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Randomised Controlled Trial
Dental Implants

Does platelet-rich fibrin have a role in osseointegration of immediate implants? A randomized, single-blind, controlled clinical trial

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Abstract. Immediate implants are a valuable treatment option to replace natural teeth in the aesthetic region. The hypothesis of this randomized controlled clinical trial was that immediate implants grafted with autologous platelet-rich fibrin (PRF) have better clinical and radiographic outcomes than non-grafted controls. Forty-one implants were placed in 31 subjects with one or more non-restorable single-rooted teeth. Autologous PRF was placed in the peri-implant region of the study group ($n = 21$) and no augmentation was done in the control group ($n = 20$). A staged protocol was followed for implant restoration. The patients received a definitive restoration after 3 months and were followed up for a period of 1 year. The statistical analysis included 39 implants sites in 29 subjects. A significant increase in implant stability was noted in both groups over the 3-month period (implant stability quotient: study group 56.58 ± 18.81 to 71.32 ± 7.82; control group 60.61 ± 11.49 to 70.06 ± 8.96; $P = 0.01$). No significant difference was observed between the groups in terms of implant stability. The hypothesis was thus rejected, as there was no significant effect of PRF on immediate implants with adequate primary stability.

Key words: immediate implants; platelet-rich fibrin (PRF); fractal analysis; implant stability.

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The high predictability of conventional implant-supported prostheses in the field of implant dentistry has led to the concept of early replacement of the lost tooth structure, with the aim of decreasing the total treatment time. Techniques such as immediate implants[1] and immediate loading of implants[2] have been introduced to overcome the disadvantages of conventional implants.

The immediate implant is a boon to the field of implant dentistry, as it not only preserves the bone quantity, shortens the treatment time, and maintains the alveolar architecture, but also provides psychosocial benefits[3] and is cost-effective[4]. Several prospective and randomized controlled trials on this subject have been performed. These have shown success rates of 87.5–96%[5–7], which are comparable to the success rates reported for conventional implants. The single-rooted teeth are ideal candidates for immediate implants, as they demand immediate re-

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placement due to their location in the aesthetic zone of the dental arch.

In spite of the exceptional success rates, horizontal buccal bone resorption of about 56% and corresponding lingual/palatal bone resorption of 30% has been documented with respect to immediate implants[8]. The use of modified surgical procedures such as the flapless technique and various augmentation procedures such as autografts, deproteinized bovine bone mineral (DBBM), demineralized freeze-dried bone allograft (DFDBA)[9–11], bone substitutes, guided bone regeneration (GBR)[10,11], and titanium reinforced barriers, as well as various bone-promoting molecules such as platelet-rich plasma[12] (PRP), platelet-derived growth factor[10,13], and bone morphogenetic proteins (BMPs), have been tried for bone preservation, with each method having its own benefits and drawbacks.

Currently, an autogenous graft material, platelet-rich fibrin (PRF), is being used widely in oral surgical procedures for soft tissue defects[13], intra bony defects[12,14], and sub-sinus augmentation[15], as a sole filling material or in combination with other bone substitutes to promote bone formation. PRF is simple, inexpensive, and quick to prepare and does not require any anticoagulant for preparation[16]. It consists of a strong interlinked fibrin membrane, which acts as a bio-barrier[16]. This material provides haemostasis and stimulates neoangiogenesis[17,18]. Additionally, it delivers the growth factors and leukocytes that help in healing and maturation[16]. These actions in combination effectively promote bone and soft tissue regeneration around implants, as proven in animal studies and human case reports[13–15,17–21]. Although PRF has a wide range of applications, there are very few case reports and limited studies in the literature regarding its use with immediate implants[19]. Also, the interaction between osseous cells and PRF and its effect on immediate implants is not yet clear.

The proposed hypothesis for this study was that immediate implants grafted with autologous PRF have better clinical and radiographic outcomes than non-grafted control sites. The primary objective of the study was to evaluate the clinical and radiographic outcomes of immediate implants augmented with PRF in terms of implant stability, amount of regenerated bone (bone quantity), and rate of crestal bone resorption, and the secondary objective was to compare these variables between the grafted group and a non-grafted control group. This study assessed the use of PRF in immediate implants with resonance frequency analysis (RFA) and fractal analysis to evaluate the regeneration of bone.

Materials and methods

The study was designed as a prospective, randomized, controlled clinical trial. Patients requiring the replacement of one or more non-restorable single-rooted teeth with sufficient bone volume and good oral hygiene were selected for the study. The exclusion criteria were (1) patients with any systemic disease/condition that impairs healing; (2) physically/mentally challenged individuals and heavy smokers; (3) patients showing any evidence of an infection/dehiscence or lack of cortical plate after tooth extraction; (4) implant sites that required bone grafting; (5) patients who were unable to attend follow-up appointments.

Approval was obtained from the institutional ethics board to conduct the study, and written informed consent was obtained from all participants after they had received an explanation of the procedure. Intraoral peri-apical digital radiographs and panoramic radiographs were obtained for the preliminary diagnosis (Fig. 1). Cone beam computed tomography (CBCT) was advised in cases of suspected trauma to the dentoalveolar structures.

The implant sites were allocated randomly to two groups based on the sequence of appearance at the study institution. In the study group, autologous PRF was placed in the peri-implant gap. No augmentation was used in the control group. The person collecting and analysing the data was blinded to the group allocation.

Surgical procedure

Autologous PRF was prepared according to Choukroun's protocol at the time of surgery[22], and the PRF clot was compressed between two sterile, moist, gauze-covered glass slabs of standard size for 30 seconds to obtain a membrane of adequate thickness and quality[23].

After aseptic part preparation, lidocaine with adrenaline (1:200,000) was administered and the tooth was carefully removed with minimal trauma to the socket wall using luxators, periotomes, and forceps (Fig. 2). The socket was then examined for cortical bone fracture/dehiscence. The implant size was determined based on radiographic assessment, the socket depth, and the length and mesiodistal width of the extracted root.

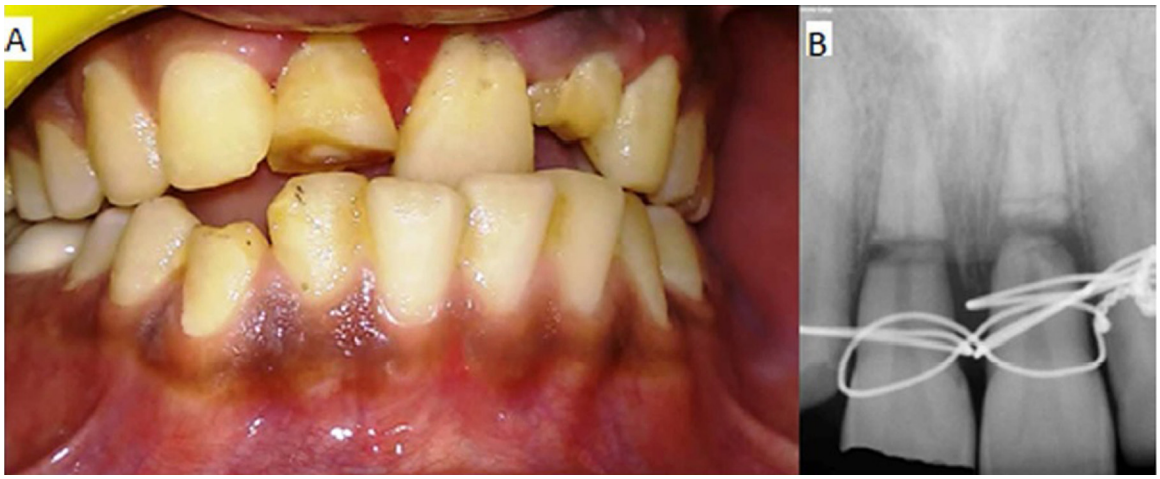

Fig. 1. Preoperative (A) clinical photograph, and (B) intraoral peri-apical radiograph.

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