ABSTRACT

Sinus floor elevation with autogenous bone grafts and/or bone substitutes is a generally accepted procedure that allows the insertion of implants. Recent studies have shown good results of the use of the PRF in stimulating bone regeneration, especially when it is used in combination with other grafting materials. The purpose of this case report is to present the clinical results of sinus lift procedure through the lateral window antrostomy in the right sinus using A-PRF and bone substituents (Cerabone) and simultaneous insertion of implants as well as the evaluation of healing time. The results of this case report shows that A PRF can be used successfully in combination with bone substitutes in lateral sinus lift technique with immediate insertion of implants. All implants that were inserted immediately, simultaneously with sinus lift procedure were osteointegrated correctly and it was possible to proceed to the stage of final prosthesis. Conclusions: The use of the combination of A-PRF and Cerabone in sinus lift technique speeded healing time by approximately 50%, thus favoring implant osseointegration, went without postoperative complications and showed good acceptance by the patient.

KEYWORDS: lateral sinus lift, aprf, bone substitutes

INTRODUCTION

Insertion of implants in the posterior maxilla can be problematic due to small amounts of subsinusal bone as a result of resorption, progressive pneumatization of the maxillary sinus and reduced bone density. Maxilla consists mainly of cancellous bone, being one of the least dense bone structures of the oral cavity.

Maxillary sinus floor augmentation became a routine treatment preprosthetic in recent years. Sinus floor elevation with autogenous bone grafts and/or bone substitutes is a generally accepted procedure that allows the insertion of implants (1).

This allows the insertion of dental implants through simultaneously or in stages procedures in the posterior maxillary area, which in the past was considered inappropriate for insertion of implants due to insufficient bone volume. It is necessary to achieve a good initial primary stability to perform simultaneous implant insertion and sinus bone grafting (2).

The technique of "sinus lift" consists in increasing vertically the alveolar ridge of maxillary posterior area by interposing different types of bone grafts between Schneider sinusal membrane and the floor of the maxillary sinus (3). The procedure is one of the most common preprosthetic surgical procedures performed in dentistry today.

Sinus floor augmentation was introduced by Tatum in 1976, modified by Boyne and James in 1980 (3) and then changed again by Tatum in 1986 (4), this procedure is still used today. Sinus augmentation procedure is indicated when the penetration of the implant in antrum cannot be avoided.
Open sinus lift surgery is performed under local anesthesia, an incision is practiced on the alveolar ridge and two vertical incisions. Crestal incision is made slightly to palatal side in order to keep a wider band of keratinized attached gingiva for a stronger wound closure and to prevent its dehiscence. The flap is detached, a window is carried out in the lateral wall of the sinus and with appropriate tools the Schneider membrane is risen from the walls of the maxillary sinus in order to create the necessary space for bone grafting. This new created space is filled with material for bone addition and will provide the platform for implant placement (5). It is very important for the graft material to be stable. The surgeon may opt to use a resorbable membrane to cover the material for bone addition. Finally, the created window will be covered with an artificial membrane to protect the addition material, and the gingiva will be repositioned perfectly closing the operational site.

Wallace and Froum (6), have led a systematic study about the the technique of lateral fenestration, concluding that it is advantageous to use graft particle simultaneously with the insertion of implants with rough surface and a barrier membrane covering the bone window to enhance the chances of success of the procedure. The use of membrane showed a success rate of 93.6% compared to 88.7% when not using it.

For sinus augmentation have been used bone grafts in the form of particles or block, coming from various sources. It has been reported that bone grafts using particles have greater chances of success than those in block. Cerabone (Botiss Biomaterials) is derived from the mineral phase of bovine bone, which shows strong resemblance to the human bone with regard to chemical composition, porosity and surface structure. The unique manufacturing process based on high-temperature heating removes all organic and potentially antigenic components, making the material absolutely safe and free of proteins. Its three-dimensional porous network enables a fast penetration and adsorption of blood and serum proteins and serves as a reservoir for proteins and growth factors. After the material has been sterilized, it can be used for bone additions, without causing the occurrence of an immune response from the host. In general, this type of biomaterial is osseointductive, and while it goes through physiological remodeling and becomes incorporated into the surrounding bone.

The use of A-PRF in sinus lift technique

Improving the regeneration of the human body by using the the patient's own blood is a unique concept in dentistry. Platelet concentrates are used routinely for many years in various surgical and medical specialties. The platelets play a crucial role not only in hemostasis but also in wound healing (7).

A-PRF (Platelet Rich Fibrin Advanced) is the latest technology in dental surgery and implantology shortening the healing time by approximately 50% after any intervention for oral surgery. Advanced platelet-rich fibrin (A-PRF) developed by dr. Choukroun in 2014 (8), is a third generation derived from a concentration of platelets and white blood cells (anti-infection). In order to create the A-PRF material, shall be taken a small amount of the patient's blood and centrifuged in the dental office. To produce A-PRF the protocol has been changed, the duration and spin speed have changed (revolutions per minute). By decreasing revolutions per minute and increasing the spin time for A-PRF, all monocytes are found equally distributed fibrin clot, but equally we obtained a better distribution of platelets, which was initially focused equally on the inner end of the clot. It was necessary to prolong the coagulation time in the tube, which was obtained through the use of a special composite glass which allowed the slowing of clot formation.

A-PRF membranes and plugs have numerous applications in dentistry: the protection and stabilization of bone augmentation material in sinus elevation (9), lateral ridge augmentation procedures, socket preservation after dental extraction or avulsion
(10,11), treatment of furcation defects (12), infra-osseous defects from periodontitis (13), for root coverage in the case of gingival recession, filling of cystic cavities (14,15) etc.

A-PRF membranes and plugs and the liquid obtained is used in combination with bone graft in the bone additions (9) and in implantology in order to cause the rapid healing of bone and fixation of bone cells on the titanium surface of dental implants.

Growth factors membranes and plugs obtained through the A-PRF technique are gradually released for 7 days and their actions lead to a rapid healing from the first days after surgery. By stimulating angiogenesis (formation of new blood vessels) and the intake of nutritional and healing factors in the graft, A-PRF contributes decisively in the consolidation phase of initial results. Recovery periods are significantly reduced in fractures, after surgery in the jaw bone.

The purpose of this case report is to present the clinical results of sinus lift procedure through the lateral window antrostomy in the right sinus using A-PRF and bone substituents (Cerabone) and simultaneous insertion of implants as well as the evaluation of healing time.

**CASE REPORT**

The TD patient, aged 50 years presented to the Dr. Anca Rusu Private Dental Office in Bucharest having neuromuscular, mastication, phonation disorders, changes in position of the mandible and profile, reduced vertical dimension as a result of a partial maxillary edentation.

It was absolutely necessary to evaluate preoperatively the medical and dental history of the patient. The patient was carefully evaluated from a medical, clinical, radiological point of view in order to assess the current health status and to identify any conditions that would require preliminary treatment or contraindications to implant therapy.

Were performed the following laboratory tests: complete blood count (red cells, white cells, globular value, leukocytes, platelets, hemoglobin), bleeding and coagulation time, clot retraction time, hematocrit, coagulogram.

Odontal and periodontal clinical examination was performed in the vicinity of maxillary sinus to detect any lesion that could cause odontogenic maxillary sinusitis.

**Fig.1 Initial appearance of metal-ceramic prosthesis**

OPT radiographic examination and a preoperative CT scan were performed for the evaluation of possible anatomical deformations (partial or total sinus septa) or the existence of sinus pathology (rhinosinusitis, sinusitis of odontogenic origin, cysts, pseudocysts, polyposis, tumors).

It was found that the volume of residual bone at the level alveolar process is sufficient in quality and quantity to ensure primary initial stability of implants that will be inserted simultaneously with sinus floor augmentation.

It was decided to perform a sinus lift intervention through lateral approach in right
maxillary sinus using A-PRF and bone substituents (cerabone) and simultaneous insertion of implants. The patient received detailed explanations on surgical procedures that will be performed and informed consent was obtained from him.

![Fig.2 Initial radiographic appearance](image1)

The ceramo-metal prosthesis was removed (fig.3).

![Fig.3 Appearance of abutments after removal of the prosthesis](image2)

APRF was prepared according to the protocol developed by Choukroun et al. There were collected 8 ml of venous blood from antecubital vein of the patient.

The patient's whole blood was introduced into the tubes made of a special composite based on glass, without anticoagulant and has been centrifuged by means of a machine A-PRF for 14 minutes at 1500 revolutions per minute (fig.4). Within few minutes, the absence of anticoagulant allowed the activation of most platelets contained in the sample and was initiated the coagulation. The fibrinogen at first has been concentrated in the upper part of the tube, until the effect of the circulating thrombin transformed it into a fibrin network. The result was a fibrin clot containing the platelets located in the middle part of the tube, between the red blood cell layer located at the bottom and at the top the acellular plasma. One centrifugation resulted in the formation of three layers: the top layer is platelet poor plasma, the intermediate layer is A-PRF and the deep layer, contain red blood cells. The clot was removed from the tube and attached red blood cells were scraped and removed.

In order to obtain plugs, the clot has been introduced into the special cylinders of
A-PRF Box and slowly compressed with the help of the piston. The clot was then cut to the appropriate size (fig.5), being added a metronidazole pill to prevent the development of anaerobes (fig.5,6).

Fig.5 Realisation of A-PRF plugs
Fig.6 Metronidazole used to prevent the development of anaerobes

Fig.7 The sectioned clot
Fig.8 The mixture of metronidazole with APRF and Cerabone

Antibiotic prophylaxis was performed 1 hour before the beginning of the procedure with a dose of 1000 mg Amoxiklav, and then the local anesthesia.

After local anesthesia a crestal incision was made, supplemented by two vertical incisions and the detachment of a trapezoidal vestibular flap in order to expose the lateral wall of the sinus.

Osteotomy was performed to insert implants for lateral incisor and first premolar to the length determined by radiography (fig.9). In order to ensure the parallelism of the implants have been used the parallelization pins. The implants were screwed into the openings of the alveolar bone, taking care not to exert excessive forces on bone. For the lateral incisor has been used an implant with the length of 12 mm and diameter of 3.5 mm, for the first premolar was used an implant with a length of 12 mm and a diameter of 4 mm.

The osteotomy was practiced with the achievement of a lateral window to open the sinus using globular atraumatic burs at the right first molar level (fig.10). It was fractured the well-defined bone fragment and pushed very carefully inward and superior in order to not perforate the sinus Schneider membrane, that covers the sinus floor.
The Schneider membrane was carefully detached from the walls of the maxillary sinus and sinus floor using elevators without perforating it (fig.10). It is very important to maintain intact the sinus membrane what is coming in contact with the bone graft material to prevent infection of the sinus. The bone addition material (xenograft with natural bone substitutes Cerabone, bovine bone and APRF clot) was placed under sinus mucous membrane, around the exposed implant tip and in the antral space along existing bone (fig.11).

Then inserted the 3rd implant in the first molar having a diameter of 4 mm and a length of 12 mm (fig.12).

At lateral incisor was done also the lateral augmentation of the alveolar ridge with Cerabone particles (fig.14). Lateral window was covered with a resorbable collagen membrane (Jason membrane Botiss) (fig.14) and after was performed soft tissue suture.
Antiseptic solutions for oral irrigation with Chlorhexidine 0.12% were indicated to reduce the plaque accumulation of in the area of implantation after surgery.

It were recommended anti-inflammatory pills, analgesics, nasal decongestant to improve permeability osteomeatal complex, cold water compresses, antibiotics. The patient was instructed not to blow his nose for 7 days after surgery, to cough with open mouth to avoid increased pressure in the operated sinuses and to sleep upright.

RESULTS

The patient reported only the appearance of swelling during the first 5 days post surgery. There were no clinical signs of postoperative sinusitis.

At an interval of 10-14 days the sutures were removed.

Postoperative assessment was done at one month, two months and three months after the insertion of implants to notice any pain, gingival inflammation, swelling and increasing the height of the bone and implants stability. In all implants a bone-implant contact was clearly visible. There were no radiolucencies around implants.

Fig.15 Control panoramic radiography of patient after sinus lift intervention with lateral approach. Final radiological appearance

In clinical and radiologic examinations performed at 2 months after surgery, it was found that all implants that have been inserted immediately, simultaneously with the procedure of sinus lift were osseointegrated properly and it was possible to proceed to the stage for final prosthesis.

DISCUSSION

In the systematic literature reviews conducted by Raffi et al. (16) and MR Oliveira et al. (17), the authors observed that there is a significant increase in the use of PRP to promote integration of grafts or implants, many papers have been published in this regard.

Recent studies have shown good results of the use of the PRF sau APRF in stimulating bone regeneration, especially when it is used in combination with other grafting materials (18,19,24). Several researchers have reported good results of using PRF in maxillary sinus lift procedures (20,21). Tajima et al. (22) reported success in this type of approach, using PRF as the only graft material with simultaneous installation of the implants.

Oliveira et al. (19), after the histomorphometric assessment formation in bone defects in rat skull, they concluded that the PRF alone had a positive effect, but low on bone formation and that better results are obtained by associating PRF with bovine bone particles (Bio-Oss).

Currently, lateral approach to maxillary sinus augmentation has become a routine technique for obtaining a long-term survival rates of more than 96% of implants in the posterior region of the jaw (6,23).

The use of advanced platelet rich fibrin or A-PRF, which is an autologous healing material, is a way to accelerate and enhance the natural healing mechanisms in sinus lift procedure. In this case report the use of the
combination of A-PRF and Cerabone in sinus lift technique speeded the healing time by about 50%, thus favoring implant osseointegration.

CONCLUSIONS

Sinus lift procedure with immediate insertion of implants proved to be successful resulting in osseointegration and stability of implants, went without postoperative complications and showed good acceptance by the patient.

The results of this case report presents the advantages of using APRF with bone substitutes on how to obtain a more reliable bone regeneration and a higher quality of bone from biomechanical point of view in lateral sinus lift with less patient morbidity compared with traditional methods.

REFERENCES