INDIRECT SINUS LIFT OF ATROPHIC POSTERIOR MAXILLA USING OSSEODENSIFICATION: A CASE REPORT

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Abstract

Primary stability in implant placement is one of the most critical factors determining the outcome of implant therapy. The factors mainly involved in enhancing implant primary stability are bone density surgical protocol**,** and implant thread type, and geometry. The mechanical friction between implant surface and bone walls of the osteotomy site provides primary implant stability. The insertion torque peak was demonstrated to be directly related to implant primary stability and host bone density[5]; high insertion torque could significantly increase the initial bone-to-implant contact percentage (%BIC) with respect to implant inserted with low insertion torque values. Osseodensification is a novel biomechanical bone preparation performed for dental implant placement. It causes low plastic deformation of bone created by rolling and sliding contact with a densifying bur that is fluted to densify the bone as it drills with minimal heat elevation. **Osseodensification (OD),** a bone non-extraction technique, was developed by Huwais in 2013[8] and made possible with specially designed burs (Densah™ burs) to increase bone density as they expand an osteotomy. The new burs allow bone preservation and condensation through compaction autografting during osteotomy preparation, increasing the periimplant bone density.

This paper describes a case of indirect sinus lift with compaction autografting done in posterior maxilla along with simultaneous implant placement.

Keywords: osseodensification, indirect sinus lift, posterior maxilla

Introduction

Primary stability in implant placement is one of the most critical factors determining the outcome of implant therapy. The factors mainly involved in enhancing implant primary stability are bone density, [1, 2] surgical protocol**,** [3] and implant thread type, and geometry.[4] the mechanical friction between implant surface and bone walls of the osteotomy site provides primary implant stability. The insertion torque peak was demonstrated to be directly related to implant primary stability and host bone density[5]; high insertion torque could significantly increase the initial bone-to-implant contact percentage (%BIC) with respect to implant inserted with low insertion torque values.[6] Ottoni et al [7] demonstrated a failure reduction rate of 20% in single tooth implant restoration for every 9.8 N cm of torque added.

Osseodensification is a novel biomechanical bone preparation performed for dental implant placement. It causes low plastic deformation of bone created by rolling and sliding contact with a densifying bur that is fluted to densify the bone as it drills with minimal heat elevation. **Osseodensification (OD),** a bone non-extraction technique, was developed by Huwais in 2013[8] and made possible with specially designed burs (Densah™ burs) to increase bone density as they expand an osteotomy [9]**.** These burs combine advantages of osteotomes with the speed and tactile control of the drilling procedures. Standard drills remove and excavate bone during implant site preparation; while osteotomes preserve bone, they tend to induce fractures of the trabeculae that require long remodelling time and delayed secondary implant stability. The new burs allow bone preservation and condensation through compaction autografting during osteotomy preparation, increasing the periimplant bone density (%BV), and the implant mechanical stability was reported by in vitro testing.[10] When standard drills extract enough bone to let strains in the remaining bone to reach or exceed the bone micro-damage (MDX) threshold, the bone-remodelling unit (BMU) needs more than 3 months to repair the damaged area, so maintaining bone bulk will enhance healing and shorten the healing period.[11]

Unlike traditional bone drilling technologies, osseodensification does not excavate bone tissue. Rather, it preserves bone bulk, so bone tissue is simultaneously compacted and autografted in an outwardly expanding direction to form the osteotomy. It is accomplished by using proprietary densifying burs. When the densifying bur is rotated at high speed in a reversed, non-cutting direction with steady external irrigation (Densifying Mode), a dense compacted layer of bone tissue is formed along the walls and base of the osteotomy.[12] The bouncing motion (in and out movement) is helpful to create a rate-dependent stress to produce a rate dependent strain, and allows saline solution pumping to gently pressurize the bone walls. This combination facilitates an increased bone plasticity and bone expansion. Huwais in a case demonstrated that osseodensification utilizing the Densah™ Bur technology had facilitated ridge expansion while maintaining alveolar ridge integrity, allowing for total implant length placement in autogenous bone with adequate primary stability. Despite compromised bone anatomy, osseodensification preserved bone bulk and promoted a shorter waiting period to restorative phase.[13]

Undersized implant site preparation and the use of osteotomes to condense bone are surgical techniques proposed to increase primary implant stability and %BIC in poor density bone. Different healing patterns and periimplant bone remodelling models were also bserved .The alternative to implant drilling procedures in the posterior maxilla is the osteotome technique that aims to compact the bone with the mechanical action of cylindrical instruments along the osteotomic walls. This procedure created trabecular fractures with debris, which caused an obstruction to the process of osseointegration.

Osseodensification osteotomy diameters were found to be smaller than conventional osteotomies prepared with the same burs due to the spring-back nature of bone and elastic strain. This increased the percentage of available bone at the implant site by about three times. Histomorphological analysis has demonstrated autologous bone chips in the osseodensified osteotomy sites especially in bone of low mineral density relative to regular drills. These acted as nucleating surfaces promoting new bone formation around the implants, providing superior stability and greater bone density. Gil et al on the other hand found no significant difference in bone-area-fraction occupancy (BAFO) as a function of drilling technique (p=0.22)

CASE REPORT:

A 47 year old patient reported to the clinic with missing maxillary posteriors in the 1st quadrant with 15, 16 missing. Radiographic examination revealed that the available bone to be 5mm from the crest to the sinus floor necessitating an indirect sinus lift

Fig.1 preoperative OPG of the posterior maxilla

(fig.1). After a thorough history was recorded and necessary investigations were done, the patient was scheduled for surgery. The patient was asked to take prophylactic antibiotic coverage of amoxicillin 2g 1 hour prior to surgery.

After administration of anesthetic (Lignox 2%, Warren Pharmaceuticals), a crestal incision was

Fig.2 full thickness flap raised.

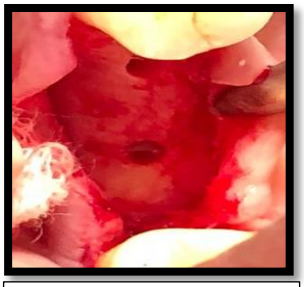

Fig.3 initial osteotomy completed with pilot drill

placed and a full thickness flap was reflected (fig.2).

Osteotomy was initiated with a pilot drill of 1.5mm diameter and was drilled to 1mm short of the sinus floor. This was done using the pilot drill in a clockwise direction (fig.3).

The position was confirmed by taking a radiograph. Once the initial osteotomy was determined, it was then sequentially expanded using the densah drills in densification mode, which involves using the drills in a pumping motion with copious saline irrigation in counterclockwise direction. The sinus membrane was simultaneously lifted along with bone densification and compaction autografting of the sinus floor (fig.4).

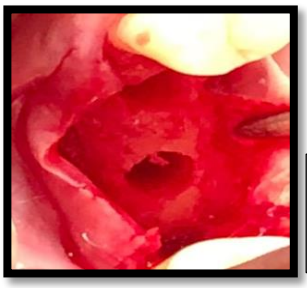

Fig.4: final osteotomy completed using osseodensification

Care has to be taken to see to it that not more than 3mm of the sinus is lifted indirectly at a given time according to manufacturer's instructions.

Two implants of 4mm and 4.5mm diameter and 8mm length were placed into the prepared osteotomies and cover screws were placed (fig.5).

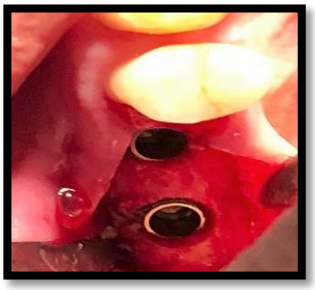

Fig.5: Implant placement done

Primary closure was achieved using silk sutures and was submerged for healing. Post-operative x-rays were recorded to assess the final position of the implants.

Following 3 months, the second stage was initiated and healing abutments were placed. After 10 days the closed tray impressions were recorded and a screw retained prosthesis was delivered. Post-operative IOPA was recorded to check the final seating of the prosthesis.

Conclusion:

Osseodensification is a novel osteotomy preparation method that is inherently bone preserving. Unlike conventional osteotomy, osseodensification utilizes proprietary high-speed densifying burs to compact and autograft bone in its plastic deformation phase. The result is an expanded osteotomy with preserved and condensed bone tissue that maintains alveolar ridge integrity and allows for implant placement with enhanced stability along with no violation of the sinus membrane.

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