The purpose of this article is to describe a drilling technique for sinus floor elevation for conical implants. This avoids the use of conical drills with the goal of increasing primary stability of the implant. The article will present two clinical cases.

The first case concerns a 45-year-old woman who is missing tooth 26, with a residual bone height (RBH) of 2.8mm. In this case, a crestal approach to the maxillary sinus was proposed. The second case describes a 60-year-old man with an edentulous superior maxilla. The decision was also made to treat using a sinus crestal approach. In both cases bovine xenografts were used.

Different drills were used for the sinus crestal approaches in each case in order to achieve maximum primary stability; there was no need for preparation with a counterbore drill to prevent the loss of primary stability. In both cases, the primary stability of the implants was satisfactory. Based on these results, and within the limitations of the present clinical cases, the use of special drills in conjunction with conical implants may be an acceptable surgical technique to increase the primary stability of the implant.

Introduction

Sinus floor elevation involves the internal augmentation of the maxillary sinus, which is intended to increase the vertical bone dimension in the lateral maxilla. This, in turn, makes the placement of dental implants possible. The procedure was first conceived of and introduced by Tatum at the Birmingham, Alabama implant meeting of 1976. The first publication concerning this surgical technique was, however, by Boyne, with a later paper by Tatum himself. The classic technique involves preparing a top hinge door in the lateral maxillary sinus wall, which is then luxated inward and upward together with the Schneiderian membrane to a horizontal position, which will form the new sinus floor. The space underneath this lifted door and sinus mucosa is then filled with graft material.

The implant can be inserted at the time of the sinus lift or during a second-stage procedure, depending on the primary stability of the implant. In 1994, Summers introduced the osteotome sinus floor elevation (OSFE). This technique is minimally invasive with an increase in residual height ranging from 5–10mm and a success rate of 96%. The OSFE procedure was subsequently modified with the addition of bone, and renamed bone-added osteotome sinus floor elevation (BAOSFE), a technique which allows surgeons to accurately and consistently achieve complete control over the height of grafted space without the risk of perforating the sinus membrane.

Since the publication of Summers’ original technique, various modifications have been proposed, one even suggesting the separation of the sinus membrane using the balloon lift control system (BLC). One of the most significant changes, however, has been the use of special burs for the crestal elevation of the maxillary sinus floor, and the introduction of the piezo-surgical sinus floor elevation (PSFE). Where appropriate, biomaterials can be used to achieve the crest elevation of the maxillary sinus. The rehabilitation of the atrophic maxilla may be greatly simplified by the use of implants ≤10mm and use of the OSFE technique without grafting.

Today, whenever possible, the implant is placed at the time of the sinus-lift. The most important factor is the primary stability of the implant. Some authors recommend maintaining a difference of 2mm between the diameter of the last drill used and the diameter of the implant placed.

Method and materials

Primary stability of the implant is extremely important for the success of treatment involving crestal elevations with simultaneous implant placement. The type of implant that is placed is
critical in achieving primary stability. Conical implants generate a force which permits greater primary stability. This is because they place pressure on the bone in directions oblique to the maxillary sinus. On the other hand, implants with parallel walls put pressure on the bone in a perpendicular direction, which reduces the primary stability on the implant (Figure 1.1–1.5).

**Clinical case 1 (implant diameter 4mm)**

The first case involves a 45-year-old female patient (Figure 2.1–2.13) who was missing tooth 26. Pre-surgical evaluation without relevant medical history revealed that she was a non-smoker and in good health. Cone beam computed tomography (CBCT) was performed, and residual bone height (RBH) of 1.81mm and crestal bone width of 7mm was observed. The treatment plan chosen was a sinus floor lift using the transcrestal technique and simultaneous implant placement.

The patient was treated with antibiotic amoxicillin/clavulanate 875/125 mg q8h starting one day before surgery for seven days, and ibuprofen 600mg q8h for five days. Local anaesthesia was administered (articaine hydrochloride 4% with epinephrine 1:100,000).

A full-thickness crestal flap was lifted with releasing incisions. After marking the bone with the initial drill, the second and final drill (2.8mm diameter) was inserted to a depth of 2mm until the maxillary sinus membrane was reached, taking care not to perforate it. At that stage the sinus membrane was touched lightly with a measuring probe and the Valsalva manoeuvre carried out in order to check that the membrane had not been perforated.

The graft material was prepared, and anorganic bovine bone mineral (Bio-Oss, Geistlich) was introduced through the aperture using a bone carrier. Next, a bone condenser was used to insert the biomaterial between the membrane and the sinus floor, coronally displacing the sinus membrane. Once the biomaterial had been inserted, an implant with a diameter of 4mm and length of 10mm (Biomet 3i) was placed with a stability of 40Ncm.
Clinical case 2 (implant diameter 6mm)

The second clinical case involves a 63-year-old male (Figure 3.1–3.9) with a completely edentulous superior maxilla. Pre-surgical evaluation established that the patient smoked one cigar per week. CBCT was performed and an RBH of 2mm and crestal bone width of 10mm was observed. The treatment that was chosen was a sinus floor lift using the transcrestal technique and simultaneous implant placement.

Before surgery, the patient was treated with the same course of antibiotics described in the first clinical case. The same dosage of local anaesthesia was also administered.

A full-thickness crestal flap was raised with releasing incisions. As the RBH was 2mm, only a diamond drill with a diameter of 4mm (Megagen implant, crestal approach) was used. The drill penetrated up to the first groove at 2mm, where the sinus membrane became visible. The graft material was then prepared with anorganic bovine bone mineral (Bio-Oss, Geistlich), and introduced through the aperture using a sterile plastic syringe. Once the maxillary sinus had been elevated with the xenograft, a conical implant with a 6mm diameter and 10mm length (Biomet 3i) was inserted at 16.

Overview

Two sinus floor elevations with simultaneous implant placements were performed in two patients. These procedures involved the replacement of missing molars. In both cases, implant site preparation was completed with a drill diameter that measured 1.2mm less than the implant used.

In the first case, an implant with a diameter of 4mm, length of 10mm (Biomet 3i) and stability of 40Ncm, was placed with only 1.8mm RBH. In the second case, an implant with a diameter of 6mm and length of 10mm (Biomet 3i) and stability of 35Ncm was placed where RBH measured only 2mm. In both cases the apex of the implant penetrated the maxillary sinus floor seamlessly. Although bone quantity, quality and width were paramount in deciding on a sinus crestal approach, the stability and integrity of the cortical crestal bone were of equal importance for primary stability.

<table>
<thead>
<tr>
<th>Implants</th>
<th>RBH</th>
<th>Elevation height</th>
<th>Implant length</th>
</tr>
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<tbody>
<tr>
<td>Case 1</td>
<td>16</td>
<td>1.81mm</td>
<td>8mm 10mm</td>
</tr>
<tr>
<td>Case 2</td>
<td>26</td>
<td>2mm</td>
<td>15mm 10mm</td>
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</tbody>
</table>
Discussion

Although osteotomes are routinely used for the crestal elevation of the maxillary sinus, the use of drills to make such preparations minimises patient trauma, and minimises the occurrence of benign paroxysmal positional vertigo. To achieve greater primary stability, a conical implant is ideal. Its anatomy favours greater primary stability in type III and type IV bone which is characteristic in the posterior maxilla. Transalveolar sinus floor elevation is a reliable method for implant placement in the posterior maxilla with ≤5mm of residual alveolar bone height, and even at sites with ≤4mm. There can, however, be serious complications when the RBH is lower.

One of the most common complications can be the migration of the implant to the maxillary sinus, or the expulsion of the implant into the oral cavity due to the loss of primary stability during the process of osseointegration. To further increase stability, the quantity of bone removed during milling should be minimal. To achieve this, a cylindrical bone preparation technique is recommended, because this removes less bone around the coronal third of the implant, thereby leading to increased pressure between the implant and the bone.

Additionally, conical implants have a narrower apex than parallel wall implants, and a progressively wider base. Therefore, the apex of a conical implant can more easily penetrate the sinus floor preparation. If a parallel-walled implant is used, one of the complications that can occur is that the implant can stop at the cortical maxillary sinus floor and rotate around itself, rather than penetrating the maxillary sinus. This is because the aperture in the sinus floor is smaller in diameter than the apex of the parallel implant. Finally, to maintain primary stability, preparation using countersink drills is not recommended.

Conclusion

It is important to start by noting that the technique described above is only suitable for a small subset of cases, and, additionally, that there can be serious consequences when carrying out a maxillary sinus floor elevation where the RBH is ≤4mm. If a thorough clinical evaluation determines that the patient is suitable for this approach, there should be a difference of at least 1–2mm between the diameter of the drill and the diameter of the conical implant in order to ensure sufficient primary stability. Using drills to make a parallel preparation for the insertion of a conical implant may be a valid approach for increasing the primary stability of the implant, although further studies are needed to establish this.
References


