. Gingival colour and surface texture (gingival stippling) corresponded to a healthy appearance (Fig. 8). To ensure long-term good oral hygiene and to prevent additional gingival recession at 11/21 in a further step a frenectomy (laser-assisted) should be performed.

Discussion

The presented treatment protocol for laser assisted gingivectomy enabled the badly destroyed teeth 11 and 21 to be restored in an aesthetically satisfactory manner. Due to the safe procedure and the drying of the surgical field after laser assisted excision, adhesive fillings were placed in the same session and exhibited no discoloration in the marginal zone, even after three months. This indicates a good bonding between the restorative material and the dentin. There was only little discomfort for the 72-year-old patient which derived from this complex therapy. After an emergency treatment, definitive rehabilitation, including adhesive restorations and endodontics, was carried out in two sessions. The patient did not report any discomfort related to the laser treatment. The patient’s aesthetic appearance in the anterior teeth of the upper jaw was restored with moderate means. This treatment procedure improves the patient’s compliance, because it allows the patient to partake in a systematic care and treatment concept, which enables the continuation of additional necessary treatment measures.

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Prof. Matthias Frentzen
Welchstrasse 27
53111 Bonn, Germany
Tel.: +49 22828722470
frentzen@uni-bonn.de
Root perforation repair has historically been a treatment with a low success rate; however, recent techniques and materials utilized in root perforation repair, have dramatically improved the prognosis of both surgical and non-surgical procedures.

Root perforation is defined as an artificial communication between the root canal system to the supporting tissues of teeth often caused by using rotary burs inside root canals.

In my practice, I have found lot of perforations caused by an inappropriate post space preparation for permanent restoration of endodontically treated teeth. They are located in the middle part of the canal and, according to my personal statistic, 80 per cent of the cases involve the first lower molar: considering this tooth, 60 per cent of perforations are in the mesial root and 40 per cent in the distal root and they are always generated by an over preparation of post space that has not taken into consideration the geometry of the cross-sectional anatomy of the lower first molar. Another consideration is that large sized perforations may not respond to repair as well as smaller ones.

**Diagnosis**

Bacterial infection emanating either from the root canal or the periodontal tissues, or both, prevents healing and brings about inflammatory sequels where exposure of the supporting tissues is inflicted. Thus, painful conditions, suppurations resulting in tender teeth, abscesses, and fistulae including bone resorptive processes may follow (1). A narrow isolated periodontal defect is a possible sign of root perforation. To determine locally isolated vertical bone losses, periodontal probing should be carried out by walking the probe around the tooth while pressing gently on the floor of the sulcus (2).

**Fig. 1:** In the first lower molar an X-ray can often show a bone loss between roots and diagnosis is easier than other teeth.

**Fig. 2:** As accurate detection of root perforations and determination of location are crucial to the treatment outcome, a paper is enough. The appearance of blood in the middle part of it is the perfect sign for a right diagnosis, detection and location of a perforation.

**Fig. 3:** The second step is represented by a conventional RCT, but obturation is done with last part of a gutta percha cone, starting with warm gutta percha condensation deeper than the perforation level avoiding any contamination of perforation area with sealer and GP. A plugger is used for GP condensation.

**Fig. 4:** During the third step MTA is positioned with MAP system. The system consists of a stainless steel or NiTi applicator with a bayonet catch for several exchangeable applicator cannulas (needles). Inside the cannula there is a plunger made in polymer that is longer than cannula providing a complete extrusion of internal material. The MTA can be taken from a dispenser thrusting the tip into the repair material and placed inside the canal in a sharp way pressing syringe piston to expel the material. An endo Micro Brush can be used to gently pack the MTA or a plastic carrier can be used for a stronger condensation. MTA must be placed to all the extension of perforation.

**Fig. 5:** The last step is represented by backfilling the coronal part with GP or composite material in a second visit.

**By Dr. Riccardo Tonini, Italy**

A clinical case that explains the technique step by step.

**Root canal repair with the MTA sandwich technology**

**Fig. 1:**

**Fig. 2:**

**Fig. 3:**

**Fig. 4:**

**Fig. 5:**
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