



Cranio-maxillofacial

Implant Directions®

Vol.16 N° 4

December 2022

English Edition



APPLICATION OF AUTOLOGOUS DENTIN AND PLATELET RICH FIBRIN
COMPOSITION IN IMMEDIATE DENTAL IMPLANTATION AND LOADING IN
AESTHETICALLY SIGNIFICANT AREAS. PRELIMINARY STUDY.

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ISSN 1864-1199 / e-ISSN 1864-1237

Published by IF Publishing, Germany



The Foundation of Knowledge

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Evidence reports and Critical Appraisals

Research & Evidence Department
of the International Implant Foundation
Munich, Germany

Annual Subscription

Euro 2.800

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International Implant Foundation
DE- 80802 Munich / Germany
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ISSN 1864-1199
e-ISSN 1864-1237

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Application of Autologous Dentin and Platelet Rich Fibrin composition in immediate dental implantation and loading in aesthetically significant areas. Preliminary study.

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Keywords

Autologous dentin (AD), Autologous dentin graft (ADG), platelet-rich fibrin (PRF), immediate implantation, immediate loading.

How to cite this article

Vares Y.E., Vares Y.Y., Fedyn Y.I., Medvid Y.O. Application of Autologous Dentin and Platelet Rich Fibrin composition in immediate dental implantation and loading in aesthetically significant areas. Preliminary study.
CMF Impl Dir 2022, 16: 12 - 24

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Summary

It is a well-known fact that teeth extraction induces significant dimensional changes of the alveolar ridge [1, 2, 10]. From the point of view of conventional 2-stage implantation this situation requires grafting of the alveolar sockets before implants placement. Nowadays a variety of materials of different origin are present on the market for appropriate bone substitution (synthetic scaffolds: HA, TCP, Bioglass, coral minerals; Ceramic xenografts: Bio-Oss®, Cerabone®; allogenic bone (demineralized, lyophilized); autogenic bone (cancellous, cortical) etc. The expectations of conventional implantologists from grafting procedure are as following: superior results, higher aesthetics, long term predictability, significantly higher success rate, faster healing etc. [18]. But, being honest, the same results are desirable from the point of view of immediate 1-stage implantation and immediate loading as well...

Although the concept of immediate implantation and loading requires no bone substitution, even of fresh extraction sockets, because it relies on natural bone healing under the influence of immedi-

ate loading, the lack of grafting sometimes leads to inappropriate aesthetic results especially in the aesthetically significant areas as frontal maxilla or mandible.

The introduction of platelet-rich fibrin (PRF) and autologous dentin (AD) as a grafting material in maxillofacial surgery and implantology drastically changed the attitude of implantologists to bone substitution and made immediate implantation procedure more predictable [3, 4, 5, 11, 13, 15, 16, 17]. Taking into account that immediate implantation and loading, especially in form of Strategic Implant® approach, is associated with multiple teeth extractions, the use of these extracted teeth in combination with PRF as a grafting material can be a superior technique which provides higher aesthetic and functional results.

The aim of this work was to study the effectiveness of AD-PRF composition in immediate implantation and loading in the aesthetically crucial areas.

Introduction

The most common problems faced by implant specialists after tooth extraction are the lack of adequate quantitative and qualitative parameters of the bone and insufficient supply of soft tissues which significantly complicates the aesthetic and functional rehabilitation with the use of dental implants and require bone augmentation. In conventional 2-stage implantology a variety of bone substitutive materials of different origin (synthetic, xenogenic, allogenic, autogenous etc.) are widely used to create necessary bone volume prior to implants placement [18].

Although the concept of immediate implantation and loading requires no bone substitution, even of fresh extraction sockets, because it relies on natural bone healing under the influence of immediate loading, the lack of grafting sometimes leads to inappropriate aesthetic results especially in the aesthetically significant areas as frontal maxilla or mandible.

The introduction of so called “sticky bone” into oral surgery and implantol-

ogy, which is a composition of PRF with any kind of granulated bone substitutive material, made the augmentation procedure more predictable [16].

Taking into account that immediate implantation and loading, especially in the form of Strategic Implant® approach, is associated with multiple teeth extractions, the use of these extracted teeth in combination with PRF as a grafting material can be a superior technique which provides higher aesthetic and functional results.

The aim of this work was to study the effectiveness of AD-PRF composition in immediate implantation and loading in the aesthetically crucial areas

Materials and methods

The material of the study were patients with periodontally compromised teeth in the frontal area, which required their removal with subsequent immediate implantation and loading and simultaneous bone substitution using AD-PRF composition.

During 2018-2022 in the clinic of the Department of Surgical Dentistry and Maxillofacial Surgery of the Danylo Halytsky Lviv National Medical University 10 patients (men - 7, women - 3) aged 23-45 years with periodontally compromised teeth in the frontal maxillary and mandibular area (intra-radicular granuloma - 1; apical granuloma - 4; radicular cyst - 3; traumatic incomplete tooth dislocation - 2), which according to initial situation and protocol of care required tooth's extraction with simultaneous implantation and grafting, were surgically treated.

Surgery was performed with the use of KOS[®], KOS[®] B, KOS[®] X, KOS[®] Micro compression screw implants (Ihde Dental AG, Switzerland) with their immediate loading and socket grafting using ADG prepared from extracted teeth ex tempore according to Smart Dentin Grinder[®] Technology (KometaBio Inc., NJ, USA) in combination with PRF (Process for PRF, Nice, France).

In the postoperative period patients underwent clinical monitoring of surgical wound healing and the dynamics of general health status, as well as a number of diagnostic studies: examination of

the implantation site using cone-beam computed tomography or dental radiography, biometric studies.

Follow-up examinations were performed at 1, 3, 5, 7, 10, 14 days after surgery, as well as at 1, 3, 6, 9 months. X-ray control was performed at 6-9 months postoperatively, depending on the area of surgery (lower or upper jaw). Biometric studies were performed to compare the level of alveolar bone relative to the occlusal plane before surgery and as of 6-9 months after dental implantation.

Clinical case

Patient B., 25 years old, addressed the Department of Surgical Dentistry and Maxillofacial Surgery of the Danylo Halytsky Lviv National Medical University 22/05/2020 with complaints of mobility of upper incisors, periodic pain and edema in the frontal part of the upper jaw which occurred after the fist hit of unknown person several days before. On objective examination the mucogingival junction in the area of #12, 11, 21 teeth was painful at palpation, smoothed, hyperemic, swollen, the teeth are slightly mobile.

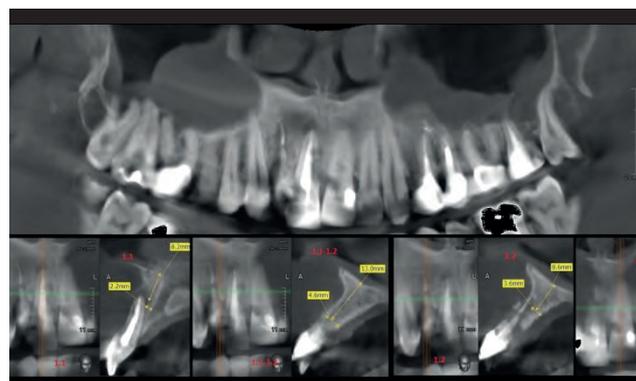


Fig. 1 A. Intraoral view of the patient B., 25 years old on admission. **B.** CBCT-visualization of the maxilla.

CBCT of the maxilla revealed focuses of bone resorption in the projection of #12, 11, 21 teeth apices, horizontal fracture of tooth #21, incomplete dislocation of #12, 11, 21 teeth with fracture of vestibular cortical plate around them. Electric pulp testing with "Digitest" (Parkell Inc, USA) device revealed an absence of excitability of #12, 11, 21 teeth if compare with the neighbouring teeth. Additionally, the over-eruption of #28 tooth was also noticed (Fig. 1, A, B).

The patient was offered #12, 11, 21 teeth extraction with immediate implantation and loading, as well as replacement of the alveolar bone defect with AD and PRF clots and membranes.

27/05/2020 after premedication (Sol. Atropini sulfatis 0.1%-1.0ml., Sol. Analgini 50% -1.0ml., Sol. Dimedroli 2% -1.0ml.) antiseptic treatment of the operation field was performed. Local infiltration anesthesia with a solution of Ubistesin forte 4.0% (3M ESPE AG, Germany) 4.0 ml. was performed. A marginal incision within the area of frontal maxillary teeth and two vertical incisions in the projection of teeth 13 and 22 were made, a trapezoid mucoperiosteal flap was created and bluntly elevated. #12, 11, 21 teeth were extracted using forceps and complete fracture of vestibular cortical plate along the root surfaces of above-mentioned teeth was noticed (Fig. 2).

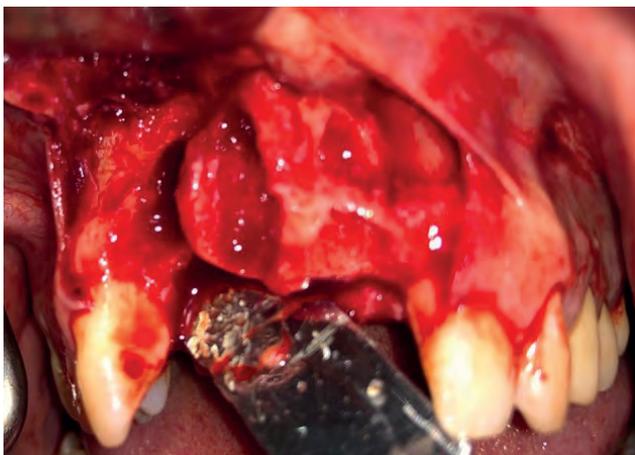


Fig. 2 State of the alveolar bone after removal of #12,11,21 teeth.

At the same time a closed (forceps) removal of #28 tooth was also performed to prepare an ADG. A dentin autograft was prepared from #22, 28 teeth according to previously published protocol [3, 6, 16]. Extracted teeth were thoroughly mechanically cleaned utilizing high-speed carbide bur. PDL, outer layer of the enamel were removed before grinding. Clean tooth was dried by an air syringe and put in a sterile chamber of the Smart Dentin Grinder® unit (KometaBio Inc., NJ, USA) to collect 300-1200 µm particles in the collection tray after grinding (Fig. 3). The obtained graft was immersed in a basic alcohol cleanser in a sterile container for 5 min to dissolve all organic remnants

and bacteria, then dehydrated with sterile gauze. The particles were then rinsed twice with sterile phosphate-buffered saline solution and then dehydrated again with sterile gauze. Later, some of fibrin clots were chopped using scissors in a metal cup and mixed thoroughly with particulate dentin to get homogenous structure.

Venous blood was taken in four vacuum tubes with a volume of 10 ml. for preparation of clots of autofibrin. Preparation of PRF was carried out in the operating room at the time of the intervention according to the standard method [9]. The tubes were subjected to automatic centrifugation in a PRF Duo Centrifuge™ (Process for PRF, Nice, France) at a speed of 1300 rpm. for 14 minutes. Autofibrin clots, separated from the erythrocyte layer, were then removed from the tubes and placed in a sterile PRF container.

To obtain fibrin membranes, pre-prepared PRF clots were placed in a sterile PRF Box® (Process for PRF, Nice, France) and covered with a metal compressor plate for a period of 2-5 minutes. During this time, there was a mechanical com-

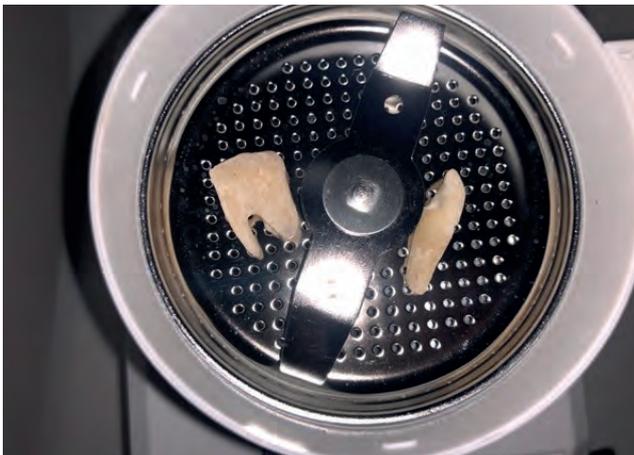


Fig. 3 Preparation of ADG.

pression of the fibrin clot under the pressure of the metal plate and the release of exudate (acellular plasma).

After thorough mechanical and chemical (Sol. Betadine 10%) curettage of the extraction sockets three 1-piece compression screw implants KOS® B with a diameter of 3.7 mm and a length of 12 mm (Ihde Dental AG, Switzerland) were installed into the sockets in palatal direction and the abutment heads were then bended to achieve proper prosthetic position in the dental arch (Fig. 4). Sockets and vestibular cortical defects were filled with AD-PRF composition and covered with PRF membranes (Fig. 5, A, B). The mucoperiosteal flap was sutured



with non-resorbable Seralon 4.0 (Wiesser-Serag, Germany), silicone impression was taken using transfer caps.

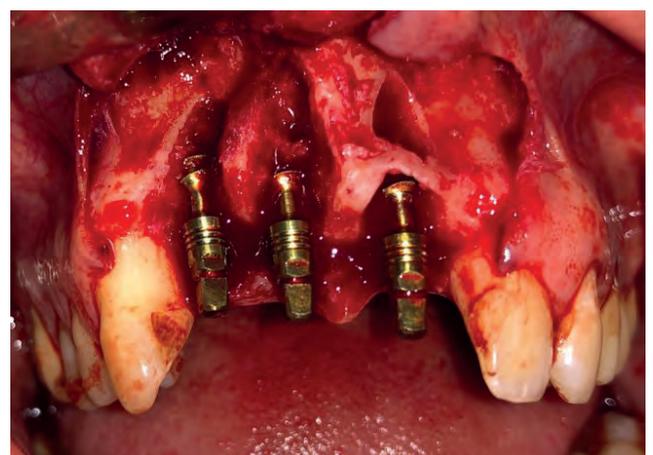


Fig. 4 Placement of KOS® B implants in the palatal cortical bone and bending of the abutments into proper prosthetic position.

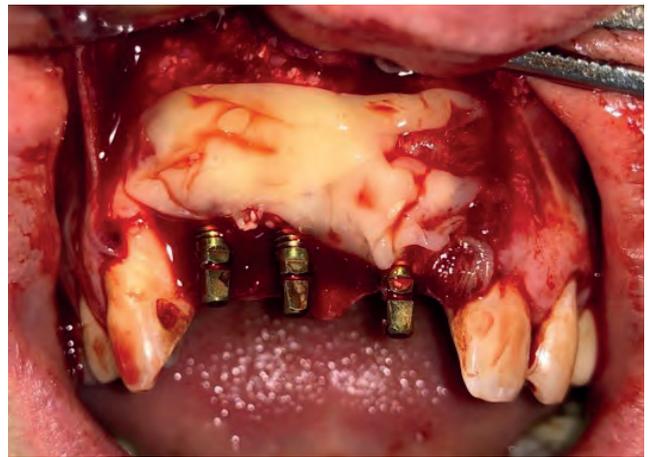


Fig. 5 A. Insertion of three KOS® B 3.7/12 mm implants. Filling of the alveolar defects with AD-PRF composition. B. Coverage of the graft with PRF membranes.

In postoperative period the patient was prescribed oral antibiotic therapy (Augmentin, GlaxoSmithKline) 1 g/day for six days, non-steroid analgesic (Brufen, Abbott) 600 mg on request, Chlorhexidine mouth wash.

On the 3rd day postoperatively the metal framework was tried in, and on the 4th day the stitches were removed and provisional metal-acrylic crowns were fixed on implants using Cem-Implant (BJM, Israel-France) cementum (Fig. 6).



Fig. 6 Fixation of provisional metal-acrylic crowns.

Patient was followed up 1, 3, 6, 9 months postoperatively.

After nine months clinical and radiological control was performed. Radiologically, complete replacement of the defect with matured bone tissue with a satisfactory pattern and density, close contact of the implants with the bone bed, and the absence of bone atrophy in the cervical region of the implants were detected (Fig. 7, A).

Clinically, the shape of alveolar process in the area of teeth removal and implantation was absolutely natural, there was a sufficient volume of keratinized gums with the formation of papillas (Fig. 7, B), which allowed to manufacture and fix a highly aesthetic metal-ceramic crowns on the implants (Fig. 8).

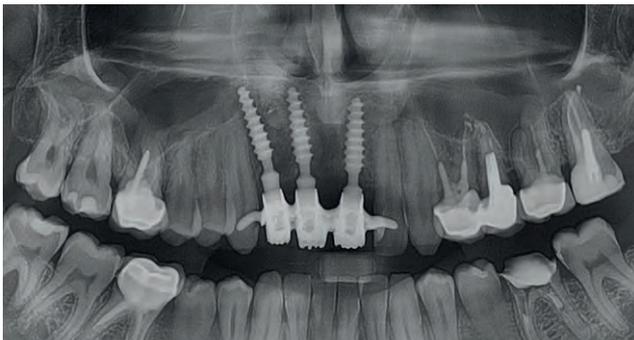


Fig. 7 A. Control OPG nine months post-op. Complete integration of three KOS[®] B implants. **B.** Intraoral view. State of the soft tissues around implants.



Fig. 8 Fixation of permanent metal-ceramic crowns.

Results

There was no any case of implants disintegration in all of 10 patients revealed 6-12 months postoperatively. The distance between the occlusal plane and the level of the alveolar ridge bone in the area of periodontally compromised frontal teeth before surgery was 10.50 ± 0.45 mm. 6 and 9 months after the operation it was 11.40 ± 0.50 mm and 11.60 ± 0.30 mm, respectively, what was insignificant, probably due to the positive effect of AD-PRF composition on osteogenesis and the stimulating effect of immediate loading. In all patients, the aesthetic and functional results of implant treatment using 1-piece compression screw implants in combination with AD-PRF composition grafting were evaluated by us as excellent. In general, all patients reported a significant and rapid improvement in dental health and quality of life after treatment.

Discussion

Recently several publications were published regarding PRF employment in implantology in general [4, 5, 7], and in immediate implantology and loading in particular [13, 19]. It was confirmed that

local application of PRF during implant or abutment installation has a stimulating effect on bone formation and guarantees excellent aesthetics of the soft tissues. Successful use of PRF at the stage of dental implantation with delayed loading has created grounds for its testing during post-extraction immediate implantation and loading in the areas of aesthetical importance [19]. It was found that the stability of implants in case of their immediate installation and loading with local application of PRF was significantly higher than the stability of implants without the use of PRF [14].

Unfortunately, the lack of osteoconductive properties of PRF sometimes do not allow a desirable hard tissue profile, especially in aesthetically crucial areas. Oppositely, autogenous teeth grafted as particles seem to undergo gradual resorption and replacement by new bone of excellent quality through osteoinduction and osteoconduction, leading to good implant primary stability and stability of marginal bone level [11, 12, 15].

Thus, the composition of AD and PRF (so called "sticky bone") looks very promis-

ing in satisfying of all demands of modern implantology. The collective role of PRF containing growth factors and AD with its excellent osteoinductive and osteoconductive properties, immediate loading with its stimulating effect on bone growth lead to complete healing of alveolar defects in relatively short time period, successful integration of the implants and extremely natural view of neighbouring soft tissues.

Conclusions

Immediate implantation and loading with local application of AD-PRF composition is an excellent solution for alveolar reconstruction in different parts of the upper and lower jaw, especially in the aesthetically significant areas in case of deficiency or minimal supply of bone tissue. PRF allows to achieve tight contact between the bone and the surface of the implant, significantly improve the condition of the soft tissues around the implant, while ADG owing to its osteoinductive and osteoconductive properties leads to good implant primary stability and stability of marginal bone level, which was confirmed by our study. We consider AD-PRF composition as the golden standard

graft for socket preservation, bone augmentation, implantation with delayed or immediate loading.

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