A variety of photo-
coagulation techniques

Haemostasis in oral soft tissue and extraction socket

Authors: Chaivasan Malakam, Nuttakarn Rungrojwittaya, Nattaya Sanposh & Sajee Sattayut, Thailand

Introduction

There is a variety of surgical procedures, such as soft tissue biopsy and surgical extraction, which usually results in difficulties for haemostasis. One of the major concerns in oral surgery is to minimise bleeding and postoperative complications. Currently, a number of laser wavelengths have been used in oral surgery and dentistry, including CO\(_2\) laser, Nd:YAG laser, argon laser, diode lasers in various wavelengths, Er:YAG laser and potassium titanyl phosphate (KTP) laser. Their applications were soft tissue procedures, such as gingivectomy and gingivoplasty, excision of tumors and lesion, incisional and excisional biopsies, frenectomy, control of bleeding in vascular lesions, arthroscopic temporomandibular joint surgery, caries diagnosis and removal.\(^1,2\)

The photothermal reaction, which depended on the tissue absorption of the laser energy, played an important part in the laser-surgery procedure with haemostasis.\(^3\) This reaction was mainly applied in soft tissue surgery comprising 1) photoablation, 2) photovaporisation, and 3) photocoagulation. Each reaction or a combination of reactions occurred with varied laser parameters and procedures.

Regarding the procedure with pure photocoagulation, there have been various techniques of laser application\(^4,5\) or light-emitting diodes in dental prac-

---

Fig. 1: Left lateral border of the tongue with 6 mm and 2 mm in diameter of leukoplakia in the tongue.

Fig. 2: Buccal mucosa with a 7-mm diameter and whitish moderate-thickening lesion.

Fig. 3: Post-CO\(_2\) excision of the lesion was completed with no active bleeding.

Fig. 4: Intra-operation of CO\(_2\) excisional biopsy (photoablation).
 hace taken, which were well absorbed by haemoglobin for achieving haemostasis after oral surgery. In the following case reports, we present a variety of photocoagulation techniques in cases of soft tissue biopsy, simple extraction socket and surgical removal of the wisdom tooth involving hard tissue surgery. The clinical outcomes of haemostasis and patient satisfaction are also reported.

Case 1: Photocoagulation for soft tissue haemostasis in excisional biopsy by LED light unit

A 65-year-old male patient presented at the Department of Oral and Maxillofacial surgery, Faculty of Dentistry Khon Kaen University, with a whitish lesion at the left lateral border of the tongue. In the past three months, the patient was treated with low intensity laser therapy and topical steroid for the chronic ulceration at the left lateral border of the tongue. The ulcer was healed with a coverage of the whitish patches. There was also a whitish lesion at the buccal mucosa of the left cheek with intermittent pain on palpation.

The clinical examinations showed three non-scrapable whitish lesions as follows: 1) a moderate thickening whitish patch at the left lateral border of the tongue, measuring approximately 6 mm in diameter; 2) a mild thickening whitish lesion at the left ven-

---

**Fig. 5**: Immediate postoperative view; A) oozing in the surgical area after CO₂ laser photocoa glulation; B) coagulative surgical area after CO₂ laser vapourisation.

**Fig. 6**: Immediate post-photocoa glulation using LED showed an initial blood clot formation without oozing.

---

**AD**

**When the drugs don’t work**

Low Level Laser and LED Photobiomodulation

Low Level Laser and LED Photobiomodulation does something that drugs and surgery don’t, this treatment actually heals the patient. Nerve injuries, wounds that will not heal, neuropathic pain, dry mouth, inflammatory pathologies that do not respond to drug therapies often respond well to this treatment. Our large online treatment library makes it easy to use, which means it can be delegated to the dental nurse / technician.

- TMD
- Iatrogenic nerve injury repair
- Dentin hypersensitivity
- Burning mouth syndrome
- Oral lichen planus
- Trigeminal neuralgia
- Post operative pain
- HSV
- Osseointegration titanium implants
- Orthodontic tooth movement
- Periodontitis
- Dentin formation
- Gingivitis
- Denture stomatitis
- Oral mucositis
- Xerostomia & hyposalivation
- Dysphagia
- Radiation dermatitis
- BRONJ

*www.thorlaser.com*
The case involved a moderate thickening whitish patch at the buccal mucosa of the left cheek, measuring approximately 7 mm in diameter (Fig. 2). The surgical procedure involved local anaesthesia (2% lidocaine with epinephrine 1:100,000) and excisional biopsy of the lesions at the buccal mucosa by using 10,600 nm CO$_2$ laser at 5 W and continuous wave. Then tissue coagulation for haemostasis was undertaken using a defocused CO$_2$ laser at 3 W and continuous wave. The ablation with haemostasis was easily achieved (Fig. 3).

At the left lateral border of the tongue, the photocoagulation was undertaken using a 10,600 nm CO$_2$ laser at 5 W and continuous wave (Fig. 4). After excisional biopsy, there was an active bleeding over the lesion because of a highly vascularised tissue (Fig. 5-A). A blue light-emitting diode (LED) for dental practice (WOODPECKER$^\text{TM}$ LED light unit; a single blue light source non-heat producing, energy density 1,000-1,200 mW/cm$^2$) was irradiated for 5 seconds to the oozing area. This was repeated for four episodes to gain an initiating blood clot (Fig. 6). For the smaller lesion at the ventral side of the tongue, the vapourisation technique was applied using 10,600 nm CO$_2$ laser at 3 W and continuous wave. There was no active bleeding at the surgical site (Fig. 5).

Clinical results
The outcome after using laser for surgical removal of the soft tissue lesion showed ablation with haemostasis except the lesion at lateral border of the tongue, a site with high vascularity. In this case, the irradiation of LED at the active bleeding area promoted blood clot formation without producing any clinical soft tissue destruction. Furthermore, soft tissue biopsy using laser had many advantages, for example, providing a dry clean surgical field enhancing visibility for the operator and reducing operation time. At the two-week follow-up, there was soft tissue healing with some coagulum coverage and no clinical signs of inflammation or infection (Figs. 7a & b). The histopathology investigation was obtainable. In this case, epithelial keratosis was diagnosed. The five-month follow-up after excisional biopsy showed complete healing of the mucosal coverage with some thin whitish areas and without tethering of the scar (Figs. 8a & b). Based on the histopathological finding, these should be in a condition for observation.

Patient satisfaction
Without any efforts to stop bleeding such as biting on gauze pads, he felt more confident with regard to the operation being necessary and agreed with routine follow-up. There was still no pain and bleeding interfering routine activities after laser surgery.

Case 2: Photocoagulation for hard tissue haemostasis after routine tooth extraction by LED light curing unit
The second case study was a 66 year-old woman who had a history of diabetes mellitus and hypertension. The upper left canine and second premolar were diagnosed “chronic periodontitis”. The tooth extraction was requested as a treatment. Routine tooth extraction was performed under local anaesthesia; 2% mepivacaine with 1:100,000 epinephrine. The LED at an energy density of 1,000-1,200 mW/cm$^2$ was irradiated at the extraction socket for 5 sec per cycle for a total of four episodes.

Clinical results
There was an oozing of bleeding after extraction (Fig. 9). An initial clot occurred in the bony socket immediately after LED photocoagulation procedure (Fig. 10).

Patient satisfaction
The patient seemed to be anxious about the operation at the beginning. After using LED light photocoagulation to accelerate blood clot formation into the sockets, she seemed more comfortable and satisfied with the procedure with no need to be worried about pressure compression by biting a gauze.
Case 3: Photocoagulation for surgical site after surgical removal of impacted tooth by 790 diode laser

A 19 year-old woman with no systemic disease presented with a lower right third molar partial bony impaction. This needed to be removed by surgical extraction. The standard procedure including flap operation, osteotomy and tooth section was conducted under local anaesthesia; 2% mepivacaine with 1:100,000 epinephrine. After the tooth was delivered, there was bleeding in the bony socket (Fig. 11). A 790 nm diode laser at 0.3 W was used to irradiate the socket and wounded area for 30 sec per cycle, for a total of two episodes. An initial blood clot was found (Fig. 12).

Clinical results
There was no active bleeding, but an immediate haemostasis in the surgical removal area, which was different compared to our experiences of using standard technique. Also the healing in a week was favourable (Figs. 13a & b).

Patient satisfaction
The patient seem to be satisfied with immediate haemostasis after the operation.

Case 4: Photocoagulation for bony socket and soft tissue haemostasis after surgical removal of soft tissue impaction by 808 nm diode laser

A 26 year-old woman with no systemic disease had a chief compliant of a lower right third molar soft tissue impaction. The surgical removal was required for treatment. The standard procedure including flap operation osteotomy and tooth section was conducted under local anaesthesia; 2% mepivacaine with 1:100,000 epinephrine. After the tooth was delivered, there was bleeding in the bony socket (Fig. 14). An 808 nm diode laser at 0.5 W was used to irradiate the socket and wounded area for 5 sec per cycle and a total of four episodes. The initial blood clot with some carbonisation was found (Fig. 15).

Clinical results
There was no active bleeding and an immediate haemostasis in the surgical removal area, which was different from our experiences of using standard technique.

Patient satisfaction
The patient seem to be satisfied that there was no bleeding after the operation.

Discussion
Although the CO$_2$ laser was commonly used in the surgical removal of intraoral lesions due to the limitation of lateral damage, which made specimen available for histopathological investigation together with the ability of sealing of vessels up to 500 micron in diameter, we experienced insufficient tissue coagulation at the lateral border of the tongue in case 1. In this case, we used the LED photocoagulation in order to avoid photoablation and carbonisation effect.

The benefits of using lasers in oral surgical procedures were clinically significant to both the dental surgeons and the patients. All techniques and wave-
lengths used in these case reports were able to create immediate haemostatic effect on soft tissue and bone socket without any complication. It was noticed that, using 808 nm diode laser, at least the parameter used in case 4 was able to produce some carbonisation, while LED and 790 nm did not show such an effect. Therefore, using 800 nm diode laser for photo-coagulation may make reducing irradiation time or power necessary to avoid a photovapourisation effect.

With regard to wound healing, the results from soft tissue laser biopsy were favourable. These were supported by in vivo studies showing laser wounds found a significantly lower number of myofibroblast and inflammatory cells, resulting clinically in less wound contracture and less post-operative complication for inflammation.\textsuperscript{10,11} In our reports, these clinical benefits were also found in the cases limited to photocoagulation such as case 3.

**Conclusion**

Both LED (single blue light source, non-heat producing) and diode laser of 790 nm at 0.3 W and 808 nm at 0.5 W were able to produce localised coagulation and enhance haemostasis in soft tissue after excisional biopsy and bone-socket due to tooth extraction and surgical removal. The results showed successful management in terms of clinical outcome of haemostasis and healing together with patient’s satisfaction.

**Acknowledgement**

We absolutely thank Dr. Rattiya Hathai-dechadussadee, postgraduate student in oral and maxillofacial surgery, Faculty of Dentistry, Khon Kaen University, for being an operator in the surgical removal of impaction and all members of staff in LDRG-KKU and Faculty of Dentistry, Khon Kaen University. We are also very thankful for every patient who trusted us and permitted data to be reported.

**contact**

Assoc. Prof. Sajee Sattayut DDS, PhD
Lasers in Dentistry Research Group, Khon Kaen University
Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Khon Kaen University
123 Mittraphap Rd. Amphur Muang
Khon Kaen, Khon Kaen, Thailand 40002
Tel.: +66 0935466178
Fax: +66 43202862
sajee@kku.ac.th

---

**Literature**

Fig. 14: After surgical removal of the lower right third molar impaction, it was oozing via the bony socket.

Fig. 15: Initial blood clot formation without oozing was found immediately after post-photocoagulation using 808 nm diode laser.