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Case Report

Treatment of Schneiderian Membrane Perforation with Sutures during Open Sinus Lift - A Case Report

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Abstract

Among the paranasal sinuses, the maxillary sinus is of particular interest in dental implantology. As a result of the loss of premolars or molars in the maxilla, the maxillary sinus enlarges in the lower direction. The progressive pneumatization of the maxillary sinus leads to a reduction in the bone structure of the maxillary alveolar process. As a result, the bone structure of the maxillary alveolar process cannot sufficiently hold a dental implant. Depending on the degree of bone structure loss, to create conditions for implantation, the bone structure is restored through the sinus lift procedure using an open or closed method.

Keywords: Sinus lift; Schneider membrane perforation; Augmentation; Buccal

Introduction

The human paranasal sinuses include the sphenoid sinuses, ethmoid cells, frontal sinuses and maxillary sinuses. The maxillary sinus is the first sinus to form during embryonic development. In an adult, the maxillary sinus has the shape of a pyramid with a capacity of 20 ml. The mouth of the maxillary sinus is in the middle nasal passage. The maxillary sinus is lined with a Schneider membrane. Schneider's membrane is formed by multirow columnar epithelium, basal and goblet cells, basal membrane, lamina propria, and periosteum. Under physiological conditions, the Schneider membrane is a membrane with a thickness of 0.2 mm to 0.8 mm. Therefore, a normal, healthy Schneider membrane does not appear on computed tomography scans.

In the lateral part of the maxillary alveolar process, obtaining primary stabilization of dental implants is difficult when the maxillary sinuses are pneumatized and bone tissue atrophy occurs. To place implants in the lateral part of the jaw, in the case of bone loss, a sinus lift procedure is performed.

Raising the bottom of the maxillary sinus

Maxillary sinus lift, or sinus lift, is a procedure that allows for an appropriate height of the bone between the top of the alveolar process and the bottom of the maxillary sinus to be obtained. Depending on the amount of available bone tissue, sinus lift is performed preoperatively in the lateral section of the jaw using the closed or open method.

In the case of significant atrophy of the maxillary alveolar process, i.e., less than 6 mm, the lifting of the bottom of the maxillary sinus is performed by the open method. The protocol of the procedure for lifting the bottom of the maxillary sinus using the open method is as follows:

- Administration of local anesthesia
- Incision and delamination of the full thickness flap
- Creation of the bone window
- Elevation of the maxillary sinus membrane
- Placement of the membrane and bone graft
- Closing and suturing of the wound.

Schneider membrane perforation

Complications may arise during any phase of the sinus lift procedure following the open method. One of the most common possible intraoperative complications during the open approach is perforation of the maxillary sinus membrane, which may most often occur during osteotomy or sinus lift [1,2]. In the literature, this complication is reported in 11% to 56% of cases [3,4]. Schneider membrane perforation is not a contraindication to the continuation of the procedure. However, this complication requires proper management [5].

Many techniques for the treatment of Schneider membrane perforation have been described [6,7]. Treatment of small maxillary sinus perforations up to 5 mm in diameter can be performed by inserting a collagen membrane, while for perforations with a diameter greater than 10 mm, the treatment can be postponed for 3 months or performed using the Loma Linda technique. Another possible solution to treat the perforation, regardless of its size, is to suture the Schneider membrane. Suturing the Schneider membrane can avoid the risk of collagen membrane displacement and thus accidental infiltration of the bone substitute material into the maxillary sinus and reduces the number of additional procedures necessary for the patient if the procedure will be postponed.

Treatment of schneider membrane perforation

Perforations in the sinus membrane can be covered by sutures with a resorbable thread. Due to the anatomy of the Schneider diaphragm, suturing the torn parts is technically difficult. To cover

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the perforation of the sinus membrane with a resorbable thread, a 2 mm diameter hole should be made on the buccal plate of the maxillary alveolar process with a surgical handpiece. Next, a needle with 4.0 resorbable threads is threaded from the buccal side into the maxillary sinus through a hole in the bone plate, after which the thread passes through the movable part of the Schneider diaphragm, and a nodal suture is formed to stabilize the Schneider diaphragm to the bone plate. Depending on the size of the perforation in the sinus membrane, its management may require the production of several holes in the bone plate. The assessment of the tightness of the perforation closure is performed by rinsing 30 ml of a saline solution through the created space between the edge of the maxillary alveolar process and the raised sinus membrane with the patient in the supine position, without suctioning the solution with a vacuum. If the patient does not feel the fluid pass beyond the maxillary sinus, the perforation is properly treated. The patient's perception of fluid on the back of the throat indicates the need to verify closure of the perforation.

Case Presentation

A healthy 38-year-old woman underwent replacement of missing tooth 26 in December 2019 (Figure 1). In the interview, it was revealed that tooth 26 was removed in June 2019 due to a fracture in the bottom of the tooth chamber. Then, in September 2019, the patient underwent conservative laryngology treatment due to a condition of the maxillary sinuses. After the end of laryngology treatment, the patient returned for implant treatment. The patient's wish was to supplement missing tooth 26 with a dental implant, and the patient did not want to replace the missing tooth with a prosthetic bridge. With physical examination and CBCT examination (Figure 2), pneumatization of the left maxillary sinus in the place of missing tooth 26 was found. The height of the alveolar process in the location of the missing tooth was 2.4 mm. Before implantation, the alveolar process required preparation. In December 2019, to reconstruct the alveolar process, the bottom of the left maxillary sinus was raised. Under local infiltration anesthesia with 1.5 amp Ubistesin Forte 3M buccal and 0.5 amp Ubistesin Forte 3M palatal, a 15C incision was performed on the suturing of the alveolar process at the site of missing tooth 26. The incision was extended in the alveolar pockets buccally to include one tooth distally and two teeth mesially in relation to the alveolar absence and one tooth distally and one tooth mesially in relation to the palatal absence; then, a mesial release incision was made, and a full thickness flap was delaminated.

A 4 mm × 5 mm bone window was created on the buccal surface of the alveolar process with a diamond drill on the surgical hand piece, and the lower edge of the window was 3 mm above the bottom of the maxillary sinus. Then, the sinus floor was lifted with sinus lift tools. While lifting the bottom of the maxillary sinus by the open method, the Schneider membrane was perforated in the upper edge of the window. The 9 mm perforation was closed with a Safil 4.0 DS absorbable suture [8]. To suture the Schneider membrane, a perforation was made in the buccal part of the alveolar process above the upper edge of the bone window with a diamond drill on the surgical hand piece (Figures 3 and 4).

After the perforation was closed, the tightness of the closure was checked by a saline rinse with the patient in the supine position. Then, Gen Os 0.5 material was placed with autogenous bone chips collected

Figure 1: Replacement of missing tooth 26.

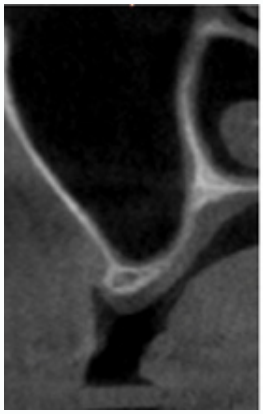

Figure 2: CBCT examination.

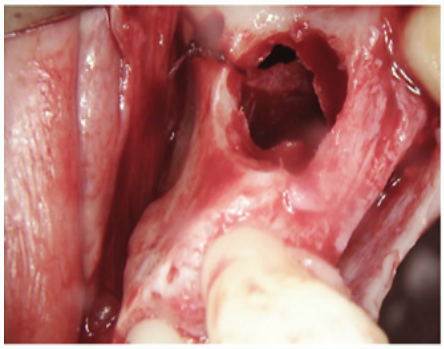

Figure 3: Schneider membrane, a perforation was made in the buccal part of the alveolar process above the upper edge of the bone window with a diamond drill on the surgical hand piece.

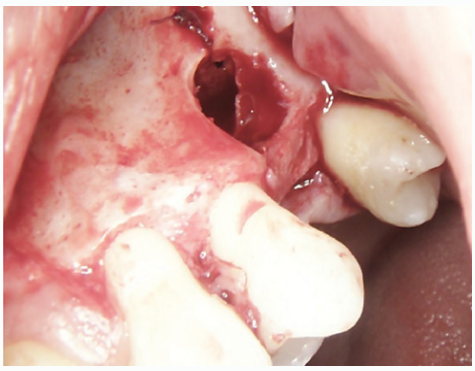

Figure 4: Schneider membrane, a perforation was made in the buccal part of the alveolar process above the upper edge of the bone window with a diamond drill on the surgical hand piece.

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with a bone scraper from the buccal part of the maxillary alveolar process distal from tooth 27 in a 1:1 ratio. The bone window was covered with the Evolution collagen membrane without fixation. The wound was closed and sutured with Dafilon 5.0 DS16. Postoperative computed tomography was performed (Figure 5), and the height of the reconstructed ridge was 10 mm. The patient reported that the sutures were removed after 14 days. In the postoperative period, she used Augmentin (1.0 g) every 12 hours for 7 days, ibuprom 400 mg × 3 daily for 3 days, xylometazoline1 dose in each nostril 3 times daily for 5 days and Elugel topically 3 times daily for 14 days. Six months after the sinus lift, the patient underwent follow-up CBCT (Figure 6). The conical computed tomography examination revealed no inflammation in the maxillary sinus, no penetration of material into the maxillary sinus and stable augmentation of the bottom of the maxillary sinus.

Figure 5: Postoperative computed tomography.

Figure 6: Six months after the sinus lift, the patient underwent follow-up CBCT.

Discussion

Perforation of the Schneider membrane is one of the most frequent intraoperative complications when lifting the maxillary sinus floor using the open method, and this complication is reported in up to 56% of cases [3,4]. Perforation of the maxillary sinus membrane during the open sinus lift procedure may occur at the stage of flap elevation (insertion of the raspatory through a narrow alveolar process, oro-sinus fistula or the lateral wall of the maxillary sinus, which is covered only with soft tissue), while performing osteotomy, when lifting the maxillary sinus membrane and during placement of the graft (where excessive pressure on the maxillary sinus membrane may lead to its perforation).

Factors that influence the risk of perforation during osteotomy include the surgical tools and Schneider membrane thickness. When using rotary instruments, i.e., surgical drills, the risk of perforation is as high as 56%, while the use of piezosurgery for osteotomy lowers the risk of perforation to 3.8% [9]. A thin Schneider membrane (less than 1.5 mm) leads to an increased risk of perforation, 31% compared to 16% for a thicker Schneider membrane (more than 1.5 mm) [10].

The factors that affect the risk of perforation when lifting the Schneider membrane include the size of the sinus lift window produced (a small window promotes perforation, the traditional shape of the window is oval or rectangle, but in the case of sinus lift in the front part of the maxillary sinus, the optimal window shape is a trapezoid; the optimal position of the lateral window opening is 3 mm above the bottom of the sinus and 3 mm distal to the inclination of the anterior wall), sinus width (the angle formed by the bottom of the sinus with its medial and lateral walls, i.e., the angle between the alveolar process and the medial sinus wall; narrow anterior part of the sinus, where an angle of up to 30 degrees is associated with a 62.5% risk of perforation; in the case of a wider sinus, where the angle ranges from 30 to 60 degrees, the risk of perforation is 28.6%; and for the widest sinuses with an angle above 60 degrees, the risk is 0%) [11,12] and the presence of bone partitions in the maxillary sinus (their presence increases the risk of perforation of the maxillary sinus membrane up to 44.2%, and in their absence, the risk is 35.7%).

Due to the high risk of a perforation complication (up to 56%), when lifting the bottom of the maxillary sinus using the open method, the operator should be aware of and be able to perform treatment techniques for this complication.

Closing the perforation with sutures allows the perforation to be treated in a way that prevents the displacement of the collagen membrane and avoids the risk of the penetration of bone substitute material into the lumen of the maxillary sinus, which leads to sinus infection, postoperative inflammation and obstruction of the sinus opening.

When treating Schneider diaphragm perforation, the following general rules apply: small-sized perforations may self-heal when a clot forms or overlapping sinus membrane layers are present. To better stabilize large-sized perforations (10 mm and above), extensive repair is required, and a substitute material should be placed for extensive treatment of the perforation in the repair area; this causes the area to bulge upwards. Membranes can be used to treat perforation, and those placed close to the sidewall tend to move medially during the introduction of bone substitute material; when treating large perforations, it is not recommended to use membranes that become shapeless and soft when wet.

In the case of perforations up to 5 mm in size, the treatment can be continued, and the perforation can be secured by placing a resorbable collagen membrane. In the case of large perforations exceeding 10 mm in size, the perforation may be treated with the Loma Linda technique [13] or delayed lifting of the bottom of the maxillary sinus. Another repair technique involves the use of autogenous L-PRF membranes. Regardless of the size of the perforation, treatment can be performed by suturing with resorbable thread, but in extreme cases, where there are too few fragments of the intact membrane to place the

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sutures, it is recommended that the procedure is abandoned to allow the membrane to regenerate; the procedure can be repeated after 4 months. Due to the lack of unambiguous agreement as to the survival of implants after surgery, when there is an extensive perforation of the Schneider membrane and its reconstruction is performed using a barrier membrane, the Loma Linda pocket technique can be a problem because the membrane used to repair the membrane completely surrounds the graft, which may delay the blood supply to the graft through the sidewalls of the bone window [14-17].

It is reported in the literature that the technique of securing a Schneider membrane perforation with sutures is difficult due to the nature of the Schneider membrane (its fragility) and difficulties with access. In the author's experience, the technique of treating Schneider perforation by suturing is not difficult, provided that the correct access approach to the side window is achieved while lifting the Schneider membrane, a single hole is made in the sidewall of the jaw, an appropriate surgical suture is used and the appropriate direction of its displacement is established. In the author's experience, the thread that optimally sutures the perforation and provides appropriate tension and closure of the perforation edges is the Safil 4.0 DS24 resorbable thread (Braun), the direction of needle movement (suturing direction) should start from the hole drilled in the sidewall of the bone to the edge of the Schneider diaphragm. Optimal suturing of the perforation is achieved when the edge of the sinus membrane is sutured to the bone substrate, but it was technically difficult for the author to achieve this by suturing between the two parts of the membrane.

Conclusion

- Treating the Schneider membrane perforation by suturing with a resorbable thread may be beneficial for the patient by reducing the number of surgical procedures and shortening the treatment time.
- Treating a perforation of the bottom of the maxillary sinus by suturing with a resorbable thread is an effective method for reducing intraoperative complications.

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