ATRAUMATIC SINUS LIFT ELEVATION PROCEDURE USING DYNAMIC MAGNETIC MALLET: A CASE REPORT

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Abstract:
The sinus lift procedure is a well-established technique in dental Implantology, commonly performed to augment the posterior maxilla's bone volume in cases of insufficient alveolar height. Traditional sinus lift methods, such as the lateral window approach, may be invasive and carry risks. The use of a magnetic mallet for performing an indirect sinus lift has emerged as a promising, minimally invasive alternative, offering potential advantages in terms of precision and reduced trauma.
This case report describes the successful use of a magnetic mallet for an indirect sinus lift procedure in a 42-year-old patient with insufficient bone volume in the posterior maxilla. The patient presented with a desire for dental implants to restore masticatory function and esthetics. Preoperative imaging confirmed bone deficiency and adequate sinus pneumatization for the procedure. The magnetic mallet was used to gently elevate the sinus membrane without the need for a lateral window approach, thereby reducing surgical time, soft tissue trauma, and postoperative discomfort.

Introduction:
The most important factor in implant placement is the quality and quantity of bone. In the maxillary posterior region, this procedure becomes more complicated due to the limited bone volume and the close proximity of the sinus [1.] The sinus floor is near to the first molar region, the size of the sinus increases with age if the area is edentulous.
The maxillary sinus is a bony cavity lined by the Schneiderian membrane (sinus membrane). In implant placement procedures, it is important to carefully lift the sinus membrane to avoid damaging the maxillary sinus
The posterior region of the maxilla presents a particularly challenging anatomical region for dental implants, especially when there is insufficient residual bone height. In such cases, a sinus lift procedure, also known as residual bone augmentation, is recommended. This surgical technique involves elevating the floor of the maxillary sinus to create sufficient bone height for the successful placement of dental implants. There are various approaches to performing a sinus lift, including the Lateral Antrostomy, the Crestal Approach using Osteotomes, the Balloon Sinus Lift.[1]
The newly introduced Magnetic Mallet is an innovative surgical device that enhances the efficiency of sinus lift and split crest

procedures and also claims to do the routine osteotomy procedures. This ergonomically designed, magneto-dynamic handpiece is powered by a control unit, which regulates the precise timing and application of forces. The device generates a magnetic wave followed by a shock wave, modulating the force's timing to create both axial and radial movements at the tip of the osteotome. One of the key benefits of this device is that it eliminates common patient discomforts such as dizziness, nausea, vertigo, and Benign Paroxysmal Positional Vertigo (BPPV), which are often caused by the displacement of otoliths in the inner ear during traditional procedures.[1]

Case report:

A 42-year-old female patient presented to department of oral implantology with missing teeth in the posterior left maxilla (tooth numbers 25, and 26). The patient had been edentulous in this area for several years, and upon clinical and radiographic examination, it was determined that there was inadequate residual bone height for successful implant placement.
The patient was healthy, with no significant medical conditions that would contraindicate surgery. Her medical history included controlled hypertension, which was monitored throughout the treatment process and has a history of hyperthyroidism which was also in control as patient was taking medication for the same. Upon clinical examination patient had adequate interocclusal height and mesiodistal width. (fig 1)

Figure 1

On radiographic examination, available space with tooth no 25 was 13.8mm and tooth no 26 was 5.6mm, making 26 a sinus lift procedure as residual bone height was not sufficient. (fig 2)

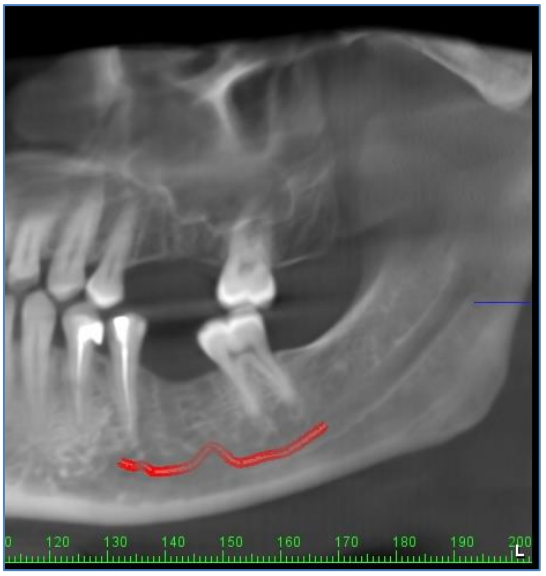

Figure 2

Patients consent was recorded prior to the surgery.
The procedure was performed under local anaesthesia (Septodont, lidocaine

hydrochloride 2% with adrenaline 1:80000 USP), with the patient being fully aware but pain-free throughout the surgery.
A mid crestal incision was made in the gingival tissue over the posterior maxilla, and a flap was reflected. (Figure 3)

The proposed implant site was first clearly marked with a 2 mm round drill (Straumann) followed by 2 mm pilot drill (GM helix aqua Neodent: Straumann).
Initial drilling of the bone at this site was done to confirm the density of the bone at the site, as bone in the posterior maxilla is generally spongy
The Magnetic Mallet (Osseotouch) was used to initiate the sinus lift. The device was connected to a control unit, which modulated the timing of force application. (fig 4)
The osteotome was carefully placed, and the Magnetic Mallet generated controlled magnetic and shock waves to precisely lift the sinus membrane, minimizing trauma to the surrounding tissues (fig 5)

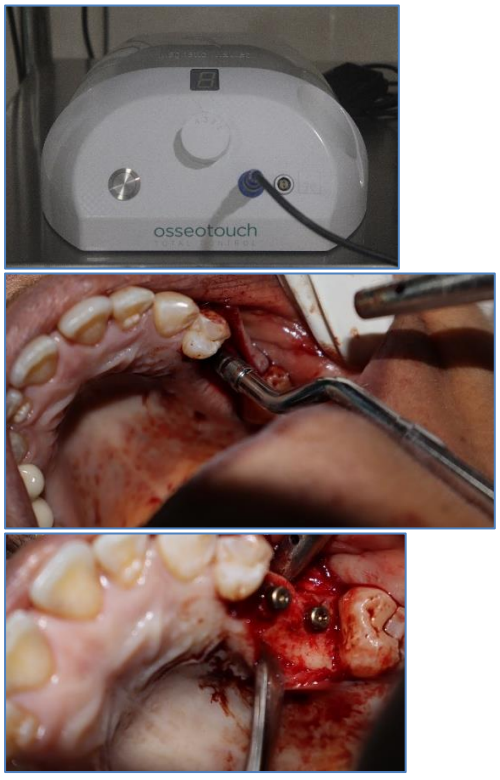

Figure 4, Figure 5 and Figure 6

The shock waves produced axial and radial movements, gently lifting up the sinus floor without creating stress on the bone and at the same time condensing as well as densifying the bone. Following which 3.75/10mm implant (Neodent GM Helix Acqua) was placed. Implant stability quotient was measured using a device using magnetic resonance frequency analysis (Osstell®, A W & H company). The recorded ISQ values were 76.
Cover screws (Height 2mm) for an uneventful healing and second stage surgery was scheduled post 4 months of implant placement. (fig 6)
The buccal flap was apically repositioned and stabilised with resorbable sutures [3- 0 vicryl (Ethicon) Johnson and Johnson Pvt Ltd]
Post surgery instructions were given, patient was prescribed antibiotics (Augmentin 625mg) and Non-Steroidal Anti-inflammatory Drugs (Zerodol SP)
Patient was asked to use mouthwash (Chlorhexidine ADS) for 15 days post-surgery and was also prescribed nasal drops (Otrivin) for 2 weeks post- surgery.

The radiograph was then taken to verify the position of implants. (fig 7)

Figure 7

Patient was recalled after 3 months for second stage and a CBCT was taken which revealed minimal bone loss. Implant stability quotient value obtained was 72. Following which abutment selection was done.

Figure 8

Figure 9

Selection of Abutments:

The choice of abutments included Universal abutments (Neodent: Straumann) of diameters
3.3/6/2.5 /17 degrees for 25 and 4.5/4/2.5 straight for 26. The abutments were selected using the abutment trail kit (Neodent: Straumann). Closed tray abutment level impressions were made with addition silicone impression material (3M ESPE) (Fig 10)

After a week a cement retained prosthesis (porcelain fused to metal) was done and post cementation instructions were given to the patient. (fig 11)

Figure 10 and Figure 11

Discussion:

Alveolar bone resorption is the most common complication post tooth extraction which ultimately influences the placement of implant thus reducing the treatment outcome as well as the prognosis.

Apart from this, there are other local factors such as the condition of the bone, type of the bone, location of the anatomical landmarks and patient systemic factors as well. Extraction technique depends on patient factors as well as clinicians skill and experience.

There have been various tooth extraction techniques i.e. elevators, periotomes and piezo-electric surgeries etc to create an atraumatic surgery thereby preserving the available bone. During extraction if there is bone loss, ridge preservation techniques can be done to achieve better bone during implant placement thus favouring the stability and overall prognosis of the implant. In addition to all these whilst implant placement there may be other complications that may be present in the form of decreased bone height, low lying sinus floor deviating the treatment options. Indirect sinus lift procedures or direct sinus lift procedures are the treatment options for such scenarios.

In indirect sinus lift procedures, there have been various techniques such as summers osteotomy using osteotomes, densification burs using densah burs, densification done with the implant drills, intracrestal lift and direct sinus lift using the lateral approach.

Summers osteotome is a minimally invasive technique which initially used progressively increasing osteotomes to lift the sinus however it was observed that the concave tip was lifting but at the same time tearing the bone resulting in sinus membrane perforation.[2] The concept of transcrestal approach was based on the implant supporting the membrane like a tent thus creating a space with clot which ultimately gets replaced by bone. These techniques are sensitive to variables such as the shape of the sinus floor, presence of sinus septae, Sinus membrane itself and the bone density. Thus, selection of patients is a key factor.[3]

Osseodensification was another technique that prepared the osteotomy by compacting the bone with use of specialized densah drills in a counterclockwise manner (2000 Spring Arbor Rd Suite D, Jackson, MI, USA)[4]. Osseodensification was less invasive and reliable in conserving the bone however some studies have noted a significant reduction is stability after 4 weeks [5]. Due to the limitations and most

commonly post operative symptoms by the patients, magneto dynamic tools are currently in use for such procedures.

The magnetic mallet showed improved precision in comparison to regular techniques simultaneous to preserving the bone and with controlled temperature which reduced the necrosis of bone [6]. Apart from sinus lift elevation these are also used in extractions, ridge splits, and implant site preparation. Since the mallet is designed in such a way that there is superior control which directs the forces in a constant motion thereby reducing post-surgical trauma.

The concept of magnetic mallet is based on generation of forces along the axis longitudinally which radially shifts the internal wall of the osteotomy causing a controlled fracture and break in the cortical bone thus preserving the bone tissue and maintaining the stability [7]. The literature supports the use of Magnetic Mallet as it causes less discomfort to the patient and also does not overheat the bone maintaining the crestal bone [8]. In another study done by Crespi et al it was noted that the implant survival was 96% after 24-36 months of follow up in implants sites placed with magnetic mallet Thus, magnetic mallet reduces the risk of complications and aids in implant survival [9]. However, studies are required with a long term follow up in sinus lift approaches

Conclusion:

Within the limitations of this report, magnetic mallet was shown to reduce the post operative complications experienced by the patients and improved control in complex situations requiring additional procedures such as sinus lift elevation. Patients were comfortable post surgery and had no post operative complaints.

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