Incidence of oral sinus communications in 389 upper third molar extraction

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Received: 12-03-2005
Accepted: 12-02-2006

del Rey-Santamaría M, Valmaseda-Castellón E, Berini-Aytés L, Gay-Escoda C. Incidence of oral sinus communications in 389 upper thirmolar extraction. Med Oral Patol Oral Cir Bucal 2006;11:E334-8.

Indexed in:
-Index Medicus / MEDLINE / PubMed
-EMBASE, Excerpta Medica
-Indice Médico Español
-IBECS

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ABSTRACT

Introduction. The incidence of oral sinus communications (OSC) following the extraction of an upper third molar remains uncertain.

Objectives. The purpose of this study was to determine the incidence of OSC following the extraction of 389 consecutive upper third molars during 2003 in the Master of Oral Surgery and Orofacial Implantology (Barcelona University, Spain).

Patients and method. Different variables were recorded, including patient age, sex, molar angulation, surgical technique and radiological sinus proximity, to determine the relation between third molar extraction and the incidence of OSC.

Results. Only 5.1% (95% CI: 2.2-7.3%) of the upper molar surgical extractions produced OSC, the risk of which was found to be similar in all age groups and increased with the depth of third molar inclusion, the complexity of the surgical technique and the performance of an ostectomy.

Key words: *Oral sinus communications, incidence, third molar, tooth extraction.*

RESUMEN

Introducción. La incidencia de las comunicaciones bucosinusales (CBS) tras la extracción del tercer molar superior no se conoce con exactitud.

Objetivos. El objetivo de este estudio fue identificar la incidencia de las CBS tras la extracción de 389 cordales superiores realizadas durante el año 2003 en el Máster de Cirugía Bucal e Implantología Bucofacial de la Universidad de Barcelona.

Material y método. Se registraron diversas variables con el fin de determinar la relación de la extracción del tercer molar con la incidencia de las CBS: la edad y el sexo del paciente, la angulación del cordal, la técnica quirúrgica y la sospecha radiológica de proximidad con el seno maxilar.

Resultados. Únicamente el 5.1% (IC 95%: 2.2-7.3%) de las extracciones quirúrgicas de los cordales superiores provocaron una CBS. El riesgo de producir una CBS fue similar en todos los grupos de edad, y aumentó con la profundidad de inclusión del tercer molar, la complejidad de la técnica quirúrgica y al efectuar ostectomía.

Palabras clave: *Comunicación bucosinusal, incidencia, tercer molar, extracción dentaria.*

INTRODUCTION

Oral sinus communications (OSC) are pathological conditions characterized by the existence of a communication between the oral cavity and the maxillary sinus, as the result of a loss of the soft and hard tissues which normally separate both compartments (1). OSC are a complication of dental extractions that facilitate microbial contamination from the oral cavity towards the interior of the maxillary sinus (2). If the OSC remains open to the buccal space, or if infection persists for a long period of time, chronic inflammation of the sinusal membrane may result (3,4), with permanent epithelization of the oral sinus fistula – a situation that further increases the risk of sinusitis (5-7). In recent OSC, the margins are seen to be edematous, as a result of which spontaneous healing depends only on the existence of normal, stable and uninfected clotting, and the capacity to cover the clot with ciliary epithelium of the maxillary sinus and squamous epithelium of the oral cavity (4-6).

The most frequent cause underlying OSC is surgical extraction of the second premolar and of the first and second molars of the upper jaw (the latter also being referred to as "antral teeth") (2,6,8,9). This is due to the proximity between the apexes of these teeth and the maxillary sinus (2,5,6,10,11), with a distance of 1-7 mm (5), or to root protrusion into the floor of the maxillary sinus secondary to important pneumatization of the latter (11). The thickness of the lateral walls of the maxillary sinus is not uniform and varies between 2-3 mm in the region of the sinus floor (8). In a study published by Killey and Kay (cited by Punwutikorn et al. (10)) involving 250 patients, more than half of the OSC occurred after extraction of the first molar, and approximately 25% as a result of second molar extraction. The complication may also arise in the case of upper third molar extractions, when performing an aggressive surgical technique, excessive post-extraction alveolar curettage, or when the patient in the immediate postoperative period performs maneuvers that tend to increase intrasinus pressure (1,6). Other factors may also contribute to produce perforation of the sinus membrane and OSC, such as traumatisms, other dental extractions, implant surgery and radiotherapy of the head and neck. Other contributing conditions include infectious and inflammatory processes of the upper jaw, cysts developing from the mucosa of the maxillary sinus, benign or malignant sinusal neoplasms, and specific infections such as syphilis or tuberculosis (4,6,12-14).

The incidence of OSC in patients subjected to upper third molar extraction is not clear, and the patients at greatest risk of developing this complication remain to be defined. The present study thus attempts to determine the incidence of OSC following upper third molar extraction in an Oral Surgery Unit, and define the course of the complication and the pre- and intraoperative factors associated with the appearance of OSC.

PATIENTS AND METHOD

The data corresponding to 389 upper third molar extractions (353 surgical and 36 conventional) performed during 2003 in the Oral Surgery Unit of the Master of Oral Surgery and Orofacial Implantology (Barcelona University, Spain) were documented. Before the intervention and on the visit after 7 days to remove the sutures, the following variables were recorded: patient age and sex, third molar angulation, radiological sinus proximity, the surgical technique employed (conventional extraction, with the raising of a flap, or with the raising of a flap and ostectomy), the existence of post-extraction OSC, and the cause underlying the latter.

Third molar angulation was established based on the Winter classification, which relates the third molar to the longitudinal axis of the second molar (mesioangular, horizontal, vertical, distoangular or inverted) (1).

Following infiltration anesthesia with 4% articaine and adrenaline (1:100,000), a crestal incision, distal to the second molar, and a vertical releasing incision were made, and a mucoperiosteal flap was raised. The bone was removed where necessary, using a handpiece and rounded number 8 tungsten carbide drill, with luxation and avulsion of the third molar using straight and Pott elevators. At the time of the intervention, and based on the Valsalva maneuver, the presence or absence of OSC was determined. The result was defined as positive in the event of intraalveolar bubbling when the patient attempted to expel air through the plugged nose. Alveolar cleaning and curettage was subsequently carried out, avoiding in depth maneuvering and irrigating with sterile physiological saline solution. The surgical wound was finally sutured using simple 3/0 silk stitches.

After the operation, an antibiotic was prescribed (amoxicillin 750 mg/8 hours p.o. for 7 days), together with an antiinflammatory agent (sodium diclofenac 50 mg/8 hours p.o. for 3 days) and a mouthrinse (0.12% chlorhexidine digluconate every 12 hours for 10-15 days). All smokers were instructed to avoid smoking in the first 8 days after the intervention. The patients diagnosed of OSC were advised to avoid intranasal pressure-increasing maneuvers during the postoperative period (Valsalva maneuver, gargles, repeated suctioning, etc.).

The data obtained were processed and analyzed with the SPSS 9.0 statistical package. Statistical significance was assessed with the Pearson chi-square test. The nonparametric Mann-Whitney U-test was in turn used to correlate patient age to intraoperative OSC.

RESULTS

Only 20 OSC were identified during surgical extraction of the 353 upper third molars, while none of the 36 molars subjected to conventional extraction were associated with OSC. This corresponded to a 5.1% risk of OSC (95% confidence interval (95% CI): 2.2-7.3%). In most cases (n = 18/20) OSC occurred after luxating the tooth within the alveolar cavity. In only one case was perforation directly caused by the elevator, while in another case the tooth itself was impelled into the maxillary sinus as a result of the luxation maneuvers. This molar was subsequently retrieved adopting

a Caldwell-Luc approach. Eighty-five percent of all OSC were observed in women (17 cases), corresponding to 4.4% of the total.The risk in female was 2'4 times greater than male, though the difference between sexes was nonsignificant ($X^2 = 2.213$; df = 1; p = 0.137). The median patient age was 21 years. The risk of OSC did not differ significantly among the different age groups (Mann-Whitney U-test = 3337; p = 0.470). The risk oscillated between 4'8% in the group of patients older than 40 years and 5'3% in the group of patients between 20 and 39 years old. The relative risk of OSC doubled when an ostectomy was performed during surgery, though the chi-square test proved nonsignificant ($X^2 = 2.385$; df = 1; p = 0.123)(Table 1).

Table 1. Relation between the occurrence of intraoperative OSC and the surgical technique performed for upper third molar extraction. The risk of OSC is seen to increase with the complication of molar extraction, though the linear-trend chi-square test failed to reach statistical significance ($X_{LT}^2 = 3.411$; df = 2; p = 0.065).

	Conventional extraction	Surgical extraction without ostectomy	Surgical extraction with ostectomy	Total
OSC	0	7	13	20
No OSC	36	159	174	369
Total	36	166	187	389
Risk	0%	4.2%	7.0%	

Of the global OSC recorded, one-half corresponded to the left side and the other half to the right. No relation was observed between the surgical side and the occurrence of intraoperative OSC ($X^2 = 0$; df = 1; p = 0.991). In only 7 (35%) of the global 20 cases of OSC, the surgeon don't suspect a close relation between the third molar roots and the maxillary sinus, based on the orthopantomographic findings. The risk of OSC was seen to increase with the surgical complexity of extraction, though the linear-trend chi-square test failed to reach statistical significance ($X_{LT}^2 = 3.411$; df = 2; p = 0.065)(Table 1). Of the 20 OSC produced, none presented a permanent fistulous trajectory during the control at 7 days after the intervention. In all cases OSC was sealed by filling the alveolar space with textured collagen and performing flap suture.

DISCUSSION

The results obtained in the present study show most patients subjected to third molar extraction to be women (70.2%), as a result of which oral sinus communication (OSC) was more frequent in this sex (85%). The difference between sexes failed to reach statistical significance, however. The relative risk (RR) male:female is 2'4, this means that women have 2'4 times OSC than men, in coincidence with the observations of other authors (2,10,15). Nevertheless, Amaratunga (16) reported a greater frequency of OSC in males – attributing this observation to a more frequent indication of third molar extraction and increased technical difficulties than in women.

We observed no significant differences between patient age at the time of upper third molar extraction and the occurrence of OSC, though according to Punwutikorn et al. (10), the incidence of OSC is greater in the 60-69 years age group. Other authors in turn refer a greater number of OSC and fistulas in the third (2,5,15,16), fourth and fifth decades of life (17), together with a very low or negligible incidence of the complication in childhood (2,10,16). In this context, it should be mentioned that many of these studies (2,10,16,17) include the extraction of other teeth (e.g., molars or premolars) with a closer relation to the maxillary sinus.

21% of upper third molars have a partial bone retention but did not need ostectomy as we can see in table 2 and 3. The bone of the upper maxillary tuberosity is of a softer consistency than in the lower jaw – a fact that allows direct third molar luxation and avulsion using straight and Pott elevators, with the need in many cases of an ostectomy. Only based in the orthopantomograph, is posible to make a mistake in the diagnostic of surgical difficulty.

Table 2. Relation between the occurrence of intraoperative OSC and the need for ostectomy during upper third molar extraction.

	No ostectomy	Ostectomy	Total
OSC	7 (35%)	13 (65%)	20 (100%)
No OSC	197 (53%)	171 (46.5%)	368 (100%)
Total	204 (52.6%)	184 (47.4%)	388 (100%)
Risk	0.034 (3.4%)	0.071 (7.1%)	

Table 3. Relation between the occurrence of intraoperative OSC and the inclusion degree of upper third molar.

	Submucosa inclusion	Parcial o total Intraoseus inclusion	No inclusion	Total
OSC	3 (15%)	16 (80%)	1 (5%)	20 (100%)
No OSC	84 (22.8%)	250 (67.8%)	35 (9.5%)	369 (100%)
Total	87 (22.4%)	266 (68.4%)	36 (9.3%)	389 (100%)

OSC was found to be as frequent on the left side as on the right, in agreement with the observations of Punwutikorn et al. (10). As regards the cause underlying OSC, our observations are in line with those published by other investigators, according to whom actual dental extraction is the most frequent cause (1,2,4,5,10). In comparison, the existence of cysts, iatrogenic effects attributable to poor use of the surgical material, or the penetration of roots and even complete teeth into the maxillary sinus are considered to be only minor causes (6,9,18).

Our study did not take into account the reason for upper third molar extraction – a factor that could be of importance in predicting the risk of OSC. In some cases a periapical lesion may weaken the thin bone lamina separating the maxillary sinus from the alveolar space (10,13). In any case we don´t evidenced clinical or sintomatology who made suspect a fistulous trajectory presence from the maxillary sinus to the oral cavity. Is possible that 7 days after extraction is not enough to assure the absence of fistulous trajectory, but is no necessary more controls in a patient without clinical and sintomatology. All cases develops favourable.

It would have been interesting to measure the size of the bone defects resulting from surgical extraction, since according to some authors gaps measuring over 5 mm in diameter are unlikely to undergo spontaneous primary closure (9-11,19,20). Kretzschmar and cols. (11) limited the spontaneous primary closure to 2 mm in diameter, over this size we need to suture the maxillary sinus membrane and if this is not possible to make a palatin flap. However, due to the limited visibility of the surgical field it is not always possible to precisely determine the size of the resulting OSC. In our series the alveolar space was always filled with textured collagen, attempting to achieve primary mucosal closure – thereby making it easier for OSC to heal by first intention, without the need for suturing the maxillary sinus membrane. 39% of the OSC presenced in tha Hirata and cols. (15) study undergo spontaneous primary closure during postoperative controls and 56% needed sterile physiological saline solution irrigation. In the series published by Ehrl (17), 51% of the OSC with signs and symptoms of sinusitis and subjected to conservative management were not successfully resolved.

The intraoperative diagnosis of OSC is usually based on the Valsalva maneuver (6,11,12), which offers a sensitivity of 52% (17). Penetration of a blunt-edged Bowman probe to assess perforations of the maxillary sinus floor is also valid for diagnosing OSC (6,12), with a sensitivity of 98% (17). A limitation in our study is represented by the fact that the diagnosis of OSC was based only on performance of the Valsalva maneuver. If in addition to the latter other methods such as visual inspection, alveolar palpation and a Bowman probe had been used, a higher sensitivity would probably have been achieved.

In the case we can foresee a OSC, Kretzschmar and cols. (11) recomended an antibiotic treatment during 10 days as a prophylactic measure to avoid a bacterial rhinosinusitis. However Walton (21) is not agree with this obsevation and he do not need necessary antibiotic administration in sinus exposition cases because of the presence of penicilin resistances baterias.

Although periapical X-rays can be useful for diagnosing OSC, the usual approach is to employ extraoral projections (e.g., orthopantomography and the Waters projection) which can visualize the oral cavity, the maxillary sinus and the trajectory of the communication. However, in well established OSC, fistulography and transalveolar endoscopy afford more information regarding the size of the perforation, its anatomical relations, and the fistulous trajectory. Computed axial tomography in turn can assess the size of the fistula, the characteristics of the bone and mucosa surrounding the perforation, and the nature of the sinus mucosal lesion (1,4,6,12,22,23). Nevertheless, computed axial tomography has certain limitations and is unable to detect fine bone laminas – as a result of which the diameter of the fistula may be overestimated.

When the radiological study conducted prior to extraction suggests a risk of OSC, the Ries-Centeno technique can be performed, involving the raising of a mucoperiosteal vestibular flap before extraction, and covering the defect by rotating and suturing the flap once extraction has been completed (6,13). In the event OSC occurs during extraction, it is always advisable to achieve primary closure; as a result, during surgery the alveolar space should be filled with reabsorbable hemostatic material, joining the gingival margins with suture (1,2,6). If sufficient gingival tissue is available, an alveoloplasty is performed to reduce the bone height and ensure sealing of the communication with suturing of the gingival margins (1,6,7). Kitagawa and cols. (20) reported 2 cases of OSC produced during an upper first molar extracction that were closed succesfully by the transplantation of a third molar with the apex closed. The root canal treatment of the transplanted theeth was made 3 weeks after. The prosthetic treatment was made at 5 months. In both cases the controls were made at 2 and 3 years respectively. Whith this procedure, the OSC is closed and masticatory function is established inmediately. When the OSC persists for more than three weeks, the fistulous trajectory between the maxillary sinus and oral cavity begins to undergo epithelization – thereby precluding spontaneous closure (18). In order to allow cicatrization and closure of the defect, flaps comprising the tissues adjacent to the OSC should be employed wherever possible. Additional measures include a meticulous surgical technique with good asepsis (6) and optimum patient cooperation after the intervention. Our postoperative recommendations, such as the provision of a liquid diet, the prescription of adequate pharmacological treatment, avoidance of the Valsalva maneuver, and the suppression of smoking, all coincide with the recommendations of other authors (1,6,11,12), and may account for the low incidence of OSC observed.

CONCLUSIONS

1.- Only 5.1% (95% CI: 2.2-7.3%) of the surgical extractions of upper third molars produced intraoperative OSC.

2.- The risk of intraoperative OSC was similar in all age groups.

3.- In all cases of OSC clinical and sintomatology absence was checked during the control 7 days after the intervention, before filling the alveolar space with textured collagen and performing flap suture.

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