Hydraulic sinus lift technique: description of a clinical case

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Abstract

Introduction

In this work the authors describe a new method, indicating in the maxillary sinus lifting through a crestal approach, characterised by the hydraulic detachment of the mucosa and simultaneous filling of the sub-schneiderian space, with a graft material of a pasty consistency.

Case report

In a 56-year-old non-smoking patient, edentulous in area 1.6 (Figure 2), presented to our observation for the need to re-integrate the missing element, we planned the implant placement and the later completion with an implant-supported metal-ceramic crown. The endoral x-ray exam of the edentulous site showed a reduced thickness of the residual bone which was confirmed by the Denta Scan CT exam (Figure 3.1); it was decided to make, along with the implant positioning, the maxillary sinus floor lifting, through the hydraulic sinus lift technique.

Conclusion

The hydraulic sinus lift technique allows the hydraulic detachment of the maxillary sinus mucosa and, at the same time, the filling of the sub-schneiderian space with the graft material.

Introduction

The techniques for lifting the floor of the maxillary sinus through a crestal approach, for implant purposes, today are widely used in ambulatory clinical practice, for managing bone atrophy of the lateral-posterior sectors of the upper maxillary³⁴, their indication has progressively increased over the years also due to their lower morbidity compared with the techniques with a lateral approach⁵⁷.

The fracture or wear of the cortical sinus floor and the later displacement of the sinus membrane constitutes the crucial phases of all the crestal lifting techniques⁵⁷ not supported by direct visual monitoring.

Detachment of the Schneiderian membrane can be performed directly with manual instruments⁹ or indirectly through the graft material, most techniques use the latter⁶,¹⁰-¹². The reason is found in the fact that the graft material is usually permeated with blood that, being a liquid, is not compressible. In 1994, Summers¹⁰ stated that the pressure, exercised by the compactors on the graft material mixed with the blood, forced the indirect hydraulic detachment of the maxillary sinus mucosa¹². Conversely it should be noted that the force transmitted by the compactors on graft material is not easily controlled to the point of sometimes being detrimental to the integrity of the sinus membrane⁹.

Some authors have recently proposed crestal lifting techniques that use hydraulic pressure for the displacement of the sinus membrane with alternative methodologies to those currently in use¹³,¹⁴. The proposed methods provide a preliminary detachment of the Schneiderian membrane through injection of a liquid followed by its spontaneous expulsion or aspiration, to then pass on at the insertion of the graft material in the sub-schneiderian space created this way. These methods, while effective, involve a prolongation of the operating procedure since it is conceptually simpler to use a graft material in a liquid state that when injected hydraulically raises the mucosa and fills the sub-schneiderian space at once. Furthermore, the method described above used conventional single-use syringes in which it is not possible to finely check on the progression of the piston since this is connected with individual sensitivity. Other authors also have proposed, in the past, direct injection of fluid graft materials in the sub-antral space but always through conventional single-use syringes activated manually¹⁵.

In 2010, Andreasi Bassi and Lopez¹⁶ proposed a new method that takes advantage of the hydraulic pressure exercised on a graft material of a pasty consistency to detach the antral mucosa and simultaneously fill the sub-antral space created this way. The authors called the technique Hydraulic Sinus Lift (HySiLiF)¹⁶. The instruments made for this purpose consist of three components: a titanium syringe (Hydromab, FMD, Rome, Italy) (Figure 1) equipped with a micrometric control piston on which it is possible to assemble single-use plastic syringes of various volumes, possibly equipped with a Luer-lock attachment; a dispenser in threaded surgical steel (ML Injector, FMD, Rome, Italy) available in two forms (conical and cylindrical) and four measurements (two cylindrical of ø 3.2 and 4.0 mm and two conical of ø 2.8-4.0 and 3.5-4.6 mm) and a needle in surgical steel, also equipped
with a Luer-lock attachment, complementary to that of the single-use syringe, that allows connecting of the two instruments described above. The single-use syringes can be pre-loaded with a desired amount of graft material that, in our experience, was represented by nanocrystalline hydroxyapatite in an aqueous medium (Ostim, Heraeus-Kulzer, Hanau, Germany), or it is possible to directly use the syringe containing the graft material as provided by the manufacturer. The semi-spherical tip of the ML Injector allows this instrument to penetrate barely 3 mm in the sub-schneiderian space without damaging the overlying mucosa while the lateral openings allow uniform distribution of the Ostim that, due to its paste-like consistency, forms a dome precisely in correspondence to the future implant site. The threaded portion of the dispenser extends for a length of 6 mm thus making its use indicated for ridges of thickness between 3 and 6 mm to ensure sufficient stability of the tool during the injection manoeuvre.

The choice of the type of dispenser used is a function of the diameter and the shape of the implant that will be positioned at the end of the elevation. The method cannot, however, be associated with the simultaneous insertion of the implant if the residual ridge has a thickness less than 4 mm, such as not to allow its sufficient primary stability. In this case only the injection of the material will be performed and, after six months, after the consolidation of the graft, implant insertion will occur.

Generally the procedure takes 5 minutes to inject 1 ml of material, but in most operating situations that provide for the treatment of a single site, the volume injected is between 0.5 and 0.7 ml. The micrometric screw can be activated manually or, if desired, by contra angle hand piece geared down. In this last case, a speed of 20 rpm and a torque no greater than 45 Ncm is recommended. After completing the injection, the Hydromab is disconnected from the dispenser and elevation obtained is checked through an x-ray prior to removing it. If the elevation is not considered sufficient it can be implemented by injecting other biomaterial with the same means already described.

After removing the ML Injector, if the remaining ridge has a height of more than 4 mm, the implant can be inserted and possibly should have a diameter of 0.4–0.5 mm wider than that of the dosing device used. Compatibility, however, with the horizontal dimensions of the residual bony ridge the implant tunnel may, however, be corrected, in the judgment of the operator, with osteotomy or with milling in order to make it more suitable to accept the implant chosen. The aim of this report was to discuss a HySiLift technique.

Case report

In a 56-year-old non-smoking patient, edentulous in area 1.6 (Figure 2), presented to our observation for the need to reintegrate the missing element, we planned the implant placement and the later completion with an implant-supported metal-ceramic crown. The endoral x-ray exam of the edentulous site showed a reduced thickness of the residual bone which was confirmed by the Denta Scan CT...
Before the implant placement the cortical portion of the implant housing was prepared by milling in order to allow the positioning of a cylindrical implant of convenient diameter (Eli-sir, FMD, Italy) (Figures 3.4 and 6), followed by the suture of the flaps. Ibuprofen (Brufen 600 mg, Abbot, Italy), every 8–12 hours for five days, and betamethasone phosphate (Bentelan 1 mg, Biofutura Pharma, Italy), 4 mg for five days, were administered for the control of the post-operative pain and oedema. For the disinfection of the surgical wound rinses were prescribed with chlorhexidine digluconate 0.2% (Corsodyl Mouthwash, GlaxoSmithKline, Italy), two/three times/day for seven days. After six months of waiting, the implant uncovering was performed and progressive management of the prosthetic load, protracted for a period of four months, through a temporary resin crown screwed onto pre-formed Peek abutment, was carried out. The case was finalised through a cemented metal-ceramic crown, on a pre-formed titanium-screwed abutment (Figure 7).

**Case report**

exam (Figure 3.1); it was decided to make, along with the implant positioning, the maxillary sinus floor lifting, through the HySiLift technique. The patient was treated with an antibiotic coverage with amoxicillin clavulanate (Clavulin, GlaxoSmithKline, Italy), 1 g every 8 hours for seven days, begun three hours before the intervention. After a first rinse of 1 minute with chlorhexidine digluconate 0.2% (Corsodyl Mouthwash, GlaxoSmithKline, Italy), for the disinfection of the mouth, loco-regional anaesthesia was performed for infiltration with articaine hydrochloride 4% with epinephrine 1:100 000 (Citocartin, Molteni Dental, Italy). Having exposed the bone plane through an envelope flap, the implant tunnel and the later controlled discontinuation of the sinus floor (Figure 4), through dedicated 2.8 mm drills (Sinus Lift Drill-FAL-LIFT-FMD, Italy), were performed, followed by positioning of the dispenser ML pre-loaded with Ostim (Figure 5). Before connecting the ML to the Hydromab a radiographic checking was performed in order to evaluate the protrusion of its nozzles in the lumen of the maxillary sinus (Figure 3.2).

Progressively, 0.5 ml of material was injected, in a span of 3 minutes, followed by radiographic control before the removal of the ML (Figure 3.3).

**Figure 3:** Endoral x-ray: (1) pre-operatory, (2) intra-operatory that shows, on site 1.6, the protrusion in the sub-antral space of the ML Injector; (3) verification of the dome elevation and (4) implant in situ.

**Figure 4:** Implant tunnel preparation and sinus floor discontinuation immediately before ML Injector placement.

**Figure 5:** ML Injector in place pre-loaded with the biomaterial.

**Figure 6:** Implant placement.

**Figure 7:** Prosthetic finalisation of the case, occlusal view.
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A year, after prosthetic finalisation, a clinical and radiographic follow-up, of the case, was performed verifying proper condition of the soft and hard peri-implants tissues (Figure 8).

Conclusion

The HySiLift technique allows the hydraulic detachment of the maxillary sinus mucosa and, at the same time, the filling of the sub-schneiderian space with the graft material. This method, which can be used both with flap and flapless interventions, joins the most common techniques for preparation of the implant tunnel and discontinuation of the maxillary sinus floor, allowing conspicuous and harmonic increases in the three dimensions of the sub-antral space volume. The strong point of this method is researched in: a brief learning curve, reduced invasiveness, reduction of the operating times and greater precision, thanks to the micrometric control, on the progression of the piston, that guarantees a precise and progressive application of the biomaterial.

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.

References


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