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Evaluation of the use of plasma rich in growth factors with immediate implant placement in periodontally compromised extraction sites: a controlled prospective study

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Abstract. This study was conducted to evaluate the use of plasma rich in growth factors (PRGFs) with immediate implant placement in periodontally compromised extraction sites. Fifteen patients with chronic periodontitis were included. Each received two implants placed immediately after extraction in the anterior region of the mandible. One of the two implants was treated with PRGFs (group I), while the other was not and served as a control (group II). Implant survival, plaque index (PI), bleeding index (BI), probing pocket depth (PPD), and marginal bone loss (MBL) were evaluated for both groups. Complete soft tissue healing occurred in all patients and all implants were successfully osseointegrated over 12 months. At 12 months, results showed mean PPD values of 3.8 ± 0.3 mm at the control site (group II) and 3.4 ± 0.4 mm at the test site (group I); the mean MBL values were 1.1 ± 0.1 mm at the control site and 0.6 ± 0.1 mm at the test site. There were no statistically significant differences between the test and control groups regarding PI or BI, while there were statistical differences between the test and control groups regarding PPD and MBL throughout the follow-up period.

Key words: bleeding index; immediate implant; implant survival; marginal bone loss; periodontally compromised sites; plaque index; plasma rich in growth factors; probing pocket depth.

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Severe periodontitis leads to the loss of alveolar bone. In such cases, the extraction of a tooth and its replacement with an implant-supported prosthesis may be the appropriate treatment option for some patients. The standard protocol requires a delay of at least 6 months before the placement of an implant in the extraction socket.[1] However, immediate implant placement in post-extraction sites, without waiting for the site to heal, is a treatment modality that has received much attention

and has shown favourable results, such as the preservation of aesthetics, shorter total treatment time, maintenance of socket walls, and reduced surgical time.[2–7] In some studies, periodontal disease has been considered a risk factor in implant therapy; a statistically significant, greater long-term peri-implant marginal bone loss (MBL) has been observed in those with periodontal disease compared to periodontally healthy subjects.[8,9]

Plasma rich in growth factors (PRGFs) is derived from autologous blood by sequestering and concentrating the platelets by centrifugation.[10] It is suggested that platelet concentrations can enhance oral wound healing by releasing abundant growth factors, including platelet-derived growth factor, transforming growth factor, insulin-like growth factor, and epidermal growth factor.[11] Recently, PRGFs have been applied clinically to facilitate bone and tissue healing. Some trials have shown that the use of PRGFs during the placement of dental implants promotes osseointegration and bone regeneration.[12] The use of autologous platelets appears to improve early bone apposition around the implant and thus results in an increased rate of osseointegration.[13] Contradictory results have been reported in an animal study by Casati et al.,[14] who investigated the influence of platelet-rich plasma (PRP) on bone regeneration in dehiscence-type bone defects around dental implants. They demonstrated that PRP alone does not enhance bone regeneration for peri-implant defects.

There is a lack of scientific evidence in the literature regarding the results of the use of PRGFs and immediate implant placement in terms of accelerating the rate of osseointegration or reducing crestal bone resorption around dental implants. The aim of this study was to evaluate the clinical and radiographic outcomes of the use of PRGFs with immediate implant placement in periodontally compromised extraction sites.

Materials and methods

The present study was conducted on 15 patients (eight females and seven males) who ranged in age from 30 to 55 years. The study protocol had the necessary ethics committee approval. All patients had to be in good health, with no chronic disease or smoking habits; all were physically able to tolerate the procedure. Patients were excluded if they had any disease, condition, or medication that might compromise healing or osseointegration, or if they were unable or unwilling to return for follow-up visits.

All implants in this study were Euroteknika implants (Euroteknika, Sallanches, France), which are compatible with the Astra system (Dentsply International, Waltham, MA, USA). Primary stability (torque 25 N/cm) of the implants was achieved during the surgical procedure. Preliminary diagnostic procedures included a digital panoramic radiographic evaluation.

The present study was conducted on patients with chronic periodontitis in the anterior region of the mandible. Treatment was required in order to replace the residual hopeless teeth, which had lost 75% of the supporting bone or had a probing depth (PD) >8 mm. A fixed partial implant-supported restoration was used in the presence of four bony walls of the remaining alveolus with at least 5 mm depth on both sides and the presence of 5 mm of bone beyond the root apex. Patients were excluded if there was a need for grafting of the implant site. Each patient received two implants in the region of the lateral incisors of the mandible, which were placed immediately after extraction. One of the two implants was treated with PRGFs (group I), while the other was not and served as a control (group II). The test and control sides were switched according to the order of patients.

Preparation of PRGFs

Before surgery and the administration of local anaesthesia, 10 ml of peripheral blood was drawn. The blood was deposited in laboratory glass tubes pre-treated with 3.8% trisodium citrate. The tubes were centrifuged at 270 rpm at room temperature for 7 min in a centrifuge unit specifically designed for use with this technique (PRGF System; BTI Biotechnology Institute, Vitoria-Gasteiz, Álava, Spain). This allows the separation of blood into distinct layers: a cellular layer at the bottom, PRP in the middle, and platelet-poor plasma at the top. The cellular components (mostly red blood cells and a thin layer of white blood cells) remain at the bottom of the tube, above which is the plasma component consisting of PRGFs and finally a layer of plasma poor in growth factors. The middle layer was collected and stored in a sterile glass container until use. Leukocytes were not collected in this preparation. At the time of the application, approximately 50 μl of 10% $CaCl_2$ solution was added per 1 ml of PRGF concentrate to enable clot formation. A platelet cell count was done before and after centrifugation.

Procedure

One hour before the surgical procedure, the patient began a prophylactic regimen of 600 mg clindamycin. All procedures were performed after the administration of 3.6–5.4 ml of a combination consisting of local anaesthetic (mepivacaine HCl 2%) and a vasoconstrictor (levonordefrin) at a ratio of 1:20,000. A full-thickness mucosal flap was raised and the teeth extracted gently with extraction forceps, with minimum surgical trauma and without any damage to the adjacent hard tissues (Fig. 1A and B). The extraction sites were then carefully debrided with a sharp curette to remove any granulation or fibrous tissue that was present and were irrigated with sterile saline. The depth of the socket was measured to determine the drilling needed after the root apex. Osteotomies were performed via standard protocols in all cases, including slow-speed sequential drills and copious irrigation. At the test sites, the prepared PRGFs were injected slowly at low pressure into the drill holes immediately before implant placement (Fig. 1C). In addition, the implant was dipped in PRGFs before seating. Implants were manually screwed into the prepared osteotomies at the crestal ridge (Fig. 1D). Implant stability was monitored and noted upon placement. Closure of the wound was obtained by coronal repositioning of the flap.

Postoperative phase

Postoperative instructions were given to the patient, which included the application of extraoral ice packs for 2 h on the first day in order to minimize oedema. Oral hygiene instructions included the use of warm 0.2% chlorhexidine HCl as an antiseptic mouthwash twice daily for 7 days, the use of a soft toothbrush, and gentle cleaning with dental floss. Patients were also required to take 300 mg clindamycin orally every 6 h for 5 days and to take ibuprofen 600 mg twice daily for 7–10 days. A direct panoramic radiograph was taken immediately after implant placement to evaluate the implant position. Patients were recalled after 1 week for the removal of sutures and to assess the presence of any pain, swelling, or infection. After a healing period of 3 months, the second-stage surgical procedure was performed with the placement of a healing abutment on the implant. Prosthetic rehabilitation started 2 weeks after the second-stage surgical procedure, in which the crowns were cemented with temporary cement.