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Case study

Implantology

Crestal sinus lift using a turbine fitted with spherical diamond-faced burs with stops: Non-traumatic technique

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Abstract

Introduction

One of the most frequent reasons for failures during the operation of maxillary sinus floor lift is connected with the possibility of a rupture to the Schneiderian membrane which, if lacerated, cannot perform its function of graft containment. In order to reduce the incidence of complications the turbine is frequently used in association with spherical diamond-faced burs to cut the hard tissue with extreme accuracy and minor trauma, while saving the soft tissue.

In this study a new technique of maxillary crestal sinus lift performed with the aid of a turbine with spherical diamond-faced burs is proposed. Calibrated stops have been created to perfectly control the procedure.

Case Study

The patient was a female, 47 years old, non-smoker, healthy with no systemic disease, not on regular prescribed medication, periodontally treated, who needed an operation of maxillary sinus lift. The cortical of the maxillary sinus is reduced through the use of these burs so as to obtain a hole which can enable both access to the maxillary sinus and, subsequently, the lifting of the Schneiderian membrane. Working time is reduced to less than 3 minutes in the cortical thinning operation and percussive trauma is avoided.

Conclusion

Due to the reduction in trauma and invasivness of the process, this technique could be a valid alternative to the techniques known and applied to date.

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Introduction

With the increasing demand for implant-prosthetic treatments, there is a similar increase in the requirement for anatomic and morpho-structural sites for the application of fixtures. The anatomic limitations reduce the possibility to perform standard treatments and consequently the operator needs advanced surgical techniques in order to resolve more complex cases.

Often in the upper distal edentulous maxilla a marked osseous re-absorption is found, with large pneumatization of the maxillary sinus. This condition requires surgical lifting techniques of the maxillary sinus floor by means of which it is possible to transform part of the sinus cavity into osseous tissue adequate for implant-prosthesis.

Lifting the maxillary sinus floor can be achieved through different techniques thanks to osseous inlays: part of the maxillary sinus is filled with biocompatible material which after some months are transformed into bone thanks to re-absorption and remodelling processes.

When large cavity fillings are required, it is generally necessary to resort to vestibular approaches to the maxillary sinus. In these cases it is not always possible to insert the implants at the same time as the lifting procedure. A second operation is required when there is a residual osseous thickness, between three and six mm, such as to allow a good primary stability for the fixtures.

The crestal approach is increasingly employed where small quantities of biomaterial are required to fill the sinus cavity. In these cases it is generally possible to insert the implants immediately. These 'mini lifts' are therefore advisable when the initial osseous thickness is between 5 and 6 mm[1].

The techniques employed for the mini lift of the maxillary sinus are various, and for more than thirty years they have been continuously improving.

Among the first employed techniques was the Favero-Branemark technique that foresaw a minimum of 7-8 mm initial osseous height, utilising a green-wood (bone distraction) fracture of the sinus cortical. Despite the success of this technique only modest increments of bone growth, up to a maximum of 1.5-2 mm, were achieved[2].

One among the most widespread techniques is the Summers compaction technique, which is primarily used in the sites where there is low-density bone (D3, D4).

This technique prescribes the employment of compacting osteotomes with increasing diameter[3,4,5].

The main advantage is the resulting bone compaction, frequently not very thick in the upper distal sectors, while the disadvantage is due to the numerous and traumatic percussions. The lift can reach 3 - 4 mm.

The same technique was later modified in 1999-2002 by Fugazzotto, who introduced the employment of a trephine drill[6,7,8,9,10].

In 2000 Cosci[11] tried to make it even less traumatic by using drills without sharp (working) points.

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A variation of Summers expansion technique is the alternate osteotomic technique proposed by Malchiodi, where first concave and then convex chisels are used alternatively with increasing diameters[12].

A very widespread method is the one proposed by Zaninari that requires the sinus floor fracture with blunted chisels. The fragment of the fractured cortical is then used to lift the sinus membrane and subsequently the area is filled with biomaterial. Such a technique, that does not foresee compaction, reduces but does not eliminate the percussive trauma in comparison with Summers' technique.

While it reduces the number of chisels, the percussion strength remains a risk for the integrity of the Schneiderian membrane[13].

Recently there is the tendency to mainly develop techniques with crestal approaches such as the trans-alveolar lift with or without graft material and contemporaneous crest expansion that seem, in some cases, to achieve similar results to those obtained with vestibular access[14].

The main reason for failure of these operations is connected to the membrane laceration with consequent dispersion of the graft material in the maxillary sinus and therefore a failure in osseous reconstitution around the implant apex.

Another negative element is represented by the traumatism and invasiveness of these operations that often require various percussive procedures, resulting in trauma.
An interesting proposal is given by the ultrasound approach that slightly reduces trauma[15,16,17,18,19,20]. In particular, ultrasounds crestal approach seems to be useful to avoid ruptures of membranes[21].

Chen introduced a system of entering the sinus using a turbine drill coupled with hydraulic pressure to elevate the membrane[22].

Figure 1: operating RX with 2.3 mm drill close to the sinus floor.

Figure 2: Series of stops linked to the burs by a clip positioned in the crestal part of the drill.

Recently a new crestal hydraulic technique has been proposed. A particular injector, named ML, linked with a micrometric piston, Hydromab, allows for the elevation of the membrane and the filling of the sinus simultaneously[23,24].

The aim of this work is to propose and evaluate the efficacy of a new technique of maxillary sinus mini lift performed by aid of a turbine fitted with spherical diamond-faced burs linked to calibrated stops that allow a reduction in the cortical thickness without entering the sinus. The cavitation produced by the simultaneous use of air and water helps the detachment of the Schneiderian membrane. The technique reduces the traumatism of operations and would decrease the percentage of failure.

Materials

Spherical diamond-faced burs are used

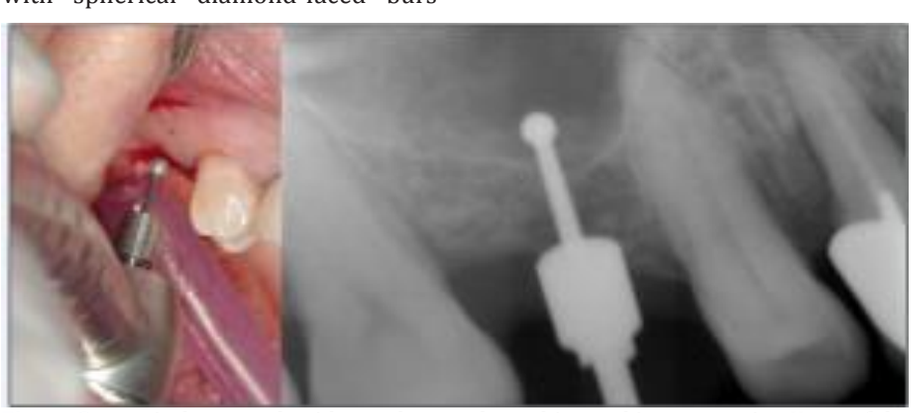

Figure 3: surgical approach with stop bur on the turbine and intraoperation X-ray of the bur touching the membrane.

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(FG 201L Intensiv, Switzerland) on which calibrated stops were connected. Eight stops were used with a dimension that increased every 1 mm and allowed for a working depth of between 1 mm and 6 mm.

The stops are easy to install and change as they have a form similar to tubular rivets with a central cylindrical void of the same dimensions as the bur at the apical end and a smaller opening with 4 incisions in the metal to allow for grip on the crestal end of each stop. The bur is slid through the tubular opening on the stop and together they can be positioned on the head of the turbine (NSK Phatelus Mach-lite S, Japan) using the crestal end of the bur, as normal.

The maxillary sinus cortical grows thinner so as to obtain a hole which can enable the access to the maxillary sinus and the lifting of the Schneider membrane internally. The cavitation produced by the contemporary use of air and water helps the detachment of the schneiderian membrane.

Case study

The following case study has been described in detail to illustrate the method used. The patient was a female, 47 years old, non-smoker, healthy with no systemic disease, not on regular prescribed medication, periodontally treated, who needed an operation of maxillary sinus lift. She had no signs of inflammation of the sinus membrane. Her second upper right premolar had been extracted 4 years previous and showed approx. 4 mm residual bone height.

The operation was carried out in the following phases:
A flapless approach to the osseous crest with circular mucotome of 4.8 mm diameter (FMD Rome, Italy).

Use of a calibrated helicoidal drill with 2.3 mm diameter to approach the sinus cortical stopping one millimetre from the cortical and at the same time to recover a small quantity of autologous bone collected in the drill coils. (Figure 1).
Preparation of spherical diamond-faced burs (FG 201L Intensiv, Switzerland) on which calibrated stops were connected (Figure 2 and Figure 3).

The membrane was detached by means of a round head compactor in order to avoid lacerations (Figure 4).

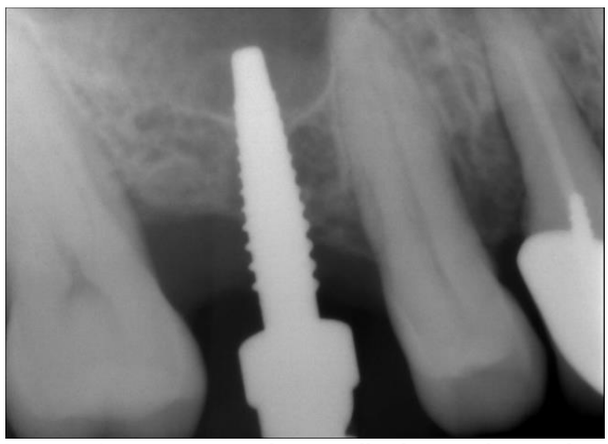

Figure 4: A compactor used to initially elevates the membrane.

Figure 5: The ML device subsequently and definitely elevates the membrane and fills the sinus with injectable biomaterial.

Figure 6: A mix of granules during the hydration.

A specific ML injector, (FMD Rome, Italy) was used to elevate the membrane and to fill the sinus[22,23]. The biomaterial used was a mix of cortico-spongious porcine derived bone in an 80% collagen matrix. The granulometry is less than 300 micron (Putty by Osteobiol-Tecnoss, Italy) This was chosen due to the fact that the small

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size of the granules better facilitates the injection process. (Figure 5).

A mixture was prepared and later inserted into the maxillary sinus, consisting of bone recovered by the drilling of the implant alveolus along with a mixture of cortico-spongious porcine derived bone granules with a dimension of between 250 and 1000 microns (Gen-Os by Osteobiol-Tecnoss, Italy). The graft was hydrated in a titanium dappen with saline solution (Figure 6).

A conical macro-morphology self-threading 3.5-4.8 implant (FMD, Italy; Shiner EVO with a 4.8 mm diameter crest neck) was inserted allowing for a contemporaneous horizontal expansion of the crest and a higher primary stability, thus reducing the risk of the implant accidentally sliding into the sinus. The implant apex is convex so as to avoid damaging the Schneiderian membrane (Figure 7).

Results

In the case described above ≥ 4 mm augmentations of osseous volume had been obtained. This result is comparable to those obtained in lifts where conventional techniques were applied.

Discussion

One of the most frequent reasons for failure in maxillary sinus floor lift operations is connected with the rupture of the Schneiderian membrane which, if lacerated, cannot contain the graft material. In fact the biomaterial, after becoming stable and remodeled, transforms into bone acting as fill-in and support to the implants located in the sinus.

In recent years there has been the increased tendency to use instruments and techniques so as to reduce the incidence of the type of complication mentioned above. In particular, the aim of this technique is to cut the hard tissues with extreme accuracy and minor trauma, while saving the soft tissues. The cavitation produced by the contemporary use of air and water along with the safety aspect that the stops provide, helps the detachment of the Schneiderian membrane.

Such characteristics not only meet the requirements of maxillary sinus surgery but are also much less traumatic a more traditional technique.

In addition, there is an elimination of percussive trauma due to the exclusive use of turbine rather than the more traditional hammer technique, with a direct decrease in the patient's discomfort. Furthermore the technique reduces the number of radiographic intraoperative checks necessary during the procedure, with consequent reduction in post-operative recovery time.

Conclusion

Even with the limited number of case studies carried out to date, is it possible to foresee that the results obtained with the technique described above are encouraging.

Both the reduced percussive trauma and the low invasivity mean such a technique should be considered a valid and concrete alternative to those known and performed heretofore.
Further studies are necessary in order to investigate the higher or lower efficacy in comparison with the statistically significant success.

Acknowledgment

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Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

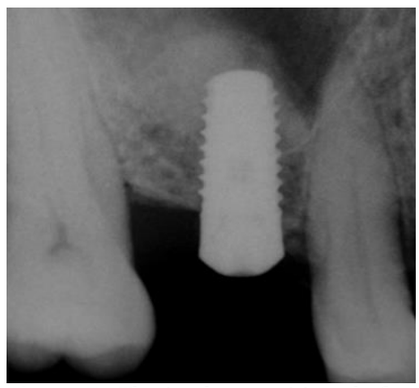

Figure 7: The implant positioned after the sinus lift.

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