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Case Report

Crestal approach maxillary sinus augmentation by osseodensification with simultaneous implant placement

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ABSTRACT

Primary implant stability at the time of implant insertion is a prerequisite to achieve osseointegration. Implant stability depends on the amount and quality available of bone tissue. The posterior maxilla is not considered the most favourable site for implant placement due to pneumatization of the sinus and low bone density. Osseodensification is a novel biomechanical bone preparation technique by use of specifically designed Densah burs™. This case report demonstrates simultaneous implant placement with sinus augmentation in the posterior maxilla with deficient bone height and compromised bone density in a patient undergoing implant therapy for replacement of missing maxillary right first molar. Implant osteotomy was prepared using the Densah burs and sinus membrane elevated using a viscoelastic putty graft material. Adequate sinus membrane lift along with enhanced bone density was achieved for the placement of standard-size implants using this technique.

1. Introduction

During the past few decades, Implant therapy has evolved into a successful treatment for rehabilitation of partial and complete edentulism.[1] This therapy has gained popularity as they restore the function and esthetics to near normal.[2] As for the replacement of single or multiple lost teeth, an Implant provides the closest simulation to a natural tooth. Achieving good primary implant stability is a prerequisite for the successful functioning of the implant, which depends on the mechanical engaging of the implant in the native bone at the time of surgical implant placement.[3,4] The posterior edentulous maxilla often presents with a hard tissue deficiency for prosthetic rehabilitation using dental implants. An alternative to counter this problem is the augmentation of the maxilla employing a sinus lift with use of a graft, thereby increasing the volume and quality of bone sufficient for implant placement, as longer implants show higher success rates, particularly in the area of poor bone density.[5] Various augmentation techniques have been proposed over the years.

To approach the maxillary sinus, a lateral window or transcrestal approach can be employed. Lateral window approach requires a slightly extensive exposure of the surgical site and may require additional releasing incisions for gaining access. On the other hand the trancrestal techniques as introduced by Summers made use of progressively larger osteotomes for sinus floor elevation. Another technique through the transcrestal approach is the Densah Sinus Lift technique. It involves the use of the Osseodensification concept for lifting the sinus membrane and simultaneous placement of dental implants. Osseodensification (OD) is a technique of biomechanical bone preparation performed for dental implant osteotomy and is characterized by low plastic deformation of bone

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that is created by rolling and sliding contact by the use of a densifying bur. This technique was developed by Huwais (2013) and made clinically possible using specially designed burs (Densah^{TM} burs). Osseodensification, a bone non-extraction technique against conventional implant site drilling that involves the removal of bone for dental implant placement. The Densah burs enable bone conservation and condensation during osteotomy preparation by compaction autografting, resulting in increased peri-implant bone density and enhanced implant mechanical stability.

2. Case Report

A 62-year-old systemically healthy male patient with the chief complaint of missing maxillary right first molar wanted replacement of the same. Radiographically, residual bone height was 6.5 mm and bone density of the region as indicated by Hounsfield units fell in the D3 category. An indirect sinus lift procedure using Densah drills was planned for placement of a standard size implant. The patient was explained the procedure and written informed consent was obtained. Professional mechanical plaque removal (PMPR) was carried out and necessary hematological investigations including a Complete blood count, bleeding time, and clotting time was carried out.

Fig. 1: Full thickness mucoperiosteal flap reflected

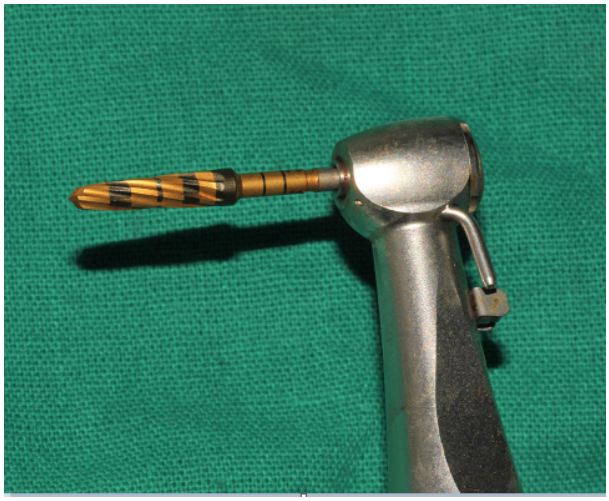

Fig. 2: Densah^{TM} Drill

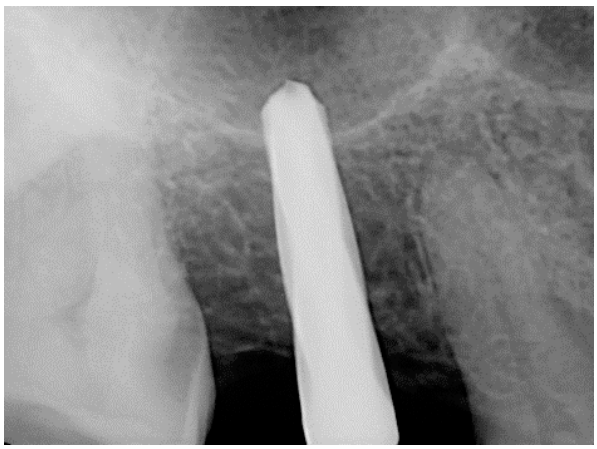

Fig. 3: Drill breaching the cortical sinus floor

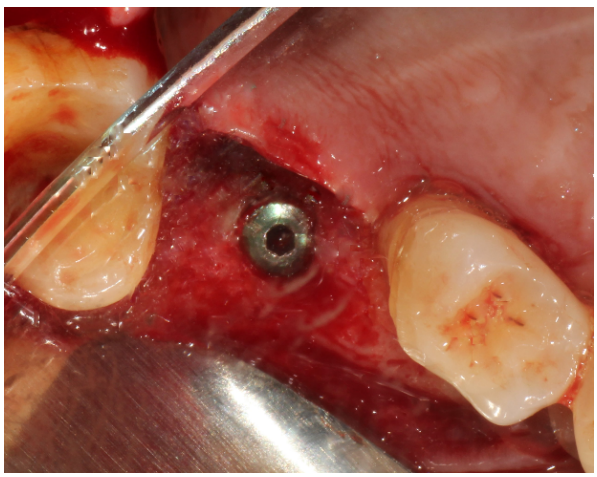

Fig. 4: Implant placement

Fig. 5: RFA primary stability reading of ISQ 82

Fig. 6: stability reading of ISQ 91

All the blood investigation report values recorded were in the normal range. Local anaesthesia (2% Lignocaine with 1: 80,000 adrenaline) was adminstered, a mid-crestal incision was given and a full-thickness mucoperiosteal flap was reflected (Fig 1). Osteotomy was initiated with a 2 mm lance drill and checked radiographically to verify the position and drill angulation. This initial osteotomy was then sequentially expanded using the densah drills in densification mode, which involves using the drills in a pumping motion in a counterclockwise direction (800-1500 rpm with copious irrigation) (Fig 2). Osteotomy was extended 1mm short of the sinus floor. The position of the drill was again confirmed radiographically. As the osteotomy is advanced carefully towards the sinus floor, one can feel the haptic feedback of the bur reaching the dense sinus floor. At this stage, the pressure is modulated with a gentle pumping motion to advance past the sinus floor in 1 mm increments (Fig 3). After achieving the final planned osteotomy diameter, the osteotomy was filled with viscoelastic alloplastic graft material - Novabone putty (NovaBone Dental Putty, NovaBone Products Alachua, FL). The last Densah bur of the osteotomy was used in Densifying Mode (Counterclockwise) with a low speed of 150-200 rpm and no irrigation to propel the allograft beyond the sinus floor. A standard size implant (4.5 x 11.5 mm) was placed with an adequate torque of 30N (Fig 4). A resonance frequency reading was taken to assess the primary implant stability and an ISQ of 82 was obtained indicating high primary stability (Fig 5). Sutures were placed to achieve primary flap closure and the implant was submerged for healing. After a healing period of 16 weeks, prosthetic procedures were initiated for implant loading. A stage 2 surgery involving implant uncovering was done and the cover screw was replaced with a healing abutment, for obtaining a gingival collar and impression making. A resonance frequency reading of 91 was achieved in terms of the Implant stability quotient (ISQ) depicting adequate secondary stability and a sound osseointegrated implant after the healing phase (Fig 6). A screw-retained porcelain fused to metal prosthesis was delivered to replace the missing maxillary right first molar.

3. Discussion

A surgical approach using osteotomes was introduced by Summers in 1994 for a crestal approach (indirect) sinus lift procedure and is appropriate when the subsinus residual bone height is 5 to 6 mm and the bone is of low density falling in the D3 category (350-850 Hounsfeild units).[6] Using osteotomes with increasingly larger diameters, bone is compacted laterally and apically around the implant site in this procedure by inducing microfractures in the cortical bone of the sinus floor. Potential complications of this technique include sinus infection, implant failure, implant displacement into the sinus, graft failure, sinus

perforation, and benign paroxysmal positional vertigo (BPPV).[7] However, this approach could also be traumatic to the patient in terms of experience as a mallet is used to tap in the osteotomes while osteotomy preparation. The Densah drill sinus elevation technique assists to overcome some of these drawbacks. These drills have a negative rake angle and a lot of lands to increase the density of bone as the bur expands an osteotomy.[8] The chances of antral membrane perforations are also minimised by virtue of the non-cutting tip as the drill is advanced to breach the cortical sinus floor.[9]

Many biomaterials such as particulate alloplastic bone replacements, have been suggested for use in sinus augmentation. The physical traits and properties of alloplastic bone substitutes have been enhanced by the continual research of biomaterials to incorporate innovative qualities including a mouldable putty consistency, improving the handling properties. The graft material used in this case report (Novabone putty) has a viscous putty-like consistency and a composition of calcium phospo-silicate, an additive phase consisting of polyethylene glycol, and a binder phase comprised of glycerin that is available in premixed cartridges and syringes.[10]Thus, the technique used in this case report allows for sinus lift and grafting along with simultaneous placement of implant with adequate implant stability, reducing the need for a second surgery for implant placement after sinus augmentation and therefore reducing the total rehabilitation time.

4. Conclusion

Subantral augmentation by indirect sinus lift procedures with Densah drills resulted in achieving adequate primary and secondary implant stability and allowed the placement of a standard size dental implant for rehabilitation of missing tooth in the deficient posterior maxilla.

5. Source of Funding

None.

6. Conflict of Interest

None.

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