

# The “Ring-Shaped” Autologous Fibrin Matrix: A Technical Note

Fernando Luiz Duarte de Almeida, Leonel Alves de Oliveira<sup>1</sup>

Department of Implant Dentistry at Santa Casa, Rio de Janeiro, <sup>1</sup>Department of Morphology, Medical School, Brasília National University, Brazil

## Abstract

The use of platelet-rich fibrin has gained importance as an autologous scaffold for tissue regeneration. One of its features is, when placing implants in fresh extraction sockets, to function as a selective scaffold and also as a barrier in order to correct marginal bone defects and/or to avoid collapse of surrounding soft tissue. However, its handling and placement require specific manipulation skills, to avoid unintentional slipping and dislodging during the suture procedure. In order to avoid these problems and to allow easier and faster use of the PRF matrix, a simple device for providing a self-stabilized fibrin plug has been developed. This plug surrounds, as an elastic ring, the transmucosal extension of the prosthetic components for conical internal connection implants, thus enhancing the effectiveness of the fibrin matrix expected performance.

**Keywords:** fibrin, immediate implant, platelet-rich fibrin

## INTRODUCTION

Immediately replacing lost teeth has become a routine approach in implant therapy. Hayacibara *et al.*, in a retrospective evaluation of 74 immediate implant placements in the single mandibular molar site, despite the 100% success rate, reported that dehiscence, with soft-tissue shrinking, was seen in all cases.<sup>[1]</sup>

It is well established that peri-implant mucosae inflammation during osseointegration period can promote host response imbalance and bone resorption by bacteria infiltration.<sup>[2]</sup> Besides that, low levels of epidermal growth factor (EGF) and EGF receptor (EGFR) are associated with inadequate healing of mucosal peri-implant.<sup>[2]</sup>

Autologous fibrin matrix, obtained by centrifugation of whole blood collected into tubes free of anticoagulants, is well established as efficient for enhancing tissue regeneration.<sup>[3-10]</sup> Fibrin plays an important role in tissue regeneration and wound healing, especially due to its cytokine and growth factor contents.<sup>[11]</sup> Platelets contain various growth factors and cytokines that are of importance in inflammation and bone healing. These growth factors are postulated as promoters of tissue regeneration.<sup>[12]</sup> Among the molecules responsible for gingival healing, EGF, binding to EGFR, activates a cascade of intracellular events capable of stimulating the proliferation of epithelial cells, fibroblasts, and endothelial cells. These events

directly influence the formation of the junctional epithelium, during osseointegration period.<sup>[13]</sup>

The protocol for obtaining platelet-rich fibrin (PRF) matrix has been extensively described in the literature.<sup>[7,8]</sup> According to the protocol, after centrifuging the whole blood, the red blood cells are separated at the tube bottom. The fibrin clot takes place at the central portion of the tube. This shall be removed from the tube, followed by scrapping of the attached red blood cells. The clot is normally manipulated or “shaped,” mostly in the form of membranes before it is ready for placement at the surgical site. There are specific boxes in the market specially designed to draining the clots through mechanical compression, thus reshaping them in a suitable form for a given procedure. The most used and described forms are membranes and plugs.

## DESCRIPTION

A simple device, created in order to shape the fibrin as a perforated clot (ring-shaped), as well as the surgical technique

**Address for correspondence:** Dr. Fernando Luiz Duarte de Almeida, 550, Visconde de Pirajá St./914 - Ipanema-RJ - 22410-002, Rio de Janeiro, Brazil.  
E-mail: [contato@hospitaldaboca.com.br](mailto:contato@hospitaldaboca.com.br)

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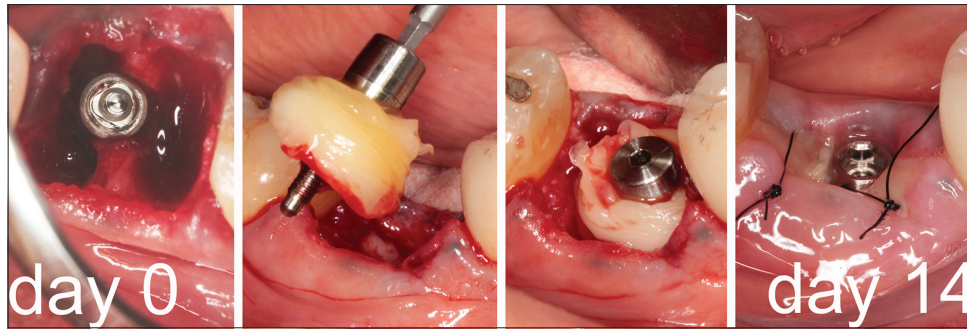
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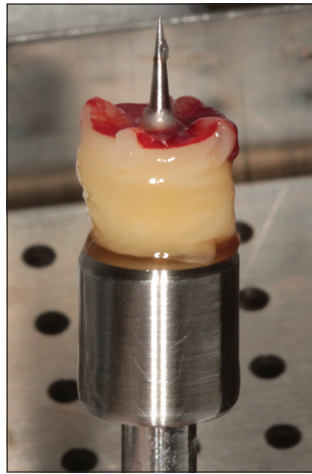
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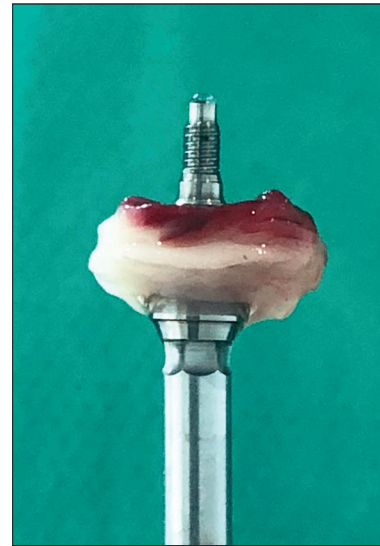
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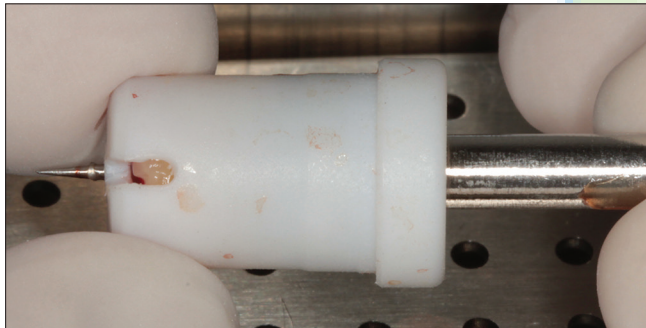
**Figure 1:** With a “ring-shape,” the fibrin matrix placement and stabilization over the implant platform can be easily accomplished, occluding the existing cervical gap between the socket walls and the implant body, as well as improving the volume beneath the soft tissue



**Figure 2:** The piston with the thin puncture carrying the fibrin ring



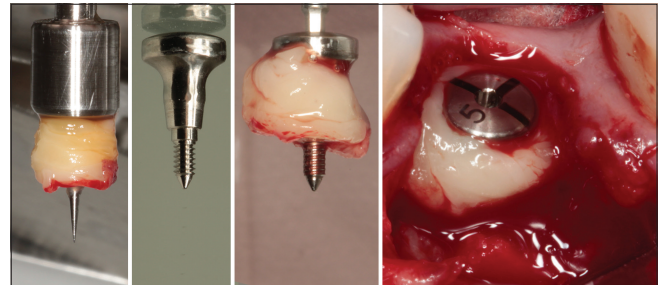
**Figure 3:** The fibrin ring can be compressed to the desired thickness and carried with the prosthetic component



**Figure 4:** The puncture perforates the fibrin clot and then transposes the bottom of the cylindrical container, which has a hole at its center, allowing the clot compression simultaneously

proposed and tested for its utilization, is herein described. Such device delivers a “ring-shaped,” ready-to-use fibrin clot, which placement and stabilization over the implant platform can be easily accomplished [Figure 1].

The device has the form of a piston with a thin puncture at the bottom part of it [Figure 2]. It was developed to promote, into a cylindrical container, the PRF clot compression drainage, at the same time that perforates it, creating a ring-shaped fibrin matrix [Figure 3]. When the piston is inserted into the cylindrical container (traditionally used to compress the plugs),



**Figure 5:** The fibrin ring is easily repositioned from the puncture-piston to the transmucosal extension of the component (healing screw or abutment) and self-stabilized in place exactly, where it is needed

the puncture perforates the fibrin clot and then trespasses the bottom of the container, which has a hole at its center, allowing the clot compression simultaneously [Figure 4].

The fibrin ring is easily transferred from the puncture-piston to the transmucosal extension of the component (healing screw or abutment) and then self-stabilized in place exactly where it is needed [Figure 5]. The final product is an autologous dense fibrin matrix rich in platelets, leukocytes,

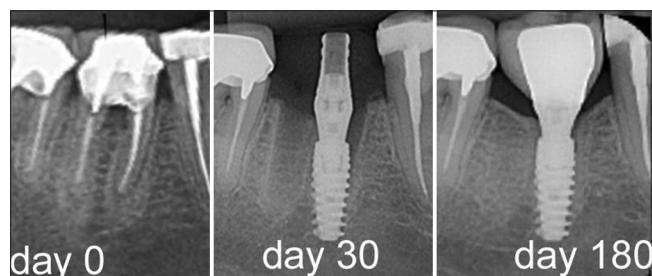
and growth factors, in a “ring-shape,” which can be placed surrounding the implant platform, occluding the existing cervical gap between the socket walls and the implant body, at the same time that strangles the transmucosal extension of the prosthetic component, improving the volume beneath the soft tissue, and performing the sealing of surgical environment.

## DISCUSSION

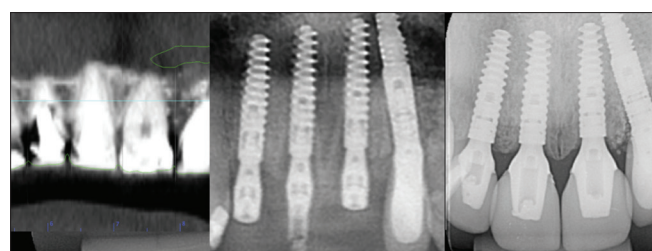
Angiogenesis is an important key for healing and consists of the formation of new blood vessels inside a wound. It requires an extracellular matrix to allow migration, division, and phenotype change of endothelial cells. The angiogenesis property of fibrin matrix is explained by the three-dimensional structure of the fibrin gel and by the simultaneous action of cytokines trapped into the mesh. Furthermore, main angiogenesis soluble factors such as fibroblast growth factor-basic, vascular endothelial growth factor, and platelet-derived growth factor are included in fibrin gel.<sup>[14]</sup>

With these fundamental considerations, PRF can be considered as a natural fibrin-based biomaterial favorable to the development of a microvascularization and able to guide epithelial cell migration to its surface. It permits a rapid angiogenesis and an easier remodeling of fibrin in a more resistant connective tissue. The interest of such a membrane is evident, namely, to protect open wounds and accelerate healing. Furthermore, this matrix contains leukocytes and promotes their migration.

A current clinical example deals with the filling of a tooth socket by PRF plugs. Neovascularization takes place quickly through the PRF clot, and the epithelial covering develops fast.



**Figure 6:** This radiographic control shows the complete bone regeneration



**Figure 8:** This radiographic control shows the behavior of the interproximal crests following immediate replacement and loading of adjacent single units

In spite of the infectious and inflammatory statement of such sockets, rapid healing of the wound is observed without pain, dryness, or purulent complications.

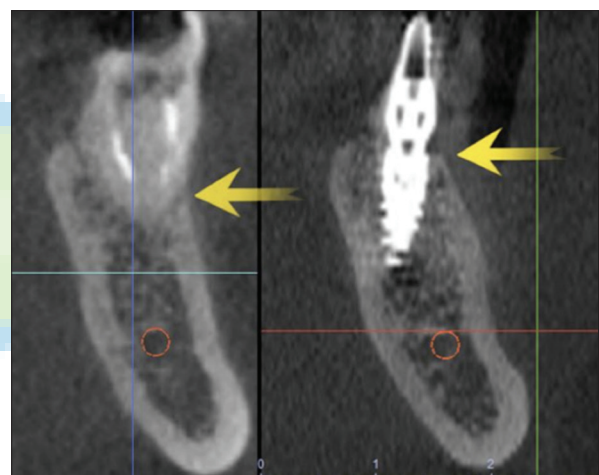
When dealing with immediate replacements with simultaneous loading, or even with implants placed in a single-stage approach, the control of the cervical peri-implant tissue outcome is always challenging.

This so-called PRF ring acts as a circumferential membrane, which strangles the transmucosal extension of the prosthetic component, improving the volume beneath the soft tissue, and performing the sealing of surgical environment.

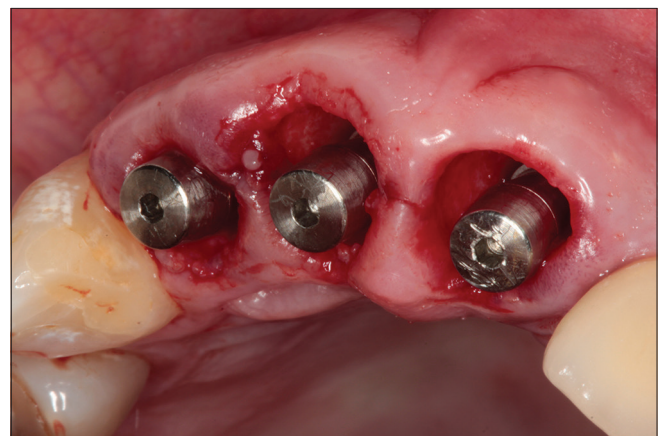
The procedure has been used since 2014 and shows satisfactory outcomes on posterior and anterior sites [Figures 6-11].

A clinical trial is going on, and we are gathering data for a future case series publishing.

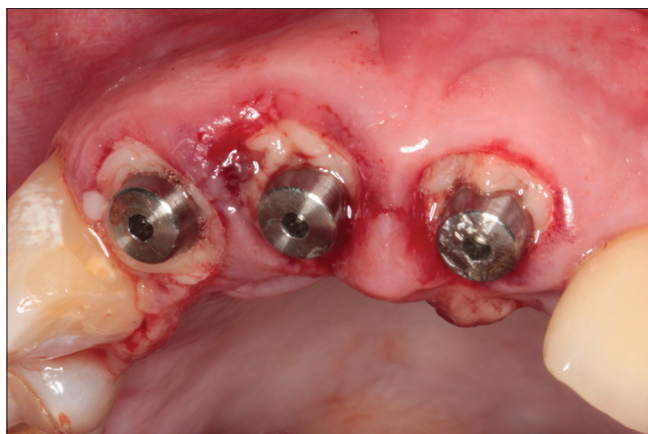
Study approved by Comitê de Ética em Pesquisa da Faculdade de Medicina da Universidade de Brasília.



**Figure 7:** This computed tomography scan control shows the buccal plate regeneration



**Figure 9:** Clinical view after immediate replacement, before loading and before fibrin-ring filling



**Figure 10:** Fibrin rings just placed, improving the volume beneath the soft tissue, and performing the sealing of surgical environment



**Figure 11:** Clinical outcome after 6 months, just before impression taking for ceramic crowns

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### Conflicts of interest

There are no conflicts of interest.

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