Blue light laser-assisted crown lengthening in restorative dentistry

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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 post-operative 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 contraindication in the

Figs. 1a–e: X-rays of the upper jaw.—Subgingival carious lesions at 11 and 21.
case of patients with symptoms of cardiac disease. In the case of multimorbid patients who are frequently prescribed anticoagulants, 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 restorative material. Here, laser-assisted procedures provide a fundamental advantage in comparison to classical surgical procedures. Adequate haemostasis after soft tissue excision with the scalpel, scalers and cuvettes is often not achievable by styptics.

This case study presents a treatment protocol for restorative and endodontic treatment of patients with extensive subgingival carious lesions in the anterior tooth area.

Case report

A 72-year-old patient visited the Dental School of the University of Bonn to obtain a dental consultation regarding prostodontic aspects. The medical history was unremarkable. The patient did not suffer pain. Among other things, insufficient composite restoration in the anterior tooth regions of the upper jaw were noticeable at the initial examination. In addition, subgingival probing showed defects in dental hard tissues at 11 and 21. For tooth 11, a fistula and an apical radiolucency were found in the vestibular marginal area in the X-ray image (Figs. 1a–e). Teeth 12 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 NaOCl and calcium hydroxide was applied. Ahead of this emergency endodontic procedure, the carious lesions on 11 and 21 were excavated incompletely and treated temporarily with glass ionomer cement.

The patient came for further treatment five days later. The fistula on 11 had closed, clinical symptoms were no longer present (Fig. 2). After an infiltration anaesthesia (1.8 ml UDS), the subgingival carious defects in teeth 11 and 21 were visualised in a gingivectomy (Fig. 3). For both teeth, approximately 4 mm of soft tissue had to be removed to expose the affected area. The gingivectomy was carried out using a 445 nm diode laser (Sirona K-Laser blu, Sirona, Bensheim, Germany) with a power output of 1.5 W in cw mode and an application tip with a diameter of 320 μm. This device is a pre-serial model equivalent to SIROLaser Blue (Sirona, Bensheim). The resection was carried out in six minutes. The surgical procedure was performed with no pain. After finishing the gingival excision, the surgical field was bloodless and dry (Fig. 3), so that the temporary fillings at 11 and 21 could be removed and the caries completely excavated under visual control. The defects were treated with adhesive...