

The Use of Leukocyte- and Platelet-Rich Fibrin During Immediate Postextractive Implantation and Loading for the Esthetic Replacement of a Fractured Maxillary Central Incisor

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INTRODUCTION

Implant-supported restoration of the maxillary anterior segment that is biologically, functionally, and esthetically acceptable following traumatic injuries in the maxillary anterior segment is always complex.¹ Careful extraction² of the fractured root, residual labial bone preservation, proper flap design, ideal positioning of the implant, appropriate soft-tissue contour, and the crown emergence are all important steps necessary to achieve a predictable, stable, functional, and esthetic success. However, healing of the tissues is always difficult to control and the development of new techniques and materials to improve these treatments is still necessary.

The use of platelet concentrates is an interesting approach.

Platelet concentrates for surgical use are widely used and continuously investigated in oral and maxillofacial surgery.³ The objective is to gather platelet growth factors and to inject them on a surgical site to stimulate the healing process. A significant percentage of the literature is focused on the platelet-rich plasma (PRP) families. PRP⁴⁻⁷ is a liquid platelet suspension often activated into a platelet-rich gel (like fibrin glues).

Another technology called leukocyte- and platelet-rich fibrin (L-PRF) allows for the preparation of strong fibrin membranes enriched with cells (activated platelets, leukocytes, circulating cells)⁸ and platelet growth factors.⁹ This autologous healing biomaterial is free of additives (no anticoagulant during blood harvest, no chemicals for activation), simple, inexpensive, and quick to prepare (15 minutes for all steps). This technique is specifically adapted to the practical needs in daily implant dentistry. Several articles have reported the use of these L-PRF membranes for the stimulation of bone and

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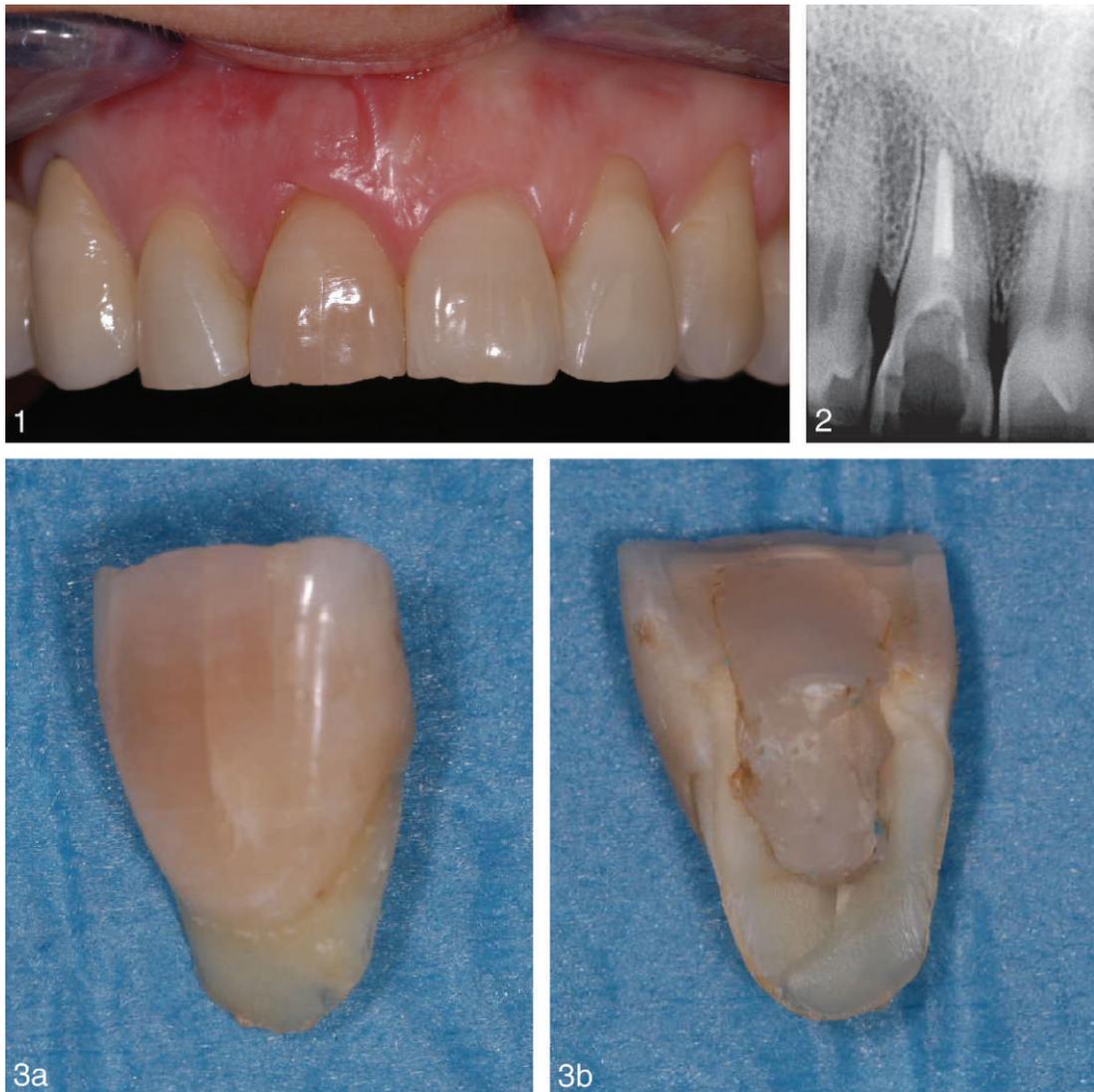
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FIGURES 1–3. **FIGURE 1.** Clinical aspect of the fractured tooth. **FIGURE 2.** Radiographic aspect of the tooth before crown removal. **FIGURE 3a AND b.** The fracture of the crown involved the buccal surface of the tooth at an infrabony depth of 3 mm.

gingival healing during subantral sinus augmentations¹⁰ and global rehabilitations using dental implants.^{11,12} The effect of these membranes on soft tissue healing and maturation is particularly significant.¹³

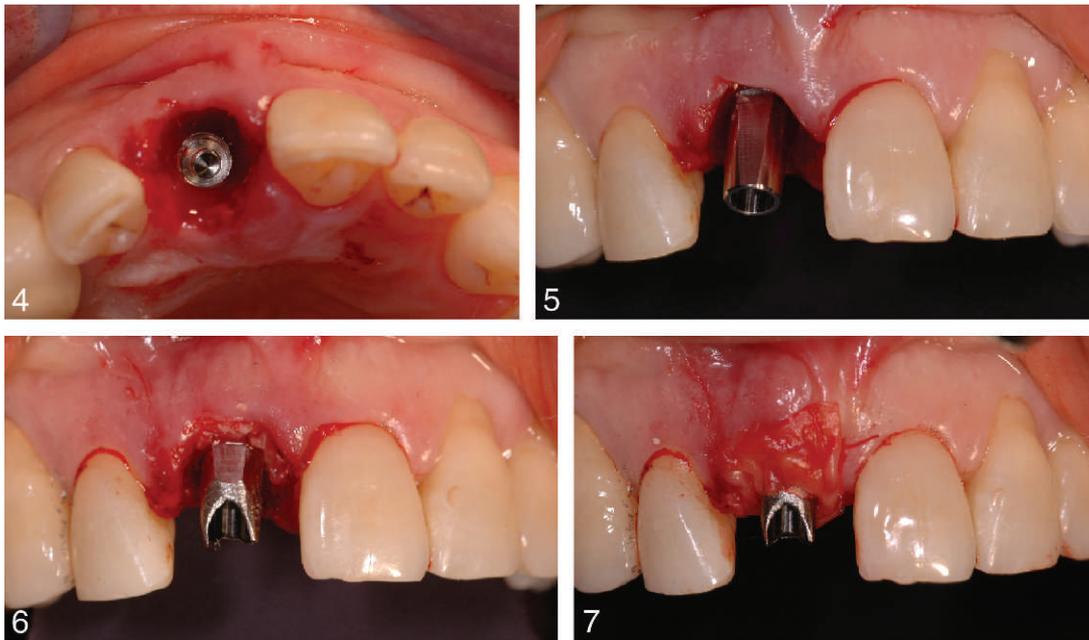
In this case letter, the replacement of a fractured central incisor with immediate postextraction implant and crown placement is presented step by step with the use of L-PRF.

CASE REPORT

A 45-year-old woman presented with an endodontically treated maxillary right cen-

tral incisor that was fractured during a recent sport-related accident (Figure 1). The tooth presented with a Class 2 crown mobility suggesting a longitudinal fracture of the crown corresponding to a deep infrabony pocket on the labial surface. Probing pocket depths and mobility of adjacent teeth were within normal limits. Radiographic examination of the tooth demonstrated an incomplete endodontic treatment but without periapical radiolucency (Figure 2).

Following removal of the crown (Figure 3a and 3b), a vertical bony defect was observed on the labial surface of the tooth,



FIGURES 4–7. **FIGURE 4.** The Ossean Intra-Lock tapered implant was inserted in the palatal alveolar crest. **FIGURE 5.** A straight titanium abutment was screwed into the fixture. **FIGURE 6.** The space between the implant and the labial bone was filled with granules of Gen-Os mixed with leukocyte- and platelet-rich fibrin (L-PRF). **FIGURE 7.** The bio-implant graft was protected by a L-PRF membrane punched onto the abutment post.

what may lead to a lack of support for the soft tissue volume and an unesthetic implant restoration profile emergence. The fractured root was carefully removed and a thorough curettage of the remaining alveolus was performed to eliminate any residual infective tissue in the avulsion socket that could compromise the osseointegration of an immediately placed implant.

A tapered 4.3 mm collar diameter and 11.5 mm length implant (Ossean, Intra-Lock, Boca Raton, Fla) was placed (Figure 4), reaching 60 Ncm primary stability. The final decision on immediate loading was made after implant placement using insertion torque and resonance frequency analysis as acceptance criteria. A straight titanium abutment was screwed into the implant at 35 Ncm and adapted to the incisal emergence profile (Figures 5 and 6).

L-PRF was produced following the standard procedure (Process protocol, Nice, France).⁹ To fill the space between the labial surface of the implant and the residual labial bone wall, a mix of L-PRF

and cortico-cancellous porcine bone (Gen-Os, TecnoSS, Turin, Italy) was placed. The bio-implant graft was covered and protected with a L-PRF membrane (Figure 7), and no suture was used.

A provisional crown was then prepared and cemented with the provisional bonding cement, TempBond (Kerr, Orange, Calif) (Figures 8a and b). To reduce lateral forces, the provisional crown had no occlusal contact with the opposing arch. Some excess of L-PRF membrane was cut away on the labial and palatal sides. The patient was instructed to eat a soft diet and avoid placing food in the area of the provisional crown during the first 6 weeks.

Two days following the surgery, the tissues presented a positive healing characteristic (Figure 9), and at 7 days postop the gingival esthetic profile was well defined (Figure 10). At this time, an esthetic adaptation of the collar was done by relining the crown with resin relining material. Regular clinical and radiographic controls were subsequently performed and no technical complications such as screw



FIGURES 8–11. **FIGURE 8a AND b.** A provisional crown was prepared and cemented on the abutment, adapting and compressing the leukocyte- and platelet-rich fibrin membrane. **FIGURE 9.** Clinical aspects of the cicatrization after 48 hr. **FIGURE 10.** Gingival maturation at 7 days. **FIGURE 11.** Tissue maturation after 3 months.

loosening, resin fracture or pain upon chewing were noted during the 3 month postsurgical osseointegration time period.

After 3 months (Figure 11), a zirconia straight abutment was prepared and a full-ceramic crown was constructed with CEREC (Sirona, Bensheim, Germany) CAD/CAM technology (Figure 12a and b). The matured gingival tissue guided the emerging profile of the tooth. After 6 months, the final result appears to be satisfactory (Figure 13). Two years later (Figure 14), the restoration is stable and esthetic. The gingival tissue has continued to mature, as observed that the

gingival collar has an improved contour and thicker biotype than in the initial months following surgery.

DISCUSSION

Immediate postextraction implants in the maxillary esthetic area are currently used frequently and are subtle, exacting treatments. The use of healing materials such as L-PRF are well suited to these applications because this material has a robust stimulating effect on the healing of soft and osseous tissues.¹⁴ Moreover, as a



FIGURES 12–14. **FIGURE 12a AND b.** A zirconia abutment replaced the provisional titanium abutment and a full ceramic crown was prepared. **FIGURE 13.** Tissue maturation after 6 months. **FIGURE 14.** Two years posttreatment, the restoration presents as stable and esthetic. The gingival collar has improved positioning, contour and thickness, representing continual maturation.

strong solid fibrin membrane, it is particularly easy to use in implant dentistry and periodontology. It additionally offers a protective effect (both mechanical and biological) to the grafted area.^{11,12}

The immediate implant and bone graft allows for the maintenance and regeneration of the damaged labial bone wall. The dental implant serves as a support for three dimensional reconstruction (vertical, horizontal, and labial/lingual thickness).¹⁵ Without the immediate placement of the implant and graft material, the alveolar ridge after extraction would resorb significantly, resulting in the absence of adequate bone volume for ideal implant positioning. This is particularly true for patients with a thin alveolar ridge and gingival tissue. However immediate implant placement and bone grafts are always sensitive to the gingival quality, as the gingival tissue has to cover and protect the site. If the gingival tissue is weak or damaged, dehiscence can appear in the covering tissue leading to the contamination of the grafted site. For this reason, some authors recommend the use of

connective tissue grafts to reinforce the peri-implant tissues.¹⁶ The L-PRF is therefore especially indicated in this application. The fibrin membrane of L-PRF acts as a bio-barrier, protecting the implant and the graft from the oral environment. Moreover, by providing growth factors, leukocytes, and a permeable fibrin matrix for the growth of endothelial and epithelial cells, this healing material stimulates neoangiogenesis and accelerates gingival healing and maturation.

Many authors have shown the positive impact of immediate loading on the protection of peri-implant bone levels and osseointegration.^{17,18} This technique offers advantages for patient comfort and the healing process. It also facilitates a natural healing and maturation of the peri-implant bone and soft tissues around the crown, therefore to achieve a more esthetic and predictable emergence profile for the prosthetic restoration.¹⁹ Combined with L-PRF, this immediate crown offers the possibility to secure the L-PRF membrane in a stable position without suture, and also to use it as a transitory supporting

material for the regeneration of the gingival tissue. Additionally, the temporary crown shapes the ideal profile emergence.

In this type of treatment, the quality and design of the implant are similarly important. The macrodesign of the implant²⁰ and its surface²¹ are aspects of the technologies that permit the clinician to have greater control and improve the treatment outcome.²² In this case, the use of a tapered implant was adapted to the shape of the alveolus, preserving the osseous structure surrounding the socket during immediate implant placement. The implant also presents a recent specific microrough nanorough chemically-enhanced surface (Ossean)^{23,24} which may also be an element of the success.

Finally from a practical standpoint, the L-PRF is easy to use on the surgical site. The elastic consistency of the L-PRF membrane allows the clinician to punch it around a prosthetic pillar (abutment). The antihemorrhagic properties of L-PRF are also advantageous and convenient for this type of surgery.²⁵ In this protocol, a flapless approach is used to avoid flaps and incisions that could significantly reduce micro-vascularization in critical areas like the interincisal papillae that would interfere with the cicatrization and the final esthetic result. Because of its texture and healing properties, the L-PRF membranes allowed for the use of a micro-surgical approach without incisions and sutures, leading to an optimal tissue healing.

NOTE

The authors have no conflict of interest to report.

ABBREVIATIONS

L-PRF: leukocyte- and platelet-rich fibrin
PRP: platelet-rich plasma

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