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Research Article

Effects of Adjunctive Photobiomodulation Therapy on Free Gingival Graft: A Case Series Report

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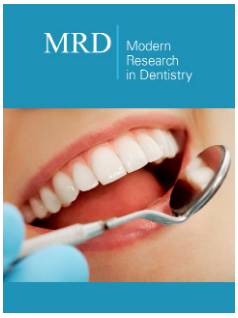

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Abstract

Introduction: This study aimed to investigate the efficacy of a 980-nanometer diode laser. Application for the Free Gingival Graft (FGG) treatment and assess the Adjunctive Photobiomodulation Therapy (PBMT) effects on accelerating wound healing, postoperative pain relief, and inflammation reduction.

Materials and methods: The FGGs method was applied to five cases involving mucogingival issues. First, graft margins were outlined on the palate using a tin foil template and the recipient bed was prepared, and FGG was obtained from the palatal area. After final graft adaptation, suturing was done, the recipient site was irradiated by the low-level 980nm diode laser with the following settings, 0.2W, 5.2J/cm^2, 10 seconds, and Continuous Wave (CW) mode in the same session and two weeks later in the follow- up session.

Result: Results were assessed after two weeks and six months following the operation, and a satisfactory tissue healing was seen in each participant.

Conclusion: This case series demonstrated that PBMT is a safe, minimally invasive, and helpful method for improving FGG survival in the recipient sites. Consequently, it can cause a significant reduction in the duration of the healing period and post-surgical complications such as pain and inflammation in the recipient site.

Keywords: Wound healing; Photobiomodulation therapy, Low-level laser therapy; Diode laser; Free gingival graft

Introduction

Gingival recession exposes the root surface to the oral cavity and results in many adverse effects, including root caries, dentinal hypersensitivity, and aesthetic concerns [1]. A sufficient width of keratinized, attached gingiva is essential to prevent the gingival recession [2]. The Free Gingival Graft (FGG) technique is commonly used to increase keratinized gingival width and create a sufficient area of attached gingiva [3]. Several complications have been reported in recipient sites during FGG procedure, including unexpected post-surgical swelling, ecchymosis, external root resorption, gingival surgical cysts, exostosis, which consequently may result in graft loss [4-8]. Although dimensional changes and shrinkage of the graft have been reported during the postoperative period, this could decrease the minimum amount of tissue required at the recipient site, leading to failure [9]. Low Level Laser Therapy (LLLT) which is recently known as Photobiomodulation Therapy (PBMT) stimulates photochemical changes in the cells, causing cellular proliferation, and reduces the time required for tissue re-

generation. Besides, the laser may stimulate healing by increasing the number of fibroblasts, collagen synthesis, and remodeling rates [10]. It also enhances new fibroblast proliferation, maturation, and attachment [11]. The suitable new blood supply in the recipient site after FGG plays an essential role in preventing graft shrinkage [12]. The PBMT enhances neovascularization and increases collateral circulation from the periosteal and connective tissue beds which will decrease graft shrinkage [13].

Furthermore, PBMT inhibits the production of interleukin 6 (IL-6), monocyte chemoattractant protein-1 (MCP-1), IL-10, and tumour necrosis factor α (TNF-α) during the inflammatory phase and therefore, has anti-inflammatory effects [14]. The PBMT normalizes vascular permeability wall, aids in edoema reduction, and enhances analgesia [15]. This case series study evaluates the therapeutic effects of the PBMT by using 980nm diode lasers, including, post-surgical wound healing levels and complications such as pain and inflammation after the FGG procedure.

Materials and Methods

From March 2019 to September 2019, five female cases with a mean age of 26.8 were included in this study. They were complaining of gingival recession and were referred to the private dental office. These patients did not have any history of systemic disease. The first instance included a female patient who was 27 years old and had gingival recession on her lower left incisor (classified as miller class III) (Figure 1A). First, nonsurgical therapy was completed and the necessary information on the cause of the gingival recession and the prevention methods was given to the patient. Although a standard toothbrush and dental floss were prescribed to maintain good oral hygiene. After four weeks, the surgical site has been assessed again for the plaque-free teeth (Figure 1B). Next, the recipient and donor sites were anaesthetized (2% lidocaine, 1:100000 epinephrine), and de-epithelialization in the recipient site was performed with a scalpel in the form of the split-thickness (Figure 1C). The graft margins were outlined on the palate using a tin foil template. The incision of the palate was made using a scalpel, and the graft with sharp margins and appropriate dimensions for the recipient site was prepared (Figure 1D). The FGG was sutured to the prepared recipient bed by using size 4-0 resorbable sutures (Polycolates coated, SUPABON, Iran) (Figure 1E). Then, the PBMT was irradiated to the recipient site immediately after surgery using 980nm diode lasers (Wiser, Doctor Smile, and Italy). The laser safety guidelines were followed to achieve complete safety [16,17]. The laser setting was set at the output power of 0.2W, the energy density of 5.2J/cm^2, and the irradiation time was 10s on each site. It was operated in non-contact mode but very close to the tissue (the average distance was 1-2mm), in Continuous Wave (CW) mode, and using PBM tip (0.384cm^2 in diameter). The irradiation was started from the borders of the graft and gradually was taken over the whole graft (Figure 1F). The images were obtained under identical photographic conditions just after the operation, two weeks later, and six months later. To eliminate inter-operative bias, a single surgeon performed all of the operations. Finally, the surgery site was covered with Perio-Pack, and postoperative instructions were given to the patient. In the follow-up session after two weeks, the Perio-Pack was removed, and the patient followed up for six months to assess the result of the treatment. For the rest of the cases, the same procedure was accomplished similar to the first case. The second case was a 24-year-old female complaining of the gingival recession on the mandible anterior incisors (classified as miller class II) (Figure 2). The third case was a 29-year-old female with gingival recession on the lower anterior incisors (classified as miller class II) (Figure 3). The Forth case was a 22-year-old female with the gingival recession on lower anterior incisor (classified as miller class I) (Figure 4). The fifth case was a 32-years-old female complaining of gingival recession on lower incisors (classified as miller class III) (Figure 5).

Figure 1: A) Before nonsurgical treatment, B) Preoperative view, C) De-epithelialization of the recipient site, D) Trimmed graft, E) Immediately after suturing, F) PBMT immediately after surgery, G) Follow up after two weeks.

Figure 2: A) Preoperative view, B) De-epithelialization of the recipient site, C) Trimmed graft, D) Immediately after suturing, E) PBMT immediately after surgery, F) Follow up after two weeks, G) Follow up after six months.

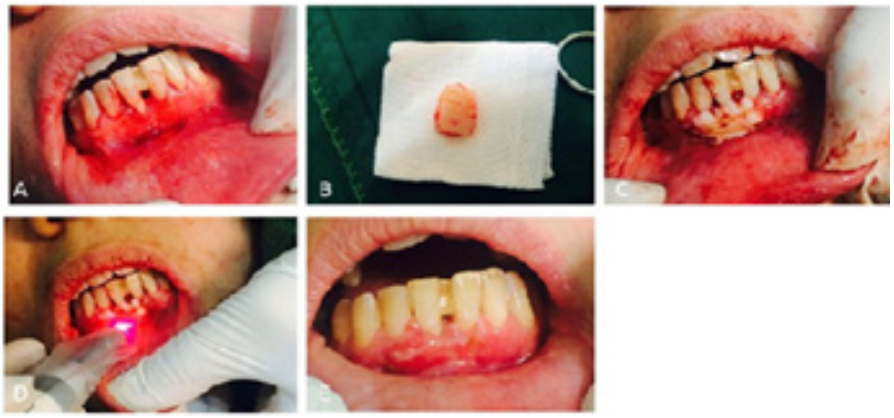

Figure 3: A) Preoperative view and de-epithelialization of the recipient site, B) Trimmed graft, C) Immediately after suturing, D) PBMT immediately after surgery, E) Follow up after two weeks.

Figure 4: A) Preoperative view, B) De-epithelialization of the recipient site, C) Trimmed graft, D) Immediately after suturing, E) Follow up after two weeks, F) Follow up after six months.

Figure 5: A) Preoperative view, B) De-epithelialization of the recipient site, C) Trimmed graft, D) Immediately after suturing, E) Follow up after two weeks, F) Follow up after six months.

Result

According to Figure 1G, the patients did not complain of pain or inflammation during the two weeks of the follow-up session. Additionally, in each case, good tissue healing was observed. The Results of the second patient after two weeks and sixth months are indicated in Figure 2F and Figure 2G, respectively.

Discussion

The present study aimed to assess the effect of PBMT on the healing process, reduction of pain, and inflammation after FGG on the recipient site. Multiple investigations about diode laser have proven the therapeutic effect of PBMT [18,19]. Histological evaluations revealed that after exposure to PBMT, collagen fibres, and fibroblasts accumulated faster than without this therapy, which led to an enhancement in angiogenesis and epithelialization [20]. Furthermore, it can accelerate circulation and microcirculation in the injured area so that it can speed up the tissue healing process [20-22]. FGG has been proven to be successful in the treatment of gingival recession, but it can cause discomfort and pain in the donor and recipient site. Pain is subjective, and it varies between people, different analgesics are used after the operation to control the pain, while it has many adverse effects on the gastrointestinal system [23]. Adjuvant PBMT is a reliable method for reducing post-operative pain by reducing biochemicals, edoema, and anti-inflammatory effects [22]. According to biochemical and histological experiments, PBMT can reduce inflammation by decreasing PGE2 and IL1-B production, assessed the effect of 808 nm PBMT (0.5W, 15 J/cm^2, for 30 s, and in CW mode) on post-operative tissue healing and pain level after FGG, and concluded that PBMT could reduce post-operative pain 24h after surgical treatment. Also, they reported that PBMT can accelerate wound healing in the donor site and cause better colour matching in the recipient site. A study by Yildiz et al. [24], designed for assessing the effect of 810nm diode lasers PBMT (0.1 W, 6 J/cm^2, for 60s, and in CW mode) after the FGG procedure. This study demonstrated that PBMT not only accelerates the healing process but also causes less shrinkage of the graft dimensions and can reduce post-operative pain. These study results are in agreement with the present study results. In contrast, in a study by Demante et al. [25], about the effect of PBMT on the healing of human oral mucosa after gingivoplasty, no acceleration was shown in the healing of oral mucosa.

It should be noted that the wavelength, dose, and amount of laser energy applied to the surgical area play an essential role in the effectiveness of PBMT. According to a systematic review [26], laser power and power density between 0.4-19 J and 5-21mW/cm^2, respectively, may have an anti-inflammatory effect and cause acceleration in wound-healing through decreasing PGE2; these parameters in the current study were set within the range of the mentioned research results.

Other factors that are essential for PBMT effectiveness are the frequency of laser application and the distance from the tissue. In articles, there is controversy over the irradiation activation time. So that there are recommendations with a wide range from daily activation in the first week to 14 days after the operation intervals [25,26]. Amorim et al. [27] reported better wound healing with the application of PBMT immediately after surgery at 24 hour, 3-day, and 7-day intervals after surgery in non-contact mode. Lafzi et al. [28], by using PBMT in noncontact mode immediately after treatment, and each 48- hour period for three times found better results. Yildiz et al. [24], applied the laser immediately after the operation as well as 1-, 3-, 7-, and 14-days post-operation in noncontact mode. In the present study, the laser irradiated instantly after the operation, and two weeks later, which is in accord with the mentioned studies.

Conclusion

According to the findings of the current study, PBMT with the mentioned settings and methods was useful for wound healing acceleration, pain alleviation, and inflammation reduction after the surgery and between follow up sessions. This case series demonstrated that PBMT is safe, minimally invasive, and useful for improving FGG survival in the recipient sites. For conclusive results, we recommend a study with more participants and a split- mouth design.

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