

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

Wu Pei-ling, Zhang Xiao-qian, Nijiati Tuerxun, Li Yi-ming

Department of Stomatology, Second Affiliated Hospital, Xinjiang Medical University, Urumqi 830063, Xinjiang Uygur Autonomous Region, China

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.

Wu Pei-ling, Professor, Chief physician, Doctoral supervisor, Department of Stomatology, Second Affiliated Hospital, Xinjiang Medical University, Urumqi 830063, Xinjiang Uygur Autonomous Region, China

Corresponding author: Wu Pei-ling, Department of Stomatology, Second Affiliated Hospital, Xinjiang Medical University, Urumqi 830063, Xinjiang Uygur Autonomous Region, China

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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^[1-17]. 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 trial.

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

Reagents and instruments used in the experiments:

Materials or instruments	Name	Sources
Implant	Anthogyr	Anthogyr, France
Planting machine	Bien air oral planting machine	Bien air, Switzerland
Set Kit	Sinus Lift Instruments Set Kit	Dentsply, America
Bone substitute	Bio-oss	Geistlich, Switzerland
Biofilm	Heal-All	ZH-bio, China
Absorbable suture	Aixikang	Heze, China

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), Xipayi mouth mouthwash liquid (20 mL).

Mucosal perforation and open maxillary sinus lift

Following conventional disinfection of surgery area, anterior palatine nerve and the surgery area were anaesthetized with primacaine^[8-10]. 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 spongy 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 cases^[4]: (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%^[5]. 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^[24-29]. In this study, mucosal damage happened in two cases when the surgeon used round burs to drill the bone wall, in two cases when the surgeon stripped off the mucosa attached to bone wall, and in one case when the surgeon encountered the maxillary sinus divided ridge.

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%^[6], 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%^[7], and oral CT has a higher rate of diagnosis for the ridge. The ridge of maxillary sinus can be presented into spiny, serrated 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^[8]; 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^[9]: round bone window has fewer opportunities than the quadrilateral bone window to cause perforation^[10-14]. 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.

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上颌窦外提升中黏膜穿孔成因与修复后的种植

吴佩玲, 张晓倩, 尼加提·吐尔逊, 李一鸣(新疆医科大学第二附属医院口腔科, 新疆维吾尔自治区乌鲁木齐市 830063)

吴佩玲, 女, 1959 年生, 山东省人, 汉族, 1983 年新疆医科大学毕业, 博士生导师, 主任医师, 教授。

通讯作者: 吴佩玲, 新疆医科大学第二附属医院口腔科, 新疆维吾尔自治区乌鲁木齐市 830063

文章亮点:

上颌窦提升术分为内提术与外提术, 是上颌后牙区骨量不足时行种植修复的方法。但是由于各种原因在行上颌窦提升术时, 特别是外提升易导致上颌窦黏膜穿孔, 使得种植手术延期或放弃。文章采用回顾性

研究分析了上颌窦底外提升术时黏膜穿孔的成因以及穿孔处理后即刻或延期完成种植的效果观察。

关键词:

组织构建; 组织工程; 上颌窦外提升; 口腔种植; 窦底黏膜; 修补; 穿孔; 植骨;

上颌窦内提升; 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

关键词: 组织工程; 口腔; 牙种植; 牙修复体修补
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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。

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作者贡献: 试验设计为第一、二作者。实施为第一、三作者。资料收集为第一、三作者。第一作者评估、成文、审校并对文章负责。

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伦理要求: 根据中华人民共和国国务院颁发的《医疗机构管理条例》, 在试验前将试验方案和风险告知对方, 并签署知情同意书。

学术术语: 上颌窦底提升术-是采用外科手术方法将上颌窦黏膜从窦底剥离后抬高, 在窦底黏膜与窦底骨之间植入骨移植材料, 这可有效增加骨的高度。

作者声明: 文章为原创作品, 无抄袭剽窃, 无泄密及署名和专利争议, 无一稿两投, 内容及数据真实, 文责自负。

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姚金凤	于保锋	郁卫东	张飞雄	张柳	张新宇	张志强	赵铭	郑明峰	周静	周静	朱恒
姚女兆	于栋	喻智勇	张桂珍	张曼	张兴	张治军	赵楠	郑卫东	周磊	周磊	朱建炜
姚女兆	于海龙	袁发煊	张海波	张沛	张兴凯	张智源	赵平	郑宪友	周梅生	周梅生	朱平
姚星宇	于美丽	袁峰	张翮	张鹏	张晓明	张子峰	赵晴	郑燕平	周苗	周苗	朱绍兴
											左奕