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Salvaging the second molar with platelet-rich fibrin and photobiomodulation (970 nm diode laser) following third molar extraction

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Abstract

Second molars are more susceptible to periodontitis when present adjacent to periodontally hopeless third molars. It is crucial to restore the health of the second molar and to prevent a dry socket after third molar extraction. To ensure complete eradication of infection along with regeneration, mere nonsurgical periodontal therapy might be inadequate. Thus, in this case report, high-level laser therapy (HLLT), advanced-platelet-rich fibrin (A-PRF), and low-level laser therapy (photobiomodulation [PBM]) were adapted to obtain a synergistic effect. HLLT was accomplished for decontamination and clot stabilization following the third molar extraction. Further, A-PRF was placed and irradiated with PBM on 3rd, 7th, 15th, and 21st days, postoperatively. There was reduced clinical probing depth and gain in clinical attachment level with a significant radiographic bone fill distal to second molar at 3 months follow-up. This combined use of HLLT, and PBM along with PRF could be a reliable treatment approach for regeneration, particularly in acute infections.

Keywords: Low-level laser therapy, periodontitis, platelet-rich fibrin, regeneration, wound healing

INTRODUCTION

The current research projects are particularly focused on tooth preservation. However, a tooth with a hopeless prognosis due to periodontal disease, nonrestorable caries, fracture, failed endodontic therapy, or pathologic lesions is mandatory for extraction.[1] Sockets heal by secondary intention, and this process is the body's typical character, which is crucial for the restoration of tissue integrity.[2] However, in the presence of infection, efforts are made to suppress the disease progression and regenerate the damaged tissues, particularly when periodontitis is the main cause of tooth loss. Active research is being done to find efficient ways to slow down bone loss, speed up bone regeneration, and make the treatment procedure along with regeneration more predictable. The majority of studies concentrate on drug therapies or surgical procedures, but of late, the use of laser therapy and platelet-rich fibrin (PRF) are popular.

Two zones of a photoreaction in the laser beam profile have been identified; the first is the photodestruction associated with laser surgery (980 nm), known as high-level laser therapy (HLLT), where the photonic energy is absorbed by hemoglobin and transformed into thermal energy (photothermolysis) to produce photocoagulation and avert dry socket after third molar extraction. The second zone of photoreaction is photobioactivation which is known as low-level laser therapy (LLLT) or photobiomodulation (PBM). Due to its nonthermal impact, this has a biostimulatory effect that influences cellular behavior to accelerate wound healing.[3] In periodontal pocket therapy, laser aids not only in eliminating diseased tissues but also with bone repair. This method can be used more effectively as a supplementary aid in socket preservation than conventional healing through blood clot formation.[4]

A well-coordinated sequence of specific growth factors is necessary for optimal and rapid wound healing. Platelet concentrates are a rich source of autogenous growth factors, and among these, advanced PRF (A-PRF) releases numerous cytokines and growth factors necessary for local tissue regeneration.[5] An animal study has demonstrated improved wound healing and bone regeneration with A-PRF-reinforced PBM.[6]

Thus, this case report presents a novel approach in which laser-assisted socket preservation with A-PRF was considered for superior wound healing and tissue regeneration.

CASE REPORT

A 35-year-old male patient reported to the department of periodontics with the chief complaint of pain in the left lower back tooth region for 2 weeks. The patient had undergone restoration at the same site 1 month ago. The patient revealed that one month prior to the

restoration a radiograph was taken [Figure 1a]. On examination, 38 had temporary restoration [Figure 2a] and was tender on percussion with grade III mobility; 37 showed grade II mobility with deep periodontal pocket of 10 mm on its distal aspect [Figure 2b]. Intraoral periapical radiograph (IOPAR) revealed radiolucency in the radicular portion between 37 and 38 [Figure 1b]. Root canal treatment was initiated for 38; however, the tooth did not respond to the treatment; hence, extraction was indicated for 38 due to hopeless prognosis. To reverse the diseased state of 37, laser-assisted disinfection followed by placement of A-PRF and PBM was planned.

Figure 1.

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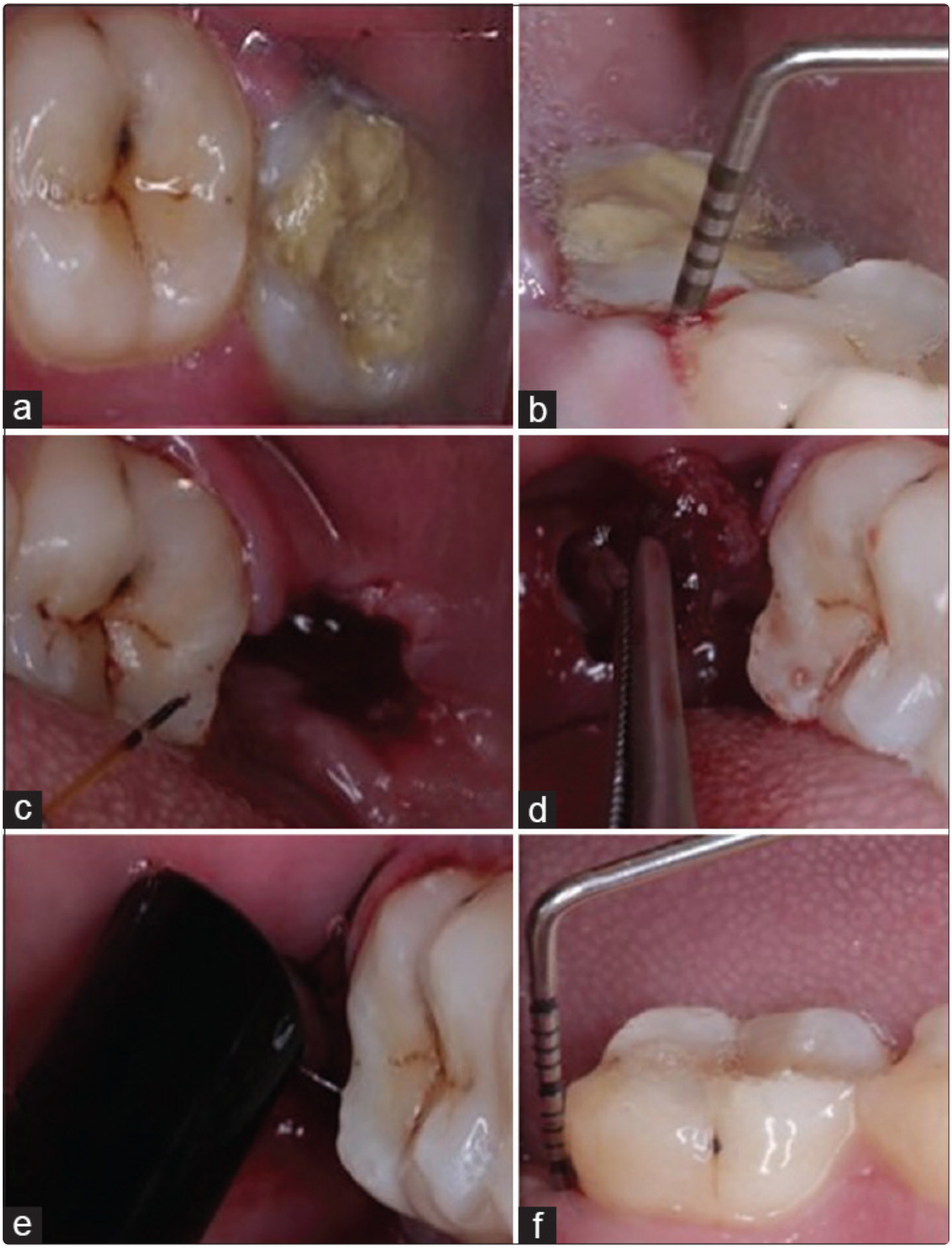
(a) Intraoral periapical (IOPA) radiograph revealing radiolucency of the crown in relation to 38 (caries); (b) IOPA radiograph revealing radiolucency along the entire length of roots in relation to 38 and distal to 37; (c) IOPA radiograph 1 month posttreatment; (d) IOPA radiograph 3 months' posttreatment

Figure 2.



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(a) Temporary restoration in relation to 38; (b) Pre-operative probing depth of 10mm distal to 37; (c) Diode laser (970nm) (high-level laser therapy)-assisted socket decontamination; (d) Advanced-platelet-rich fibrin (A-PRF) block placed into the defect distal to 37; (e) Photobiomodulation done using 970 nm following placement of A-PRF block; (f) Postoperative probing depth of 5 mm distal to 37

Verbal and written consent from the patient was obtained before the procedure. The surgical area was anesthetized with 2% lignocaine (1:80,000 adrenaline). Following atraumatic extraction of 38, the socket was gently debrided and copiously irrigated with saline. HLLT was performed on a socket using a diode laser (SiroLaser Blue, Dentsply Sirona) with the following parameters: 970 nm, 1 W, continuous emission, in contact and circular movement for 14 s at a speed of 2 mm/s [Figure 2c].[3]

Autologous A-PRF was obtained at 1500 rpm for 14 min[5] and placed within the defect distal to 37 [Figure 2d], covered by a collagen membrane (16 mm × 22 mm, Geistlich Bio-Gide®, Geistlich Pharma AG, Wolhusen, Switzerland) and criss-cross sutures were placed using 4-0 trulene. PBM using a diode laser (SIROLaser blue, Dentsply Sirona) was performed with the following parameters: 970 nm, 1 W, continuous emission, noncontact mode, 2 mm away from the surface on occlusal, buccal, and lingual for 20 s each [Figure 2e] with repeated sessions on 3rd, 7th, 15th, and 21st day postoperatively.[3]

Suture removal was done on the 15th day, and clinical wound healing was satisfactory. IOPAR on 1 month followup revealed radiolucency [Figure 1c]. On 3 months follow up, a decreased probing depth of 5 mm [Figure 2f] with no mobility was observed, and IOPAR revealed radiopacity extending up to the coronal third of the distal root in relation to 37 [Figure 1d].

DISCUSSION

The development of a periodontal pocket distal to the second molar after extraction of the third molar due to periodontal or traumatic causes is a common sequela.[7] However, in the present case, there was a preexisting periodontal pocket before extraction. Nonsurgical therapy reduces and disrupts bacterial organization. However, this treatment leaves a cementum smear layer that may negatively affect periodontal ligament cell recruitment and adhesion, thereby preventing new attachment.[8] Various lasers and PBM have been employed in investigations to condition the contaminated root surface for better periodontal ligament cell adhesion and regeneration.[9] Laser has also proven to reduce the bacterial load while aiding in clot stabilization; this has an add-on effect over conventional therapy.

Hence, the advanced technique of laser decontamination and socket preservation with A-PRF followed by PBM was considered in this case.

A human study done by Osman *et al*. has concluded that laser-assisted socket preservation with PRF resulted in improved bone density with ridge preservation.[10] Jamalpour *et al*., in their study using A-PRF reinforced with PBM observed improved wound healing and bone regeneration, suggesting that the biostimulatory effects of PBM might activate the platelets in PRF, leading to enhanced growth factors and tissue remodeling.[6]

A study by Abdel Mageed *et al*. used a diode laser of 980 nm as HLLT for disinfection and clot formation, followed by LLLT in noncontact mode for an extraction socket and observed improved healing and bone formation. LLLT induces cellular changes as it operates on membrane calcium channels or the mitochondrial respiratory chain, and the suggested treatment promotes cellular metabolism and multiplication, which facilitates the healing of wounds and encourages the formation of neovascularization, collagen synthesis, and new bone. [3]

The outcome of the present case demonstrated that nonsurgical periodontal therapy using a diode laser resulted in decreased clinical inflammation with a notable reduction in pocket depth and mobility along with the increase in radiographic bone fill, thereby preserving periodontium distal to 37. This may have resulted due to the removal of focal infection at 38 followed by early intervention of the active disease state by laser-induced photocoagulation. Incorporation of A-PRF, which is a fibrin network rich in growth factors, complemented the available clot thus accelerating wound healing. Biostimulatory effect of laser might have further activated the accrued platelets leading to enhanced release of growth factors.

Within the limitations of the study, it can be concluded that laser-assisted clot stabilization along with PRF and PBM could be a potential nonsurgical approach to restore the lost periodontium. However, to generalize the result and to establish a certain cause-effect relationship, further randomized controlled studies are necessary.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given his consent for his images and other clinical information to be reported in the journal. The patient understands that his name and initials will not be published and due efforts will be made to conceal his identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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