

Photobiomodulation Therapy for Wound Healing in Crown Lengthening Surgery: A Case Series

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Introduction: Photobiomodulation (PBM) has been considered a popular technique for reducing the post-operative complications after periodontal surgeries. The aim of this case series study was to evaluate the PBM effect on accelerating wound healing after crown lengthening procedure. **Materials and Methods:** Four patients were referred to a private office for crown lengthening surgery. After completion of medical history and oral examination, the surgery for patients were done. Then, PBM was done by diode laser at 980 nm, in continuous mode with output power of 0.3 w for 20 sec. **Results:** On follow up session after 2 weeks, satisfactory results of PBM were detected in all patients. **Conclusion:** The application of 980 nm diode laser for PBM after oral soft tissue surgeries can be beneficial due to accelerating wound healing.

Keywords: Crown lengthening; Oral surgery; Photobiomodulation; Wound healing

Introduction

Crown lengthening is indicated for teeth with subgingival caries, fractures or both to help establish a biological width and, if required, a ferrule length (1). Also, in cases with delayed passive eruption resulting in short clinical crowns and excessive gingival display, esthetic enhancement can be achieved especially in the anterior sextants (2). Crown lengthening involves various techniques such as gingivoplasty, gingivectomy, apically positioned flaps and osseous resection (1). This surgery is however, accompanied by pain, discomfort, stress and sometimes prolonged wound healing (3). Of concern to prosthodontists is the time after surgery that restorative and prosthetic treatments can begin. Studies have demonstrated that clinician must wait for a minimum of three months until the final vertical gain or rebound of supracrestal soft tissue (4). It has also been concluded that after 6 months, no further change in the level of free gingival margin is observed and periodontal tissue stability is achieved (5). Accelerating this procedure is thus appreciated. Photobiomodulation (PBM) is the application of low power monochromatic and coherent light irradiation for the purpose of tissue healing promotion, inflammation control and pain reduction (6). PBM is being extensively introduced into different areas of dentistry, including

surgical and non-surgical periodontal treatments (7). It has been shown to have effects on human gingival fibroblasts both in vitro (8) and to facilitate healing in clinical studies (9, 10) thus it could be an efficient treatment modality in delayed wound healing after crown lengthening. Commonly, for wound healing purposes, the wavelength of 660 nm was used. Recently, the application of diode laser with higher wavelength has gained special attention due to their capacity to activate the fibroblasts. In the study by Isman E *et al.* which evaluated the effect of four different wavelengths including 660, 808 980 and 1064 nm on healing of mucositis in an animal model concluded that 980-nm LLLT is more efficient in terms of cellular regeneration (11). In this case series, we report PBM with 980 nm for accelerating wound healing after crown lengthening procedure.

Materials and Methods

Case presentation

A total number of four cases, two males and two females were operated on and evaluated after 2 weeks for follow-up. The first case was a 37-year-old male patient referred to the department for crown lengthening of left maxillary first premolar for pre-prosthetic purposes (Figure 1A).



Figure 1. A) Preoperative view; B) Immediate after surgery; C) PBM; D) Follow up after 2 week



Figure 2. A) Preoperative view; B) Immediate after surgery; C) PBM; D) Follow up after 2 week

A complete medical history was carried out for each patient to rule out any systemic contraindication for surgery. After achieving anesthesia through 2% lidocaine, 1:100000 epinephrine (darupakhsh, Tehran, Iran) infiltration injection. After probing for determining of cemento-enamel junction and the points for doing the external bevel gingivectomy, the incision was made by a Kirkland knife (Figure 1B). The excess gingiva and interproximal incisions were completed by an urban interdental knife. The surgical site was under direct pressure by sterile gauze to achieve hemostasis. PBM was applied with a 980 nm diode laser (Wiser, Doctor smile, Italy), that was set 0.3 W, continuous wave (CW), energy density was 15.62 J/cm², for 20 seconds in non-contact but very close to the tissue, distance was approximately 1-2 mm, using PBM tips (Figure 1C). After PBM, there were no adverse effects. The patient was carefully followed up until complete healing occurred, with no complications documented. The area healed well after two weeks (Figure 1D). The second case was a 32-year-old female, requiring crown lengthening on second maxillary premolar on the right side (Figure 2A). Crown lengthening was carried out (Figure 2B) and PBM was applied (Figure 2C) as previously described. Figure 2D demonstrates the healed tissue after 2 weeks. A similar case was a 37-year-old male patient in need of a pre-prosthetic crown lengthening on first premolar of left maxilla (Figure 3A). After exposing necessary clinical crown and suturing the incision, PBM was applied (Figure 3B).

Results

Good tissue healing (re-epithelization without any sign of inflammation) was observed after 2 weeks as shown in Figure 3C. Lastly, a 37-year-old female received an aesthetic crown lengthening treatment (Figure 4A and 4B) and PBM was utilized to enhance the healing of tissues (Figure 3C). The final result of the treatment after 2 weeks is shown in Figure 3D.

Discussion

There have been many claims for the therapeutic effects of PBM on a broad range of disorders. Histologically, the exposure of low level laser, enhances fibroblast proliferation, collagen accumulation, angiogenesis and epithelialization (11-14). Moreover, it promotes the release of various growth factors such as TGF- β (15). Thus clinically, it results in a more accelerated healing procedure (16). These lasers are also shown to have anti-inflammatory effects which can be explained by their negative effect on PGE₂, IL-1 β production (17, 18). Locally, it reduces bradykinin, histamine while it boosts phagocytosis and lymphatic drainage (19, 20). Low level laser has been revealed to cause vasodilation as well as neovascularization thus preventing hypoxia and promoting tissue healing (21). In many oral surgeries, a reduced inflammatory response and a prompt healing is demanded. Thus the application of PBM or photobiostimulation seems



Figure 2. A) Preoperative view; B) Immediate after surgery; C) Follow up after 2 week

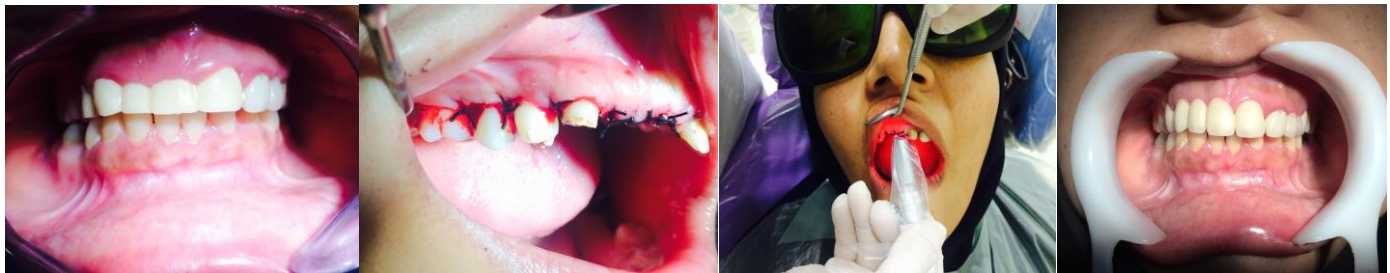


Figure 4. A) Preoperative view; B) Immediate after surgery; C) PBM; D) Follow up after 2 week

appealing. In a study by Fekrazad *et al.*, assessed the effect of low level laser therapy on post surgical pain and wound healing in patients after free gingival grafts concluded that the wound healing was achieved after 14 days in all cases in donor site and 1 month in recipient site (22). Wound healing can be achieved by the effect of photobiomodulation on cell proliferation, migration, and differentiation. Synthesis of collagen and formation of new blood vessels are the other factors that should be considered (24). In a study by Yildiz MS *et al.*, in 2018, used diode laser at wavelength of 810 nm, power of 0.1 W and energy density 6 J/cm². They concluded that the use of 810 nm diode laser provided less shrinkage of the graft dimensions. (23). Crown lengthening is a known procedure indicated for teeth with subgingival caries, fractures or both. It is considered a necessary pre-prosthetic procedure to provide sufficient length for crown placement. In other words, the soft tissues surrounding the teeth as well as the bone and other periodontal tissues are moved further apically so that the restoration doesn't invade the biological width (1). In other cases, CL is conducted for aesthetic purposes where there is gingival overgrowth or a so called "gummy smile" (2). Electro surgery-aided or scalpel-facilitated CL is common today as well as application of soft tissue lasers (24). Post-operatively complaints of delayed healing, pain and stress is common among patients (25). The clinician also prefers healing and periodontal tissue stability to be achieved sooner so that the prosthetic treatments can begin.

Thus both patient and clinician can benefit from the application of PBM after the CL surgery. In a study by Ozcelik and his colleagues which irradiated diode laser (588 nm) after gingivoplasty resulted in less epithelium denuded areas and concluded that PBM significantly improved wound healing (9).

Conclusion

In our study, enhanced tissue healing was observed in all cases after the two-week follow-up. This case series demonstrated that patients with excessive gingival display or requiring pre-prosthetic CL, can be safely, easily, and effectively, treated with low level diode laser in the dental office resulting in accelerated healing and better results.

Conflict of Interest: 'None declared'.

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