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GRAFTLESS IMPLANT PLACEMENT DURING MAXILLARY SINUS LIFT PROCEDURE: TREATMENT OUTCOMES

Dentistry

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ABSTRACT

The posterior maxilla is always a challenge for dental implant restoration. The presence of the maxillary sinus and reduced subantral bone height are the limitations for implant insertion. The need of the hour is to make surgical procedures simple, minimally invasive, and predictable. So, graftless implant placement has been tried and tested during the maxillary sinus lift procedure. This article delves deep into this procedure by throwing light on its treatment implications.

KEYWORDS

Dental implants, Maxillary sinus lifting, Sinus floor elevation, Graftless

INTRODUCTION

The rehabilitation of the posterior maxilla with prosthetic restoration poses a significant challenge due to inadequate bone height and pneumatization of the maxillary sinus. [1,2]

In 1970, Tatum developed the lateral sinus lift procedure. It is the generally accepted method with advantages of broad exposure of the sinus, hence good accessibility, significant elevation of the sinus floor, and increase in sufficient subantral bone volume. There are some disadvantages, which include the relatively extensive surgical needed, which has a steep learning curve and the possibility of risk of perforation of Maxillary Sinus Schneiderian membrane (MSSM), longer recovery time, and added cost. The second most commonly used procedure is Summers' technique of osteotome-mediated crestal sinus lift (CAS). This is less invasive, the sinus lift through the osteotomy site of implants. [3]

There are primarily two types of sinus membrane lifting approaches. The first is known as a two-stage approach, where the maxillary sinus floor is elevated through a lateral window. In this stage, the maxillary sinus membrane is augmented with various bone substitutes, such as autologous, xenogeneic, demineralised, or mineralised allogeneic bone and alloplasts. Subsequently, the implant is placed after a healing period. The second approach is a one-stage procedure that utilizes either a lateral or transalveolar approach, allowing both membrane lifting and implant placement during the same appointment. [4]

While the use of graft materials has shown favourable outcomes in sinus lifting procedures, [5, 6] the use of autograft bone presents certain disadvantages. These include the need for an additional surgical site, potential risks of donor site morbidity, postoperative pain, extended operating time, increased expenses, heightened risk of donor site fracture, and a limited graft amount depending on the chosen donor site [7, 8] Furthermore, allografts, xenografts, and alloplasts encounter various challenges, such as autoimmune rejection, a high risk of disease transmission, residual graft substances, infection, an extended healing period, and their associated high cost. [9] As a response to these challenges, an alternative method was developed, known as the lateral approach without grafting material. [2,10]

Graftless Implant Placement During Maxillary Sinus Lift Procedure

As the bone-forming capacity of the sinus membrane remains unclear according to the literature, bone-forming in an artificially created space under the sinus membrane must be based on a physiological process similar to callus formation in secondary bone healing or distraction osteogenesis.[11] This is the most probable theory, as the vast majority of the literature dealing with this topic reports reliable new bone formation in animal as well as human studies. [12,13] This would mean that the elevation of the sinus membrane is a prerequisite for the formation of a stable blood clot, which ossifies secondarily. The membrane itself is reduced to the function of a barrier whose own questionable osteogenic potential may not be necessary at all.

According to previous studies, the inherent osteogenic potential of the MSSM arises from its resident osteoprogenitor cells, which migrate to the fibrin clot and differentiate, leading to bone formation on and around the inserted implants. [14,15] The fibrin clot, which acts as a space retainer and provides an advantageous microenvironment or natural scaffold, also has a potentially beneficial effect on triggering the osteogenic potential of the cells residing within the MSSM.[16] Another study also stated that the injection of peripheral venous blood appeared to be beneficial for new bone formation in a graft-free maxillary sinus augmentation procedure.[17] The traumatic sinus lifting procedure and subsequent bleeding, ending with the formation of fibrin or a blood clot, may stimulate cells with osteogenic and probably angiogenic potential to migrate to the surgical site.

Through the healing process, these cells can differentiate into osteoblasts and vascular cells, and the clot can serve as a scaffold, creating a natural construct or a centre for the initiation of new bone formation. As indicated, mesenchymal stem cells (MSCs) derived from peripheral blood may contribute to bone formation in the sinus compartment.[18] These cells, although present in the peripheral circulating blood in low numbers, can be mobilized in large numbers from bone marrow to tissues undergoing traumatic or damaging events.[18] MSCs have been found in the blood of trauma patients with multiple bone fractures [19], suggesting that the disruption of bone marrow leads to the release of MSCs into the bloodstream. The cells then migrate or are recruited to the injury site to aid in tissue repair. [20,21] A similar mechanism may underlie the graftless sinus lifting procedure, which involves controlled trauma to the bone tissue and to the sinus membrane[14] In sinus lifting procedures, where tissue

damage occurs, the peripheral blood haemorrhage fills the compartment between the MSSM and the maxillary sinus floor. This blood is most likely very rich in MSCs and endothelial progenitor cells (EPCs), which are attracted by the stimulating factors of the traumatic event of the procedure. When this blood coagulates and forms a fibrin clot, it locks or forms an anchorage mesh for MSCs and EPCs. Cells can thereafter differentiate into osteoprogenitors and endothelial cells within the fibrin. These cells, which are evenly distributed throughout the fibrin scaffold or clot, may simultaneously initiate the formation of new bone tissue within the sinus compartment created. To this effect, it is hypothesized that these osteoprogenitor cells migrate from outside and from within the fibrin clot and serve as the main players in bone formation.

CONCLUSION

High survival rates with acceptable primary implant stability and satisfactory outcomes in terms of bone gain around the implant in both freshly extracted and healed sockets are observed in graftless implant placement during maxillary sinus lift procedure. Therefore, this approach of graftless implant placement during maxillary sinus lift holds promise as a success-producing procedure with very good clinical outcomes.

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