Mucosal perforation in open maxillary sinus lift and dental implantation after restoration

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Abstract

BACKGROUND: Mucosal perforation is the most common complication in open maxillary sinus lift, which limits the clinical application of dental implantation. Clinical effects of precise operation in open maxillary sinus lift with dental implant for mucosal perforation.

OBJECTIVE: To analyze the cause of mucosal perforation in maxillary sinus lift with dental implant and to observe the effect of dental implantation after perforation closure.

METHODS: Twenty-nine cases underwent open maxillary sinus lift (39 implants). Mucosal perforation was repaired by absorbable biofilms, and coralline hydroxyapatite was used as a bone graft material in open maxillary sinus lift.

RESULTS AND CONCLUSION: Eight of 29 cases (20.5%) developed mucosal perforation, among which, 5 were repaired and implanted instantly, and the other 3 cases underwent sinus lifting and delayed dental implantation. No infection occurred, and only one case appeared to have implant shedding. All the 29 cases (39 dental implants) completed the restoration, and no implant loosening and pain occurred. These findings indicate that mucosal perforation in maxillary sinus lift is mainly related to the mucosal condition of the sinus floor, choice of operating instruments and surgeon’s operating skill. Based on the proper mucosal repair and appropriate selection of dental implants, open maxillary sinus lift with instant or delayed dental implantation can both achieve satisfactory effects.

Subject headings: tissue engineering; mouth; dental implantation; dental prosthesis repair

INTRODUCTION

Dental implants for repairing missing teeth have been widely accepted, and the successful rate of dental implantation is also a growing concern. The quality and quantity of bone bed in planting area are the largely determinant of successful dental implantation. When a natural tooth is lost because of dental decay, periodontal disease or dental trauma, the alveolar process begins to remodel. Over time, the ridge of edentulous (toothless) area is lost both in height and width. At the same time, the level of the maxillary sinus floor gradually becomes lower, which leads to a loss of bone volume that is available for dental implantation. Insufficient bone in missing tooth area is at maxillary posterior teeth, which has limited the process of implant restoration[11-17]. In 1976, Tatum was the first to create the maxillary sinus floor augmentation[15-17].

The goal of the sinus lift is to graft extra bone into the maxillary sinus, so more bone is available to support a dental implant. The maxillary sinus lift includes closed maxillary sinus floor lift and open sinus lift. The open sinus lift not only increases the height of maxillary posterior area, but also creates the conditions of dental implantation in posterior area[18-23]. The indication of dental implantation thus can be extended remarkably. Mucosal perforation is the most common complication in the open sinus lift; while in some respects it limits the clinical application of the sinus lift[3]. In this study, after surgical repair, the implants were stable and the masticatory function became normal in patients with mucosal perforation undergoing maxillary sinus lift with instant or delayed dental implantation.

MATERIALS AND METHODS

Design
A controlled clinical trail.

Time and setting
All experiments were performed at the Department of Stomatology, Second Affiliated Hospital, Xinjiang Medical
University, China from March 2010 to December 2011.

Subjects
The study group consisted of 29 patients with 39 implants (aged 29 to 62 years, average of 45.5 years), who required to undergo the open maxillary sinus lift. There were 16 males with 21 implants and 13 females with 18 implants. The vertical height of the remaining alveolar maxillary sinus was 2–4 mm, and the average height was 3.2 mm. After hearing the comprehensive explanation of the study, the patients fully understood the treatment plan, and signed informed consent.

The subject was limited to maxillary posterior of missing tooth. Moreover, patients with uncontrolled systemic diseases, who received radiation therapy, with the history of the maxillary sinus diseases or maxillary sinusitis, who were heavy smokers, or with acute infection, were excluded from the study.

Materials

<table>
<thead>
<tr>
<th>Reagents and instruments used in the experiments:</th>
<th>Name</th>
<th>Sources</th>
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<tbody>
<tr>
<td>Implant</td>
<td>Anthogyr</td>
<td>Anthogyr, France</td>
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<tr>
<td>Planting machine</td>
<td>Bien air oral planting machine</td>
<td>Bien air, Switzerland</td>
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<tr>
<td>Set Kit</td>
<td>Sinus Lift Instruments Set Kit</td>
<td>Dentsply, America</td>
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<tr>
<td>Bone substitute</td>
<td>Bio-oss</td>
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<td>Heal-All</td>
<td>ZH-bio, China</td>
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<tr>
<td>Absorbable suture</td>
<td>Aixikang</td>
<td>Heze, China</td>
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Surgical methods

Preoperative preparation
Before sinus lift, diagnosis was run to determine the health of the patient’s sinuses. Panoramic radiographs were taken to map out patient’s upper jaw and sinuses. In special instances, a CT scan is taken to measure the sinus height and width, and to rule out any sinus disease or pathological changes, identifying improvement of maxillary sinus and implant position. About 30 minutes before operation, patients were asked to use antibiotics amoxicillin and clavulanate potassium tablets (0.75 g), Xipaiyi mouth mouthwash liquid (20 mL).

Mucosal perforation and open maxillary sinus lift
Following conventional disinfection of surgery area, anterior palate nerve and the surgery area were anaesthetized with primacaine6-10. The surgeon made a horizontal incision in the middle of alveolar ridge crest and a vertical incision relaxation in the second molars mesial papilla area. The surgeon stripped off the full thickness mucoperiosteal flap with periosteal elevator, exposed the lateral wall of the maxillary sinus and alveolar ridge and pulled the fixed mucoperiosteal flap with sutures in order to fully expose the surgical area. According to the design position, the surgeon made a fenestration in the maxillary sinus bone wall with ultrasonic bone cutter, the fenestration was designed to be radius-type, about 1.0 mm×1.2 mm, the height from sinus floor to the edge was about 2–3 mm. The surgeon ground to the bone surface and the color of the bone was turn to blue. Flat head with a blunt metal instrument was used to tap the bone inward to create a separation, instrument with a sinus lift was used to strip the maxillary sinus mucosa carefully along the edge of fenestration, push the sinus mucosa to the top of sinus inward and upward, the maxillary sinus mucosa was required to cease on the height we need.

With the stripping and relaxation of damaged mucous membrane, mucosal perforation was sealed by Heal-all biofilm. The biofilm was trimmed larger than the perforation, and sealed the perforation. At the same time, the Bio-oss spongious bone substitute was implanted in the sinus, and implants were implanted simultaneously or delayed. After that, the bone was tamped densely, the fenestration was sealed by Heal-all biofilm, mucoperiosteal flap was sewed tightly, and the wound was covered with periodontal dressing.

After operation, the local area was compressed by ice for 24 to 48 hours, and intravenous injection of antibiotics was given 3–5 days. The patients were asked to avoid blowing the nose and coughing. Suture was removed after 10–14 days.

Main outcome measures

The criteria of evaluation
According to the Albrektsson’s standard, we evaluated the osseointegration in different cases14: (1) The implants have no clinical mobility. (2) There was no X-ray transmission around the implants. (3) The vertical bone resorption of the implants should be less than 0.2 mm per year. (4) The mucosal tissue should be healthy around the implants.

Postoperative follow-up
After the restoration of implants, patients were followed up for 6 to 12 months.

RESULTS

Repair of mucosal perforation and dental implantation
During the open sinus lift, mucosal perforation was found in 8 of 29 cases (20.5%), among which, 5 cases (perforation size < 5 mm) were repaired and implanted instantly, and another 3 cases (perforation size > 5 mm) underwent the sinus lift and delayed dental implantation after 6 months. And at that time, the implant fell off in one case.

Postoperative conditions
There were some intraoperative or postoperative complications, such as one case of nasal bleeding, one case of a little of bone outflow. No infection occurred after surgery. The implant (non-submerged) fell off in once case
after 3 months, because the implant did not achieve good osseointegration. But the bone of sinus floor formed well, and we re-completed the conventional surgery after 6 months and completed crown restoration after 12 months.

Results of follow-up
During the postoperative follow-up of 6-12 months, the implants completing the restoration had no clinical mobility; there was no X-ray transmission around the implants; the vertical bone resorption of the implants was not obvious; the mucosal tissue was healthy around the implants.

DISCUSSION
With the continuous improvement of implanting technology and materials, the maxillary posterior has become the most popular way of treatment, because the bone height of the maxillary sinus floor that is not enough can be improved through the maxillary sinus lift. Maxillary sinus lift is a technical mean of increasing bone’s quality and quantity when there is no sufficient bone in maxillary posterior teeth area for dental implantation, and it is divided into external and internal lifting. Mucosal perforation has the high incidence in maxillary sinus lifting, and its incidence has been reported in 10% to 35%. Mucosal perforation leads to the delay or failure of dental implantation. In our study, mucosal perforation occurred in 8 of 29 cases (20.5%) undergoing open sinus lift (39 implants).

Considering the causes of mucosal perforation in the maxillary sinus lift, authors believed that it is related with the following factors: (1) Anatomy factor: the particularities of the maxillary sinus anatomy are easy to cause mucosal damage in stripping process, such as sinus septum, uneven maxillary sinus floor or uneven thickness mucosa; (2) the option of surgical instruments: it often appears when the round burs are drilled into bone fenestration to cause a mucosal damage with excessive grind when the round burs are used to grind the bone along with window line in maxillary anterior; (3) the trauma of surgery: it cannot fully release the mucosa attached to the side wall of the maxillary sinus when the maxillary sinus mucosa is exposed. Overall, it is the main measure to prevent the complications of maxillary sinus lifting that before operation, the surgeon should have a detailed understand about local anatomical structure and choose specific tools and have operative skills when stripping off the mucosa

Perforation occurred in 8 of 29 cases (20.5%) of the atrophic upper jaw: a review of the literature since 1974. Prosthodont. 1993;6(2):95-105.

E45-E56.

To choose appropriate cases and accurate preoperative plan is an important factor to prevent mucosal perforation in the open maxillary sinus lift. Therefore, the following aspects should be paid attentions when reducing complications in the maxillary sinus lifting. First of all, the surgeon need to evaluate the height of the maxillary sinus and sinus situation through panoramic dental film or oral CT before surgery, for example, the presence or absence of sinus inflammation, the cyst, or the ridge of sinus. The ridge of the maxillary sinus wall is the apophysis of maxillary sinus cortical bone, which is also the main cause of mucosal damage. The incidence of maxillary sinus ridge is from 16% to 58%, and it is necessary to fully understand the ridge of maxillary sinus before surgery. The panoramic dental film has a misdiagnosis rate of 44.1%, and oral CT has a higher rate of diagnosis for the ridge. The ridge of maxillary sinus can be presented into spiny, serrate or bulge-like, and it is prone to causing mucosal perforation when stripping the attached mucosa from the region, so to increase the number of windows for prevention of mucosal perforation is necessary. Secondly, it is particularly important to select the appropriate surgical instruments. In recent years, the use of new equipments has brought a lot of good clinical results. The use of ultrasonic bone surgery can decrease the incidence of mucosal perforation in the open maxillary sinus lift. Blus and co-workers pointed out that the use of ultrasonic bone surgery can decrease the occurrence of maxillary sinus perforation, due to decreased intraoperative complications, the implant has a good prognosis relatively. Finally, it is very important to choose the best surgical approach. There is a correlation between different window shapes designed and perforation occurrence. It has been reported that the shape of the bone and design of the bone window greatly affect the probability and size of mucosal perforation. Round bone window has fewer opportunities than the quadrilateral bone window to cause perforation. If the mucous membrane is damaged in fenestration, the surgeon should open window around the fenestration, and then isolate them; if the mucous membrane is damaged in stripping, the collagen membrane must seal fully. The group has no case of bleeding or bone particles out of the nasal cavity and other phenomena.

In this study, we strictly controlled surgical indications, and the clinical effects of the maxillary sinus lift could be expected in the short term. Fewer cases and no case-control studies influence the research outcome, and the long-term clinical effect need to be further studied.

REFERENCES


上颌窦外提升:黏膜穿孔:临床效果:牙列缺失:新疆维吾尔自治区自然科学基金

主题词:组织工程:口腔:牙种植:修复体修补

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摘要:背景:有研究表明上颌窦黏膜穿孔是上颌窦外提升最常见的并发症,限制了种植手术的临床应用,但在上颌窦破坏后需做种植的患者植入种植体后的临床效果至今少有报道。

目的:分析导致上颌窦外提升中窦底黏膜穿孔的原因,观察黏膜穿孔封闭后完成种植的效果。

方法:收集行上颌窦外提升术治疗的患者29例,共植入种植体39颗。若发生穿孔,修补或封闭穿孔用可吸收生物膜,植骨材料为羟基磷灰石生物陶瓷骨粉。

结果与结论:在29例共39颗种植体进行上颌窦外提升时8例(20.5%)发生窦底黏膜破损,其中5例行穿孔修补后同期完成植骨;另外3例穿孔加大修补后植骨,延期行口腔种植;所有病例未发生感染,1例(2.6%)发生植体脱落。39例均已完成后期修复,种植体无松动,无疼痛。结果证实,在上颌窦外提升术中导致上颌窦底黏膜穿孔的主要成因在于窦底的黏膜状况、提升工具的选择以及术者的操作,如果黏膜修复得当以及选择合适的种植体,同期或延期种植均可获得良好效果。