

Treatment of Oroantral Fistula

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Summary

The authors present the problems of oroantral fistula by reviewing the possibilities of surgical treatment. Known and less known operative methods are described and their advantages and disadvantages analysed. The object of this study is to remind the reader of the iatrogenic possibility of the occurrence of an antrooral communication and possibility of the development of a fistula and infection of the maxillary sinus, and to warn against unnecessary use of extreme surgical methods, which were once performed routinely. The result of treatment of antrooral communication should be the establishment of physiological functions of the stomatognathic and respiratory system with as little harm to the patient as possible.

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Introduction

The term oroantral fistula is understood to mean a fistular canal covered with epithelia which may or may not be filled with granulation tissue or polypoid of the sinus mucous membrane, and which most frequently occurs because of iatrogenic oroantral communication. In such cases communication between the oral cavity and the maxillary sinus occurs as a result of extraction of upper lateral teeth, which do not heal by means of a blood clot but inside which granulation tissue forms, and on the edges narrowing of its vestibule occurs by migration of the epithelia cells of the gingival proprium, which cover the edges of the vestibule and partially grow into the canal. During expiry the air current which passes from the sinus through the alveoli into the oral cavity facil-

itates the formation of a fistular canal, which connects the sinus with the oral cavity. The fistula may spontaneously close by swelling of the gingiva, although the chances of this occurring are not great. With the presence of a fistula the sinus is permanently open, which enables the passage of microflora from the oral cavity into the maxillary sinus and the occurrence of inflammation with all possible consequences.

Because of the anatomic position of the maxillary sinus and its connection with the teeth it is particularly important in the field of oral and maxillofacial surgery.

The largest part of the upper jaw is taken up by the maxillary sinus, which is described as a large, pneumatic space. It is also known as Highmore's

Antrum after the English anatomist Nathaniel Highmore from the 17th century, who first described the sinus as a space in the bone and called it the antrum (1).

At birth the maxillary sinus is present as a small cavity, as its growth begins in the third month of foetal life, and ends between the 18th and 20th year of life. The volume of the maxillary sinus is the result of functional development of the maxilla and its pneumatization, and it therefore increases at the same rate as the growth of the jaws and eruption of permanent teeth. Because of the smaller volume of the sinus the risk of the occurrence of oroantral communication in children and adolescents is less. In adults the volume of the sinus amounts to 20-25 ml (2, 3).

A clinical study by *Güven* in 1998 indicated that oroantral fistula most frequently occurs after the third decade of life (4), which agrees with the results of other authors such as *Lin* in 1991 (5) and *Punwutikorn and co-workers* in 1994. Investigations have also shown that the relation of pneumatization of the jaw in men and women is identical (6-8), although in 1991 *Lin et al.* in 1991 reported that the maxillary sinus is more developed in women and that there is therefore greater possibility of the occurrence of oroantral communication and fistula in women (5). *Güven* concluded that the occurrence of chronic sinusitis and antral polyp is frequently a consequence of oroantral fistula. If during tooth extraction the sinus is open, but no inflammation is present, its spontaneous closure frequently occurs. When a clinical diagnosis of chronic sinusitis is made radiographic follow-up of the sinus inflammation is necessary (4).

The floor of the sinus is often uneven and deepened, which can be determined by determining the position of the lowest part of the sinus to the floor of the nasal cavity. The floor of the sinus can have three basic positions: beneath the level of the floor of the nasal cavity, on its level or above its level. The relation is particularly important, in which the floor of the maxillary sinus is beneath the level of the floor of the nasal cavity, because its floor can extend to the tops of the dental roots, or go even deeper between them. Such roots are separated from the sinus by a thin bony lamella and its mucous membrane, or very rarely only by the mucous mem-

brane of the sinus. The thickness of the bone wall varies and is on average 0.2 - 16 mm (3, 9).

The symptoms which occur during the occurrence of an oroantral fistula are similar to the symptoms of oroantral communication. A purulent discharge may drip through the fistula, which cannot always be seen. Also, when the patient drinks he feels as though part of the liquid enters the nose from that side of the jaw and occasionally runs out of the nostril on the same side. When the nostrils are closed with the fingers and the patient is asked to blow through the nose, air hisses from the fistula into the mouth. A similar occurrence happens when the patient blows out his cheeks, only then the air passes from the mouth into the sinus and nasal cavity, the so-called Valsalva test (3). In some cases the test of blowing through the nose or mouth does not necessarily give a positive answer, e.g. when the fistular canal is filled with inflammatorily changed sinus mucous membrane. However, the test with a blunt probe will confirm the existence of a fistular canal (10).

Therapy consists of the following. The fistula must be quickly closed as its persistence intensifies the possibility of inflammation of the sinus by infection from the oral cavity. It is important to establish whether or not infection of the sinus has occurred during the existence of the fistula. The presumption is that the duration and width of the lumen of the fistular canal contributes to infection of the sinus, although infection of the sinus is possible in a short period and with a very narrow fistular canal (3).

Some authors, such as *Hanazawa*, report that an oroantral fistula of less than 2 mm diameter has the possibility of spontaneous healing, while in the case of a diameter of more than 3 mm spontaneous healing is hampered because of the possibility of inflammation of the sinus or periodontal region (11).

In 1957 *Martensson*, in contrast to *Hanazawa*, considered that there is less possibility of spontaneous healing when the oroantral fistula has been present for 3 to 4 weeks, or when its diameter is greater than 5 mm (12).

In his investigation in 1982 *Von Wövern* demonstrated that the oroantral fistula did not heal well in 21% of cases, when no preoperative treatment of

the sinus infection was performed, compared to only 2% of cases which did not heal with controlled infection of the sinus (13).

In 1973 *Amšel* wrote of the possibility of protection by a flap for closing the antrooral communication with a palatal plate. In 1977 he described probably the simplest method of treatment of fresh antrooral communication, also with a palatal plate. By this method, immediately after tooth extraction and the occurrence of communication, airflow through the alveoli into the sinus is prevented and its spontaneous healing enabled, i.e. prevention of the occurrence of a fistula. With simultaneous antibiotic protection the method is very successful and is routinely applied in practice in this country (14, 15).

In 1985 *Krmpotić and Bagatin* described immediate closure of an antrooral communication with a rotating gingivovestibular flap. The method can also be applied for closure of an antrooral fistula, and consists of a modification of a vestibular flap with the aim of avoiding the lowering of the fornix, which regularly accompanies the application of vestibular flaps (20).

A review of operative techniques

Numerous surgical methods have been described for treatment of oroantral fistulas, although only a few have been accepted in daily practice (16).

In 1936 *Rehrmann* first published a method for closing an oroantral fistula by a simple and efficient method, the method of a buccal flap (17). The method of a buccal flap starts with an incision around the opening of the communication, at a distance of 3 to 4 mm, as the opening of the soft tissue is always smaller than the opening of the sinus itself. The communication can be closed with one layer, if the tissue around the opening is cut and removed, and the vestibular flap is the only layer, or it can be closed with two layers, if after partial elliptical incision the soft tissue from the vestibular and palatal side is turned and carried over the fistular opening and resorptive sutures made above it, and thus the internal layer is obtained and the outer layer consists of a vestibular flap, which completely covers it. In order to obtain a vestibular flap two vertical incisions are made; from each side towards the buccal

sulcus. The base of the flap is always wider to enable a better supply of blood to the flap. If the flap cannot be brought over the opening of the communication, a horizontal counter incision is made in the base through the periosteum (17). The advantage of the buccal flap method is that it can be used in cases when the alveolar ridge is very low and when it is impossible to apply the method of interseptal alveotomy (18). In 1975 *Killey and Kay* reported success with this method in 93% of cases (16).

A disadvantage of the method is that it does not protect the bone base (18), and in 1981 *Obradović et al.* concluded that with the buccal flap significant lowering of the vestibulum and cheek oedema occur (19), while in 1982 *Von Wovern* recommended the use of buccal flap for edentulous jaws only (13).

In 1939 *Ashley* was first to describe a method of using a palatal flap of full thickness in order to close an oroantral fistula. The method of palatal flap enabled the closure of a fistular opening with the mucous membrane of the hard palate (21).

A medial incision is slightly more lateral than the medial line of the palate, and a lateral incision follows the edge of the gingiva or is about half a centimetre along the edge of the gingiva of the tooth on that side of the jaw. A convex incision is made towards the front, which joins the medial and lateral incisions. The flap is bent to a right angle and its front edge is sutured with the edge of the vestibular mucous membrane (21).

A palatal flap contains blood vessels, which enable a satisfactory blood supply, and with its thickness and width it covers the site of the fistula better and safer (21). In 1980 *Ehrl* concluded that this method could also be applied for oroantral fistulas larger than 1 cm diameter (22). An advantage of this method compared to the method in which a buccal flap is used, is that no lowering of the vestibulum occurs and the flap is firmer and more resistant to trauma and infection than the buccal flap (22). A disadvantage of this method may be considered the denudation of the palatal surface, pain, and the later appearance of roughness and deepening of this area as a result of secondary epithelialization over two to three months. The most unpleasant possible complication is necrosis of the palatal flap.

In 1961 *Goldman et al.* applied gold foil to ensure stability of the flap while closing the fistula and prevent possible recurrences (23).

In 1974 *Takahashi and Henderson*, and in 1980 *James*, modified the operational method of the palatinal flap by the application of a mucosal palatinal island flap so that in the anterior of the flap only the mucous membrane was separated from the palate, which was shaped according to the size and shape of the oroantral fistula, and the submucosal layer and periosteum remain on the site of the defect in the palatal surface. In this way the area of the palatal surface is protected, compared with the use of a much thicker palatinal flap (24-26).

In 1974 *Choukas* published a method for closing a fistula by a palatinal flap which is carried under the bridge of the palatinal gingiva along the alveola of the extracted tooth (27).

In 1980 *Ito et al.* isolated the mucosal upper layer and connective lower layer of submucosa on a palatinal flap, so that the submucosal part of the flap covered the fistula, and the mucosal part of the flap the denuded palatal surface, and thus the occurrence of roughness at the site of the denuded palatal surface was completely avoided (28). This is a so-called palatinal submucosal flap (28).

In 1985 *Yamazaki et al.* described a method of submucosal palatinal island flap, in which the submucosal layer of the anterior part of the palatinal flap covers the fistula, and the mucosal part covers the defect of the palatinal surface in the frontal part, and with a much thicker flap in the posterior part (29).

All methods preserve the bone surface in such a way so that they do not touch the periosteum (29). The advantage of these methods is that healing of the defect is enabled without necrosis of the palatinal mucosal layer, and the fact that they can apparently also be used in cases where there is a wide oroantral fistula caused by a large cyst or tumour (29).

In 1986 *Amaratunga* compared the methods of *Rehrmann* and *Ashley*, and according to the obtained results concluded that there is no significant difference between the methods of successful surgical treatment of oroantral fistula, although he considered that the preoperative condition of the mucous membrane of the maxillary sinus is decisive (30).

In 1992 *Zide and Karas* used blocks of hidroxy-lapatite during plastics of an oroantral fistula, with the same intention as *Goldman* in 1969 and numerous other authors, who had attempted to fill the bone defect in the alveoli with different materials and form a basis for newly created bone tissue and support for the flap used (31).

The technique of interseptal-interradicular alveolectomy is one of the possibilities for treatment of oroantral fistula, described by *Hori et. al* in 1995 (18), on the basis of *Dean's* technique of 1936, used for the purpose of preprosthetic surgery, where the interalveolar septa is removed by operative procedure, while the buccal and palatinal cortices are not touched (18).

The technique of interseptal alveotomy is performed in such a way that the incision follows the alveolar ridge of the neighbouring tooth to the retro-molar region and stretches over the fistula. The gingivoperiosteal flap is separated 2-3 mm from the buccal and palatinal sides, in order to enable removal of the alveolar bone and avoidance of soft tissue damage. The interradicular septum is removed until resistance is felt by the floor of the maxillary sinus, and the palatinal and buccal cortices remain intact. Vertical osteotomy follows by means of a fine chisel, with which the buccal and palatinal wall of the alveolar ridge is broken. Their closeness facilitates suturing by individual sutures (18).

The authors report that the advantage of the above technique is the non-traumatic procedure and because swelling is rarer after the operation compared to the technique of buccal flap (18, 13). Suturing the wound is without tension, the height of the vestibulum does not change, the muscle insertion remain intact and the risk of sinusitis is reduced. At the same time the patient finds it easier to endure wearing the temporary dentures during the period of healing (18).

The described method cannot be applied when there is space of less than 1 cm between the neighbouring teeth, and when the alveolar ridge is extremely low. If in such a case the buccal bone fractures there is a risk of the soft tissue not closing completely, because the buccal bone fragment can cause inflammation, and in unsatisfactory cases can sequestered (18).

The surgical technique which *Güven* most often used was the BAF-buccal advancement flap, because he considered it a simple method with a flap which has a wide base and thus a good blood supply, and additional vestibuloplastics are unnecessary (4).

Some authors, such as *Von Wowern and Zide* consider that a disadvantage of this method is the postoperative reduction in the height of the vestibulum (7, 31). However, *Rehrmann, Eneroth and Martensson* conclude that this is a temporary result, which lasts at the most for 8 weeks (17, 32, 12). Apart from the BAF technique *Güven* also describes the technique of a sliding bridge flap, which he used for total edentulous patients, in patients with reduced vestibulum after resorption of the alveolar ridge, and used a mucoperiosteal flap for covering oroantral fistulas (4).

In 1995 *Hanazawa et al.* closed an oroantral communication by applying a BFP-pedicled buccal fat pad graft (11). After removal of the mucous membrane of an oroantral fistula 3 mm up to healthy tissue, a divergent incision is made from each side in the vestibulum, with which a buccal mucoperiosteal flap of trapezoid form is obtained. This is followed by a vertical incision 10 mm through the periosteum from the internal side of the released flap and preparation in the soft tissue so that fatty tissue is obtained from the cheek. The preparation is carried to the zygomatic ridge and cheek, and through the opening obtained the buccal flap of fatty tissue is pulled up to the opening of the oroantral fistula and sutured to the edge of the palatal mucous membrane. The mucoperiosteal flap only partially covers the flap of fatty tissue up to the edge of the vestibular alveoli, where it is sutured. It is used in patients with a fistula of 8 to 20 mm in diameter. Over a period of three weeks the fatty tissue converts into granulation tissue and epithelises, which has been confirmed by documented histological indicators (11). An advantage is smaller retraction in the area of the vestibulum, as the vestibular flap does not reach the edge of the palatal mucous membrane, as in the case of the use of buccal flap alone. Apparently it is suitable for closing a fistula in the area of the posterior part of the maxillary region (11).

In the case of unsuccessful closure of an oroantral fistula by multiple surgical procedures or long-term

persisting fistulas, hyperplasia of the mucous membrane of the sinus occurs, which should be solved surgically. A radical operation of the maxillary sinus is undertaken. A modified incision according to *Ramon* is made, the mucoperiosteal flap is lifted and detached to the intraorbital opening. An opening is made on the anterior wall of the maxillary sinus in the area of the fossa canine. The thickened hyperplastic mucous membrane in the sinus is completely removed so that pure bone is left. After this antrostomy is made in the lower nasal passage. The preserved mucous membrane of the lateral wall of the lower nasal passage is transferred in the form of a flap to the floor of the sinus. Finally the sinus is tamponaded with iodineform gauze, which is pulled through the lower nasal passage and through the nostril and fixed with an adhesive bandage to the nose. The mucoperiosteal flap is returned and sutured with individual sutures. An antibiotic is applied postoperatively for a period of seven days. The tamponade is shortened after three days and completely removed from the fifth to the seventh day after the operation (33).

Conclusion

When choosing the surgical method of treatment of an oroantral fistula its location and size should be taken into consideration, also its relation to neighbouring teeth, the height of the alveolar ridge, duration, existence or otherwise of inflamed sinus and the general health status of the patient.

In the case of small perforations of the sinus, when there are no signs of sinusitis, spontaneous healing is possible, while in the case of larger perforations the chance of spontaneous healing is less.

By permanent wearing of a palatal plate, with occasional rinsing of the sinus with a physiological solution, enteral application of an antibiotic and topic action of rinsing with a solvent antibiotic, it is possible to cure an inflamed sinus and achieve spontaneous closure of the fistula, even in cases which have existed for more than a month.

Today daily practice is increasingly in favour of vestibular flaps for closing communications, and radical operative methods, in which the mucous membrane of the sinus is completely removed, are avoided whenever possible.

If there is hyperplastic mucous membrane in the vicinity of the fistula on the floor of the sinus it should be removed, although not necessarily as a routine, to carry out the procedure of connecting the sinus with the lower nasal passage. All unchanged mucous membrane of the sinus should be preserved and tamponade of the sinus, used to prevent the accumulation of

blood in the sinus cavity, should be performed in the oral vestibulum in the anterior of the incision, to enable its removal in two to three days.

Radical methods of surgical treatment remain as the choice in cases in which the fistula has lead to the sinus filling with hyperplastic mucous membrane, which has lost its function.