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BONE AUGMENTATION AND BILATERAL SINUS ELEVATION AT A FEMALE PATIENT WITH TYPE 2 DIABETES

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Abstract

Introduction. *Chronic periodontal diseases and dental caries are the primary reasons for tooth loss in adults, which is further increased in people with diabetes. In most cases of bone loss, the treatment of partial edentulous patients with implant supported restorations impose additional surgical procedures, like sinus lift elevation and bone augmentation, which can complicate the healing process.* ***Case report***. *This case report presents a type 2 diabetes female patient with several oral health problems, like periodontal disease, poor decay control, bad oral hygiene, a severe maxillary atrophy and the presence of a large maxillary periapical cyst. After a careful examination, based on clinical and radiographic findings, a comprehensive treatment plan was established. The sequential treatment plan consists in extraction, surgical removal of periapical cyst, bilateral external sinus lift procedures and bone augmentation. The surgical protocol was adapted to the particular health conditions of this type 2 diabetes patient.* ***Conclusion***. *Sinus elevation and bone augmentation are predictable procedures often required when restoring the posterior maxilla with dental implants. In case of diabetes patients with bone resorption and defects due to periapical cyst, if the correct protocol is followed, no post-surgical complications and good result in bone augmentation can be attaint.*

key words: *type 2 diabetes, periapical cyst, bilateral sinus elevation, PRF membranes*

Background and aims

Chronic periodontal diseases and dental caries are the primary reasons for tooth loss in adults [1]. The prevalence and severity of periodontitis are further increased in individuals with diabetes, especially if poorly controlled [2,3]. Also, the risk and degree of alveolar bone loss is positively correlated with the lack of metabolic control [4]. Changes that appear in bone metabolism is considered to be one of the important long-term complications associated with diabetes mellitus. Alveolar bone loss is one of the main outcomes of periodontitis, and diabetes is among the primary risk factors for periodontal disease [5].

The presence of type 2 diabetes (T2DM) has been considered for a long time a contraindication for dental implant insertion, because severe complications like osteomyelitis

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can occur [6]. Acute and chronic odontogenic infections present a significant challenge to effective ridge augmentation procedures prior to dental implant placement. Sinus elevation is a predictable procedure that is often required when restoring the posterior maxilla with dental implants. Even with high success rates, careful pre-surgical planning is crucial. A CBCT (*cone beam computer tomography*) is a valuable aid for the clinician to establish the correct diagnosis and the surgical procedure and can reduce the risk of complications and decrease the potential for error [7,8].

Recent data has suggested that PRF (*platelet rich fibrin*) can be used as a barrier membrane in regeneration procedures. Platelet rich fibrin (PRF) used as a resorbable membrane for guided bone regeneration procedures, can act as a biodegradable scaffold owing to the tetra molecular structure consisting of cytokines, platelets, and stem cells [9,10].

This membrane can create the space for osteogenic and angiogenic cells to migrate to the wound site in order to prevent epithelial cells from invading the defect [11].

This case report presents the protocol and surgical technique in case of periapical cyst removal and bi- lateral sinus elevation followed by bone augmentation in a female patient with T2DM.

Case presentation

A 60-year-old female patient with T2DM was referred to the Prosthodontics clinics with a non- functional full arch upper fixed partial denture.

After clinical and radiological examination was performed, the prognosis for remaining posterior teeth was questionable. A medical consult revealed no known allergies and no current or past medications that would preclude bone regeneration procedures.

The patient performed an upper maxilla computer tomography (CBCT) and based on this investigation the bone support was analyzed for future dental implants insertion.

The CBCT revealed that there was insufficient bone support in the upper molar and premolar area for implant insertion, but also a well- circumscribed radiolucent lesion in the upper right premolar area was observed (Figure 1).

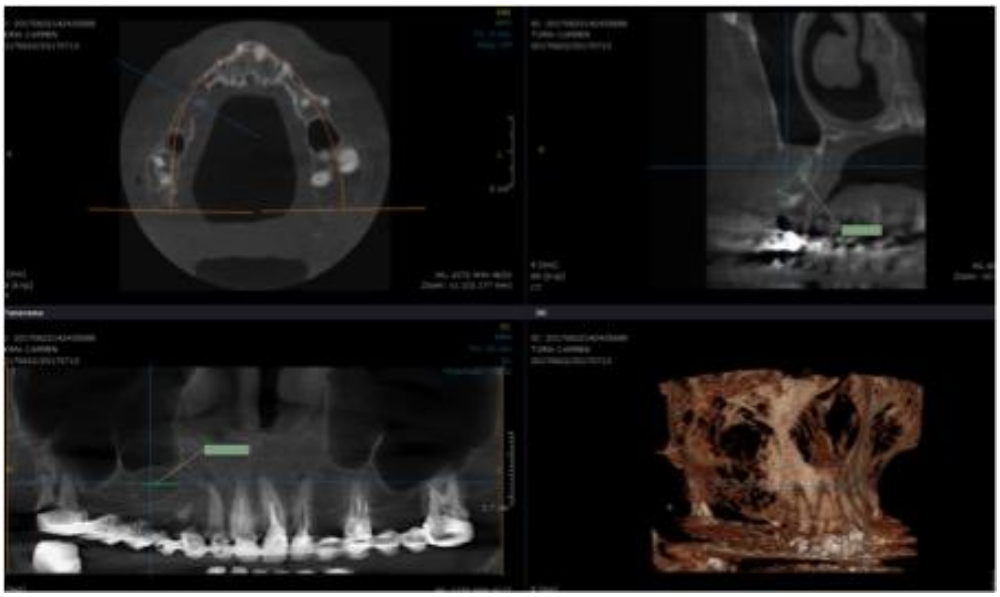

Figure 1. *CBCT image before treatment: the presence of periapical cyst and bone resorption can be observed.*

After performing the differential diagnosis, it was considered that the lesion can be a periapical cyst, which is the most common odontogenic cyst, caused by pulpal necrosis secondary to dental caries or trauma. Highly common in the oral cavity, the periapical cyst is asymptomatic, but highly significant because a secondary infection can cause pain and damage.

Due to the size of the lesion and its radiographic appearance, a significant amount of bone loss and buccal plate destruction was anticipated. The patient accepted the treatment plan and signed the inform consent for surgery.

The proposed treatment plan was to remove the 1 cm diameter radiolucent lesion from the upper right maxilla and prepare the maxillary bone in order to insert dental implants. The bone reconstruction involves bilateral external sinus elevation procedures, lateral bone augmentation.

The risks for the surgical intervention at a T2DM patient that consists in delayed wound closing, the risk of infections and healing complications, were presented to the patient. The patient accepted the treatment plan and signed the inform consent for surgery.

To prevent the infection, one day before the intervention the patient started the antibiotic treatment, which was continued for another 6 days after the intervention.

Before beginning the surgical treatment, four test tubes (10ml) of patient's blood were drawn and spun in a centrifuge at 3300 RPM for 5 minutes. Two of them were chopped and mixed with the artificial bone in order to have a better vascularization of the newly- formed bone and the remaining two PRF membranes were used to cover the resorbable collagen membrane, in order to obtain a better healing and to avoid any dehiscence.

The surgical procedure started with the right maxillary quadrant. After performing the extraction of the roots, an incision was made along the maxillary ridge, starting from the canine area and extending to the second molar area. The flap on the premolar corresponding area was raised, and the cyst was visible both on the vestibular and on the palatal wall of the bone (Figure 2). The cyst was sent for the histopathological examination, that confirmed the initial diagnostic.

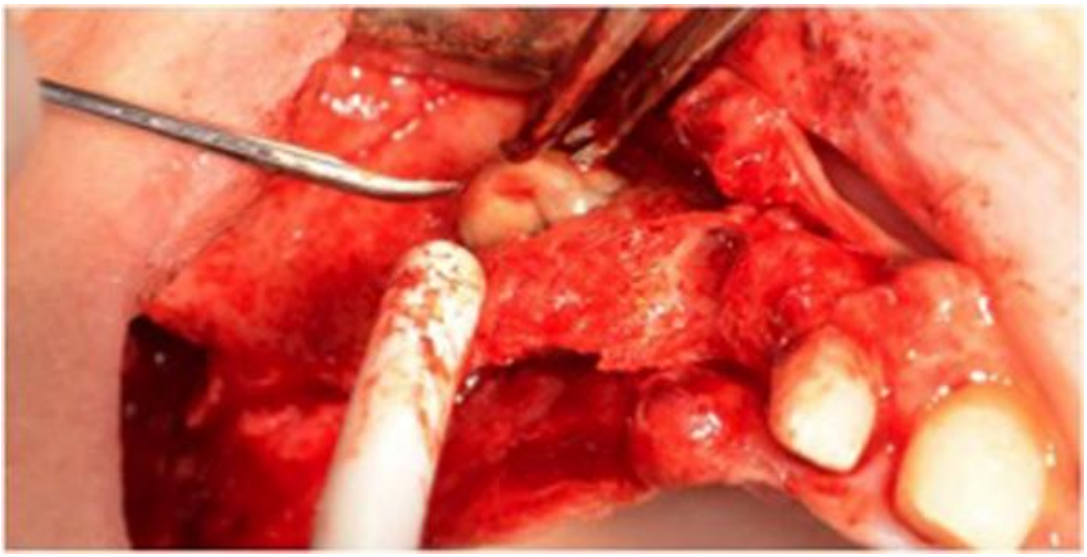

Figure 2. *Periapical cyst removal.*

Figure 3. *Bone grafting and PRF membrane.*

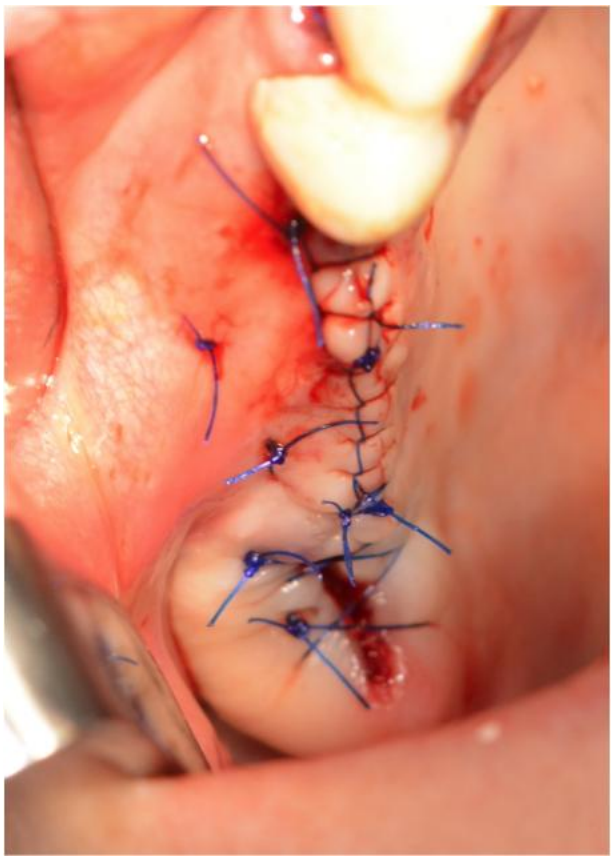

Figure 4. *Clinical aspect after sutures.*

After the surgical removal of the cyst, the defect was washed- out with an antibiotic solution and the lateral window for the right quadrant sinus lift procedure was created. The Schneiderian membrane was elevated, a collagen membrane was placed in order to protect the sinus membrane, and the freeze- dried bone allograft mixed with trimmed PRF membrane was inserted. The defect corresponding to the periapical cyst was filled with artificial bone, mixed with trimmed PRF membranes and another collagen membrane was placed on top. (Figure 3).

Knowing the wound healing deficiencies in T2DM patients after surgical interventions, PRF membranes were placed over the pericardium membranes to prevent any dehiscence. For the first sutures, 3 apical mattresses were performed, to avoid any tensions in the margins of the flap (Figure 4). Then continuous sutures were placed, until the flap was completely closed. At the end of the surgical procedure, anti- inflammatory solution was injected, to reduce the post operator edema.

The healing process was uneventful. The patient was seen every 3 days after the surgery, the debris were cleaned and 0.2% clorhexidine gel was used, twice a day. After 3 weeks the sinus elevation and the lateral augmentation procedure were performed on the left maxillary quadrant, respecting the same protocol.

The patient has remained symptom free and post-surgery radiographic evaluation demonstrates that the defect after cystic lesion removal was filled with a radiopaque consistency material, commonly seen with bone. (Figure 5)

Figure 5. *Orthopantomography after surgical bone grafting on both sides.*

After six months, clinical (Figure 6) and CBCT images revealed sufficient quantity of bone and a good bone quality. Both of the lateral sites from the upper maxillary are ready for implant insertion. No complications appeared during this period.

Figure 6. *Clinical aspect, six months after surgery.*

Discussion

The advances in biomaterials and techniques have contributed to increased application of dental implants in the restoration of partial and completely edentulous patients. Oral implants are a means to anchor dental prostheses in situations of partial or complete edentulism [12].

Alveolar ridge defects can be predictably augmented using autogenous block grafts. Surgical management of patients with T2DM that require bone augmentation for implant insertion is more challenging because the increased rate of complications that can occur. Regenerative therapy, including guided tissue and bone regeneration is continuous evolving. This is partly because of complex defect morphologies that have proven to be difficult and unpredictable in term of regenerative potential. This superimposed with infection adds to the challenge. Such difficult circumstances often require multiple approaches to address all the issues for a positive outcome [13,14].

Platelet-rich fibrin (PRF) developed by Choukroun et al., is a second-generation platelet concentrate widely used to accelerate soft and hard tissue healing. PRF is an autologous fibrin matrix containing a large quantity of platelet and leukocyte cytokines [15]. The major role of fibrin in wound repair is hemostasis, but fibrin also provides a matrix for the migration of fibroblasts and endothelial cells that are involved in angiogenesis and responsible for remodeling of new tissue.

Primary wound closure, adequate angiogenesis, space maintenance and wound stability, are necessary to reduce the risk of membrane exposure and subsequently microorganism colonization.

Conclusion

This case proves that bone augmentation procedure can have good results in well-controlled T2DM patients, as long as the surgical protocol is correct. The use of PRF in addition to bone grafts can improve healing process and graft integration.

REFERENCES

1. **Thorstensson H, Johansson B.** Why do some people lose teeth across their lifespan whereas others retain a functional dentition into very old age? *Gerodontology* 27(1): 19-25, 2010

2. Offenbacher S, Barros SP, Altarawneh S, Beck JD, Loewy ZG. Impact of tooth loss on oral and systemic health. *Gen Dent* 60(6): 494-500, 2012

3. Patel MH, Kumar JV, Moss ME. Diabetes and tooth loss: an analysis of data from the National Health and Nutrition Examination Survey, 2003-2004. *J Am Dent Assoc* 144(5): 478-485, 2013

4. Zadik Y, Bechor R, Galor S, Levin L. Periodontal disease might be associated even with impaired fasting glucose. *Br Dent J* 208(10): E20, 2010

5. Wu YY, Xiao E, Graves DT. Diabetes mellitus related bone metabolism and periodontal disease. *Int J Oral Sci* 26: 7(2):63-72, 2015

6. Doll C, Hartwig S, Nack C, Nahles S, Nelson K, Raguse JD. Dramatic course of osteomyelitis in a patient treated with immediately placed dental implants suffering from uncontrolled diabetes: A case report. *Eur J Oral Implantol* 8(4): 405-10, 2015

7. Pjetursson BE, Tan WC, Zwahlen M, Lang NP. A systematic review of the success of sinus floor elevation and survival of implants inserted in combination with sinus floor elevation. *J Clin Periodontol* 35(2008): 216–240, 2008.

8. Katranji A, Fotek P, Wang HL. Sinus augmentation complications: etiology and treatment. *Implant Dent* 17(2008) 339–349, 2008.

9. Borie E, Olivi DG, Orsi IA, Fuentes, R. Platelet-rich fibrin application in dentistry: A literature review. *Int J Clin Exp Med* 8(5): 7922-29, 2015.

10. Choukroun J, Diss A, Simonpieri A et al. Platelet-rich fibrin (PRF): A second-generation platelet concentrate. Part IV: Clinical effects on tissue healing. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 101(3): 56-60, 2006

11. Chang YC, Zhao JH. Effects of platelet-rich fibrin on human periodontal ligament fibroblasts and application for periodontal infrabony defects. *Aust Dent J* 56(4): 365-71, 2011.

12. Dimitrou R, Jones E, McGonagle D, Gianoudis P. Bone regeneration: current concepts and future directions. *BMC Medicine* 9: 66., 2011

13. Simonpieri A, Del Corso M, Sammartino G, Dohan DM. The relevance of Choukroun's platelet-rich fibrin and metronidazole during complex maxillary rehabilitations using bone allograft. Part I: A new grafting protocol. *Implant Dent* 18(3): 102–11, 2009.

14. Segura-Egea J, Martin-González M, Cabanillas-Balsera D, Fouard AF, Velasco-Ortega E, Lopez-Lopez J. Association between diabetes and the prevalence of radiolucent periapical lesions in root-filled teeth: systematic review and meta-analysis, *Clin Oral Investig* 20(6): 1133-41, 2016

15. Toffler M, Bullet N, Dds D, Ehrenfest DD. Introducing Choukroun's platelet rich fibrin (PRF) to the reconstructive surgery milieu. *J implant advanced clinical dent* 1(6): 21-31, 2009.