

Is lateral sinus lift an effective and safe technique? Contemplations after the performance of one thousand surgeries

A. Šimůnek¹, D. Kopecká¹, T. Brázda¹, R. V. Somanathan¹

Implantologie Journal 6/2007

Introduction

The authors assess the importance of lateral sinus lift in current implantology. They prefer a variant of the surgical protocol that minimizes the surgical and financial burdens for the patient. In addition they provide comments on contraindications and describe the most frequently occurring complications. After comparing it with alternative procedures, they concluded that Lateral Sinus Lift, despite having some disadvantages, is the most effective method for implantation into dorsal parts of the maxilla.

Dental implantology at the beginning of the Third Millennium can replace tooth defects almost always if they occur in an adult individual who is willing to cooperate and to provide a financial contribution thereto. Contraindications for implants are increasingly being reduced. Thanks to the augmentation procedure, we know of virtually no situations that the implant could not be implanted due to insufficient quantity of the alveolar bone.^{2,10}

Lateral Sinus Lift is one of the most widely used augmentation procedures. It enables to make an implant in the dorsal parts of the maxilla, where the bone often has poor quality and is reduced by the extended maxillary sinus. When considering that the minimum safe length of the implant is 10 mm, the bone at the site of the first premolar is very low in one-fourth (25%) of patients. The bone is insufficient in more than half of patients at the level of the second premolar, and in 80 to 90% of patients at the level of molars.³

Lateral Sinus Lift is usually carried out under general or local anesthesia, or under analgesia. After lifting the mucoperiosteum from the front wall of the maxilla, we should first use a round burr to create a window in the thin bone demarcating the maxillary sinus (Fig. 1). Antral mucosa must remain undamaged. Then we should lift the mucosa away from the bone using a special raspatorium to the extent of the alveolar recession and dislocate the same cranially (Fig. 2). A space will be created at the base of the maxillary sinus (Fig. 3) that will be filled with an appropriate augmentation material.² When an inadvertent perforation of the antral mucosa occurs during the preparation, such defect is most often covered by a resorbable barrier membrane, or sometimes collagen tape, a plate from autologous or lyophilized bone, or it can be closed by fibrin glue or by a fine suture.^{2,9} The scientific literature typically says that when the residual alveolar bone is at least 3 to 5 mm high, dental implants should be introduced during the Sinus Lift, as this would ensure their sufficient primary stability (single-stage surgery) (Fig.4)². When the bone offer is smaller, the implant should not be inserted before consolidation of the augmentation material (two-stage

procedure) (Fig. 5, 6). The time of healing depends on the augmentation material used. If it is non-autologous one, implants in the single-stage Sinus Lift should not be exposed to a functional load until 9 months. When using the two-stage variant, the implants should be applied after 6 to 9 months and exposed to a functional load after another 9 to 6 months. Use of autologous bone can reduce the length of treatment to one third.



Fig. 1: Window in the front wall of the maxilla. The mucosa of the maxillary sinus remains undamaged



Fig. 2: Preparation of the mucosa of the maxillary sinus using the special raspatorium



Fig. 3: Space for the augmentation material

¹ Centre of dental implantology at the Clinic of Stomatology, Teaching Hospital and Faculty of Medicine, Charles University, Hradec Králové, Czech Republic

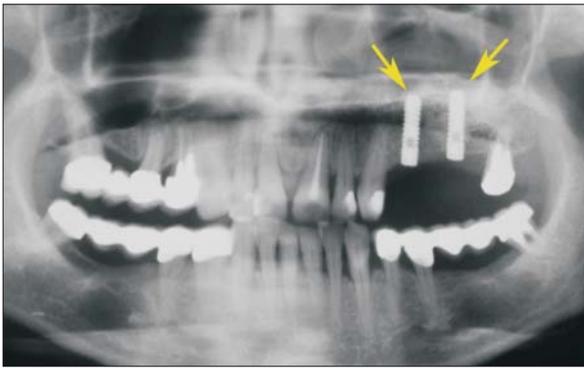


Fig. 4: Single-stage Sinus Lift

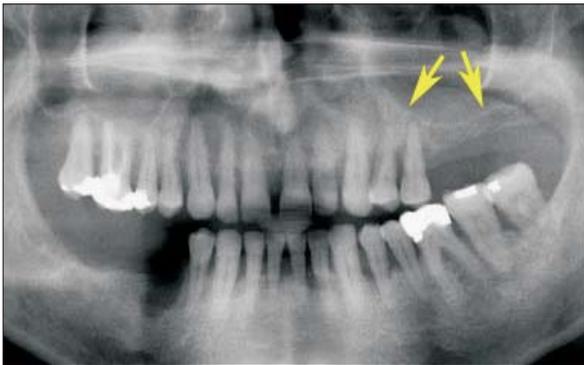


Fig. 5: Expanded maxillary sinus makes the common implantation impossible

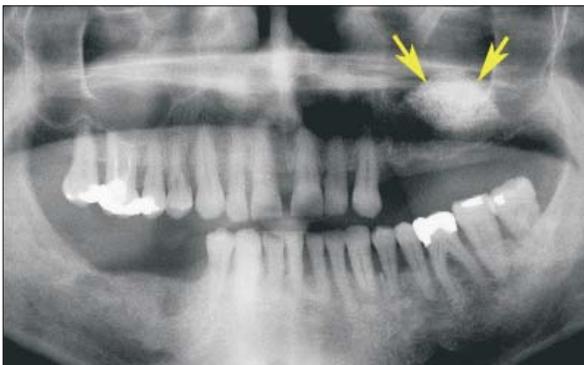


Fig. 6: Two-stage Sinus Lift in a patient from Fig. 5. A situation before the implantation

The objective of the work is to present our own experience with sinus lift surgery, describe its risks, most frequent complications and to evaluate the effectiveness of the procedure. This contemplation is based on the evaluation of results from one thousand lateral sinus lift surgeries that were performed from October 1995 until April 2007 at the authors' facility. A total of 2056 Implants (Lasak, Ltd., Czech Republic)⁵ and 232 Replace Select Tapered implants (Nobel Biocare, Sweden) were inserted into the augmented bone.

Surgical Protocol

Lateral Sinus Lift can be performed in many variants, characterized for example by type of anesthesia, method of bone preparation, selection of augmentation material, number of surgery phases, surface of implants or length of

healing period.² These factors have an influence on the rate of treatment, surgical load for patients, length of convalescence period, frequency of complications, and price of procedure. We consider the following surgical protocol to be optimal in terms of usual clinical practice. The protocol is adjusted to minimize the invasiveness of the procedure, risk of complications and financial burden for the patients. The said surgical protocol is characterized by the following parameters:

regimen:	outpatient
anesthesia:	local
bone preparation:	round surgical burr, diamond burr
augmentation material:	non-autologous
type of surgery:	single stage
dental implants:	hydroxyapatite coated
bone window coverage:	without barrier membrane
healing period:	6 to 9 months

Simplifying the procedure is the priority. Therefore, local anesthesia is fully sufficient when the surgery procedure is performed quickly. The use of a high-performance bone burr with a diameter of 3 mm (40000 revolutions per minute), which should be replaced at the end with a gentle, albeit less effective diamond ball of the identical diameter, reduces the time needed for the creation of the bone window to 1 to 3 minutes (Fig. 7, 8). The surgery as a whole including the implantation takes 30 to 40 minutes and is very well tolerated by patients. An unquestionable advantage is if the surgery is performed by a maxillofacial surgeon, as the procedure falls under the discipline of maxillofacial surgery rather than general dentistry.

Use of non-autologous augmentation material only substantially reduces the operative burden for the patient, although sometimes at the expense of longer in-growth period. Deproteinized bovine bone or beta-tricalcium phosphate are preferred materials.⁶ Addition of a small quantity of autologous bone (such as from tuber maxillae) has no positive influence on the augmentation effect.^{4,6} According to the authors, limited indications of single-stage Sinus Lift for alveoli higher than 3 to 5 mm is not justified, as it is contradictory to the commonly published opinions of experts.² Publications that prove this statement are currently under preparation.

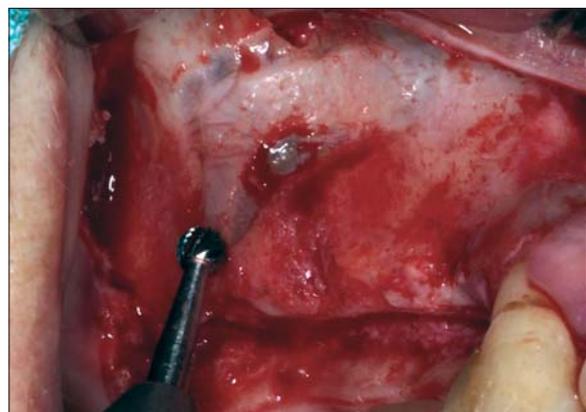


Fig. 7: A larger part of the preparation can be performed by a high-performance surgical burr

Single-stage variant of Sinus Lift is more beneficial in all aspects (Fig. 9). The standard healing period is 9 months and can be reduced to 6 months depending on the height of the alveolus. According to the experience of the authors, the rate of non-osseointegration for hydroxyapatite-coated implants is significantly lower compared to the implants with textured titanium surfaces^{1,8}. Use of a barrier membrane to cover the bone window is unnecessary. It is beneficial to apply medicines against the postoperative swelling, such as dexamethasone in the dose of 8 mg intravenously before the procedure and 0.75 mg twice daily orally for the subsequent 3 days.



Fig. 8: Completion of the preparation using the diamond burr that is gentler to the antral mucosa



Fig. 9: Single-stage Sinus Lift. Deproteinized bovine bone with Impladent implants (Lasak, Czech Republic)

Contraindications

Disorders and conditions that contraindicate the Sinus Lift have not been fully defined yet.² We would like to add the following remarks on the generally known and recognized rules:

1. Purulent exudate in the maxillary sinus is the most frequently occurring contraindication of Sinus Lift. Empyema, whether asymptomatic or not, is an absolute, though temporary, contraindication.
2. Situation after Caldwell-Luc operation usually makes the Sinus Lift highly difficult or impossible. Scar tissue cannot be treated as physiological mucosal lining.
3. If the patient reports a history of acute sinusitis and the cause thereof has not been eliminated, the augmentation may increase the proneness to further attacks of inflammation. The patient must be informed to this respect.

4. Chronic sinusitis does not complicate the Sinus Lift. On the contrary hyperplastic antral mucosa is increased mechanical resistance, which facilitates the preparation.
5. Mild osteoporosis is not considered to be contraindication, while moderate forms of this disease require prolongation of the healing period up to 12 months. We never performed surgery in case of severe osteoporosis.
6. Concurrent treatment with anti-aggregation drugs causes no life-threatening bleeding. Nevertheless it is recommended to discontinue such treatment subject to an agreement with the treating physician. Dose reduction is required in case of concurrent treatment with anticoagulants (the borderline level is INR 1.8). If not realistic, the patient should be transferred to low-molecular heparin.
7. Inhalation or superficial application of corticoids has no influence on the effects of surgery, as the absorbed dose of the medication is low.
8. Age itself is not a contraindication.
9. Controlled diabetes mellitus is not considered to be a contraindication, independently of the type of treatment.
10. We don't agree with the frequently occurring statement that heavy smokers have a thin mucous lining of the maxillary sinus, that is highly prone to perforation during the surgery.²

Complications

The following list contains notes on the most significant complication of Sinus Lift. Serious complications are very rare, while the occurrence of the other complications corresponds to the character of the procedure and is acceptable for both the patient and the surgeon.

1. By far the most frequently occurring complication is perforation of mucosa of the maxillary sinus during the surgery. If not closed spontaneously, we should use oxycellulose mesh (Surgicel, Johnson & Johnson) for coverage. This original procedure is fast, cheap and reliable, and was repeatedly published by the authors (Figures 10, 11)^{7,9}. In emergency, the mesh can be used to reconstruct the entire ceiling of the augmented space.
2. Acute sinusitis is the most serious complication. It is most frequently caused by infection of the augmentation material during the surgery. It has dramatic manifestations and requires revision surgery of the maxillary sinus under general

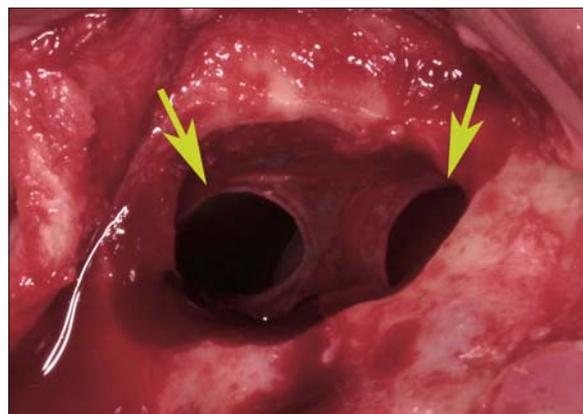


Fig. 10: Mucosal perforation

anesthesia with the removal of all foreign bodies. It is a quite rarely occurring episode, that had the occurrence of 0.1% in the presented group of patients.

3. Mild purulent exudate from a dehiscant mucosal wound accompanied by swelling, pain and subfebrile conditions, is not a big threat. It can be usually managed by irrigations and antibiotic therapy.

4. From time to time, we observe second intention healing, which represents no big risk for the effectiveness of the procedure. If the bone window is situated too close to the mucosal incision, or if the augmentation material is too much compressed, the augmentation material can be liberated from the wound. In this case, it is recommended to use antibiotic treatment and try to apply a secondary suture.

5. Postoperative hematoma is observed mostly in older females (Fig 12). It has annoying effects in esthetic terms but usually resorbs within two weeks.

6. Primary failure (non-osseointegration) of the implant remains a very rare event in hydroxyapatite-coated fixtures (1.4% in our group vs. 0.6% in implants into non-augmented bone). Long-term success is not significantly different from that of usual implantations.

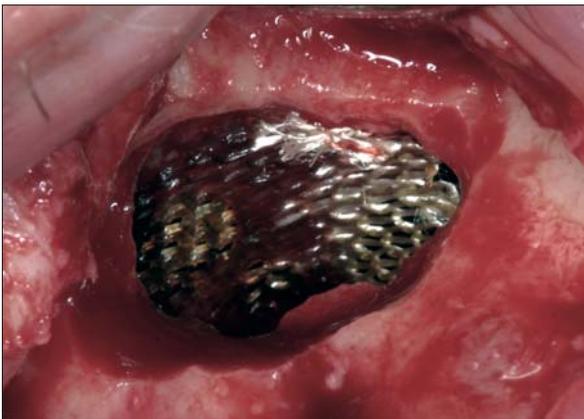


Fig. 11: Treatment of perforation from Figure 10 using oxycellulose mesh takes less than a minute



Fig. 12: Esthetically annoying postoperative hematoma

Evaluation of the Method

Sinus Lift is not an ideal technique in terms of advanced implantology that is characterized by efforts for easier and more rapid treatment. Relatively high invasiveness compared to simple implantation, need for great erudition of the surgeon, impossibility to correct vertical atrophy of the alveolar crest in the oral direction, financial burden, and especially prolonged healing period, are obvious handicaps.

However, alternative methods intended for implantation into dorsal parts of the maxilla also have some disadvantages. A limited effectiveness of the internal Sinus Lift, significantly lower reliability of tuberal or pterygoidal implants and invasivity zygoma implants are also significant shortcomings. Onlay augmentation by an extraoral bone graft is barely applicable common practice as it is difficult and invasive. A guided bone regeneration that elevates the alveolar process is accompanied by a disproportionately high number of complications and failures. Special short, large diameter implants cannot be always used and their long-term success rate has not been sufficiently confirmed. Management of a free-end situation with long distal cantilever is beyond the lege artis procedure. Sinus Lift is the only technique that enables the use of sufficiently long and optimally localized implants. Therefore we prefer Sinus Lift over any other techniques.

Conclusion

Lateral sinus lift, despite having some disadvantages, such as in particular high demands on both surgeon and the patient and longer healing period, is in most cases the best available solution for insufficient quantity of the alveolar bone during the implantation into the dorsal parts of the maxilla. Its role in current dental implantology is still non-replaceable. The invasiveness of the procedure can be substantially reduced when performed by an experienced surgeon using the presented surgical protocol. The risk of complications remains low.

Literature

1. Dostálová Z., Himmlová L., Jelínek M., Grivas C.: Osseointegration of loaded dental implant with KrF laser hydroxylapatite films on Ti6Al4V alloy by minipigs. *J. Biomed. Optics*, 6, 2001: 239-243.
2. Jensen O.T.: *The sinus bone graft*. Quintessence Publ., London 1999.
3. Kopecká D., Šimůnek A., Brázda T., Somanathan R.V.: Potřeba laterálního sinus liftu při ošetřování dorzálního úseku horní čelisti dentálními implantáty. *Čes. Stomat.*, 106, 2006, 2: 56-58.
4. Šimůnek A., Cierný M., Kopecká D., Kohout A., Bukac J., Vahalova D.: The sinus lift with phycogenic bone substitute. A histomorphometric study. *Clin. Oral Impl. Res.*, 16, 2005, 3: 342-348.
5. Šimůnek A., Kopecká D., Cierný M., Krulichova I.: A six-year study of hydroxyapatite-coated root-form dental implants. *West Indian Med. J.*, 54, 2005, 6: 395-399.
6. Šimůnek A., Kohout A., Kopecká D.: Srovnání efektu β -trikalciemfosfátu a deproteinizované bovinní kosti při operaci sinus lift. Srovnávací histologická a histomorfometrická studie. *Čes. Stomat.*, 106, 2006, 3: 67-71.
7. Šimůnek A., Kopecká D., Brázda T., Somanathan R.V., Bukač J.: Povrchová úprava implantátů zaváděných při operaci sinus lift. *Quintessenz*, 15, 2006, 1:55-59.
8. Šimůnek A., Kopecká D., Cierný M.: The use of oxidized regenerated cellulose (Surgicel®) in closing Schneiderian membrane tears during the sinus lift procedure. *West Indian Med. J.*, 54, 2005, 6: 393-394.
9. Šimůnek A., Kopecká D.: Využití Surgicelu při operaci sinus lift. *Progresdent*, 2005, 2: 30-31.
10. Vaněk J., Bilder J., Prachár P., Freyburg L.: Dentální enosseální implantáty v rekonstrukci zubního oblouku. *Choroby hlavy a krku – Head and Neck Diseases*, 7, 1998: 5-8.