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Case Report

Endoscopic minimally invasive management of a periradicular lesion invading the maxillary sinus

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Abstract: A referred patient presented with a lesion of endodontic origin located at the apex of tooth #27. The tooth had been endodontically treated and re-treated. A periapical radiograph revealed a close relationship between the lesion and the maxillary sinus. A cone-beam computed tomography scan confirmed that the lesion had invaded the sinus cavity. The treatment plan consisted of periapical surgery using an endoscope as a magnification device. Due to a sinus membrane perforation, a new sinus membrane repair technique was performed. Twelve months after surgery, a cone-beam computed tomography scan revealed successful healing of the lesion. The continuous preservation of the sinus physiology was also observed. The use of an endoscope as a magnification device and a tailored technique for sinus membrane management allowed us to achieve a successful treatment outcome in the case of an endodontic lesion invading the maxillary sinus. (J Oral Sci 53, 533-538, 2011)

Keywords: endoscopy; maxillary sinus; root-end management; endodontic microsurgery; minimally invasive sinus surgery.

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Introduction

Surgical endodontic treatment is an option for teeth with apical periodontitis and may be indicated for teeth with periapical pathology when non-surgical retreatment is impractical or unlikely to improve the previous results, or when a biopsy is needed. A success rate of over 90% has been reported with a modern surgical endodontic technique (1) using magnification and ultrasonic retrotips to allow for a precise procedure with minimal beveling of the root resection and proper retrograde canal preparation to a depth of 3-4 mm. The proximity of the maxillary posterior teeth apices to the maxillary sinus raises special considerations during endodontic surgery (2) due to a possible oro-antral communication. In the course of surgical management of the root apex, there is a risk of displacement of bacteria from the infected periapical tissue, resected root tips, or bony drilling debris into the sinus (3).

The purpose of the present article is to describe the treatment of a periradicular lesion invading the maxillary sinus cavity using a microsurgical technique with the aid of an endoscope as a magnification device.

Case Report

A 48-year-old female patient with a non-contributory medical history presented for an endodontic consultation. The patient reported pain and swelling in the area of the second left maxillary molar. The second left maxillary molar had been endodontically treated 8 years earlier and then re-treated 11 months ago by the referring dentist. Cone-beam computed tomography (CBCT) of the left

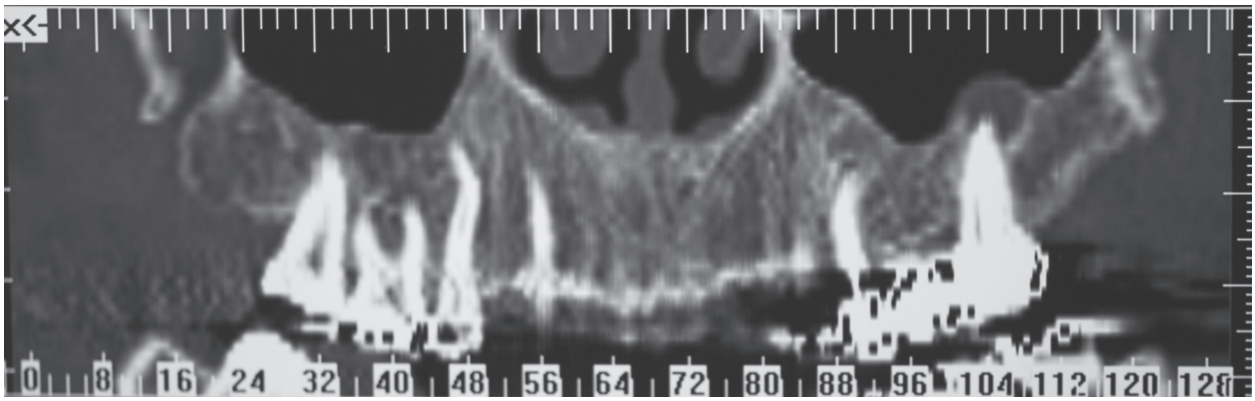

Fig. 1a

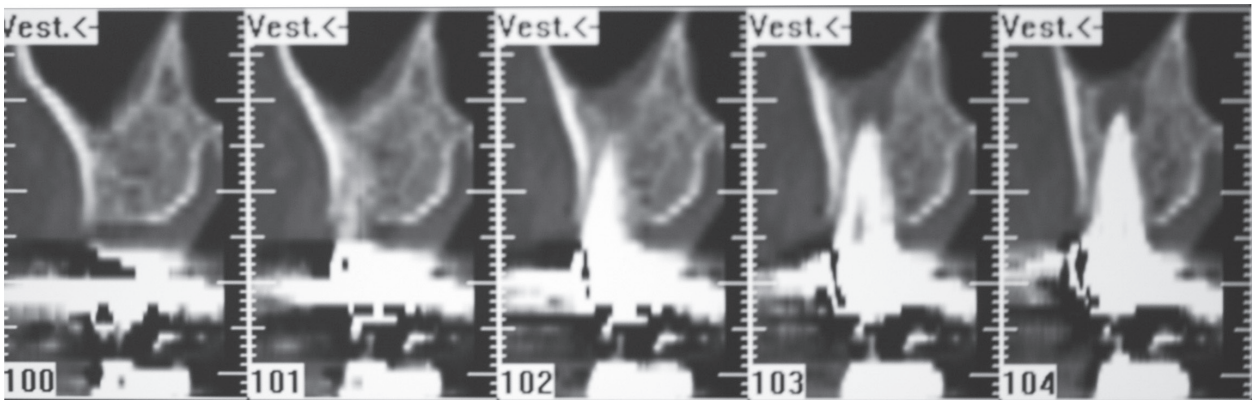

Fig. 1b

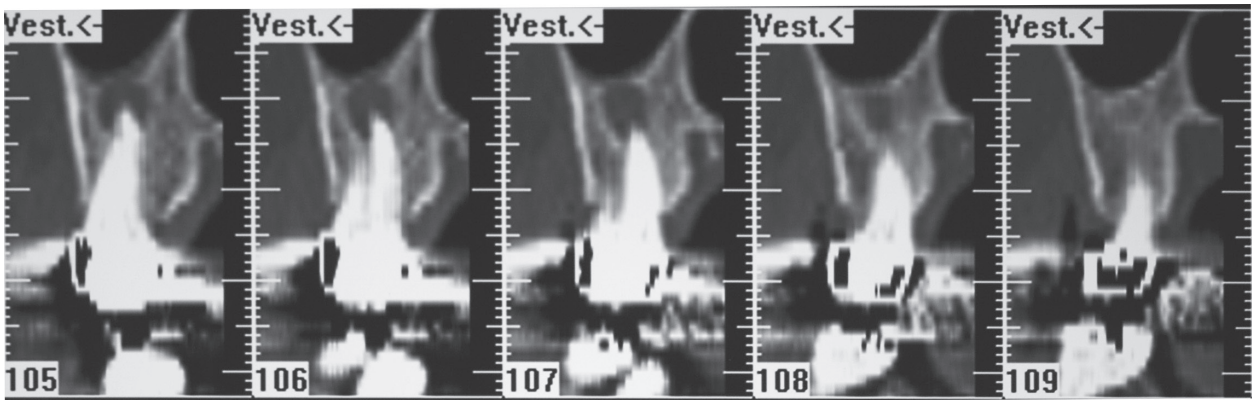

Fig. 1c

Fig. 1 Details of a cone-beam computed tomogram taken after orthograde re-treatment. a) Panoramic view; b and c) Consecutive cross-sectional images that reveal the periapical lesion at tooth #27.

upper maxilla performed 6 months after the re-treatment showed a periapical lesion of the second left maxillary molar invading the maxillary sinus floor (Fig. 1a-c). Following discussion with the patient, treatment of the second maxillary molar by periapical surgery was planned. The patient signed an informed consent. The principles of the Helsinki Declaration of 1975, as revised in 2000, were followed.

Preoperatively, the patient rinsed her mouth with 0.2% chlorhexidine digluconate (EburOs, Dentsply, Tulsa, OK, USA). Treatment was provided under local anaesthesia with 4% articaine chlorhydrate and 1:100,000 adrenaline (Alfacaina N, Weimer Pharma, Rastat, Germany). A full-thickness rectangular flap from the mesial of the first maxillary premolar to the distal of the second molar was raised using a papilla-based incision.

Surgical access to the roots was then made through the cortical bone using a sinus lift diamond bur (DASK Drill #5, Dentium, Seoul, South Korea). The bur was tilted 45° against the bone wall and used with light pressure, under

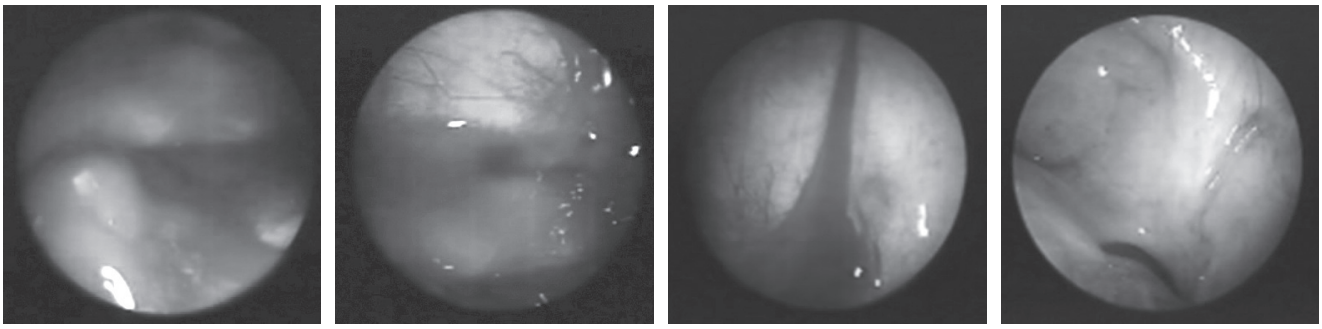

Fig. 2a Fig. 2b Fig. 2c Fig. 2d

Fig. 2 a) Endoscopic vision of the sinus cavity. b) Endoscopic view while clearing the sinus cavity; c) Endoscopic view of the sinus at the end of surgery; d) Endoscopic view of the meatus to assess its patency.

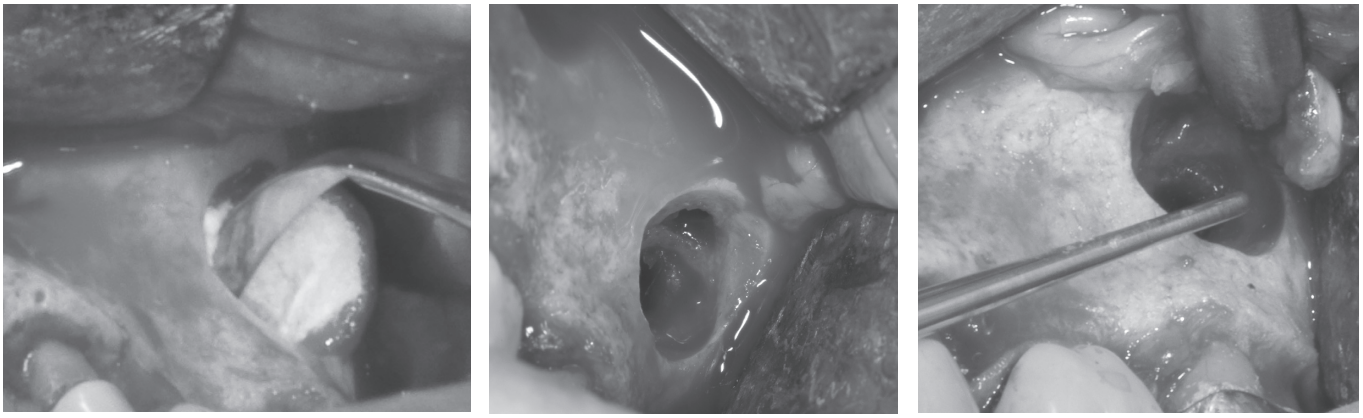

Fig. 3 Fig. 4 Fig. 5

Fig. 3 An absorbable hemostatic gelatin sponge was placed into the bone access to shield the membrane perforation.

Fig. 4 Through the bone access for endodontic surgery, both the sinus membrane perforation and the small lateral access created for the detachment and collapse of the sinus membrane are visible.

Fig. 5 Schneiderian membrane detachment is seen through the small lateral window.

constant copious sterile water irrigation until a shadow of the periradicular lesion was visible. Then, as we used sharp bone curettes and angled periodontal curettes, keeping the cutting edge towards the bone wall, the entire lesion was enucleated and placed in 10% formalin solution for pathologic diagnosis. Magnification loupes (4.3×) with a headlight were used throughout the procedure. The procedure for lesion enucleation expectedly caused a perforation of almost 5 mm in diameter in the Schneiderian membrane.

A 6-cm-long and 3-mm-wide endoscope with a viewing angle of 70° (Hopkins Tele-Otoscope 70°, Karl Storz GmbH, Tuttlingen, Germany) was carefully introduced into the sinus through the perforation to confirm the complete removal of the lesion (Fig. 2a-d). An absorbable hemostatic gelatin sponge (Spongostan®/Surgifoam®, Ferrosan A/S, Soeborg, Denmark) was placed into the bone access to close the membrane perforation and protect the sinus (Fig. 3) from the possible dispersion of dental materials (such as gutta-percha and root-end filling cement) during root-end management. A straight fissure bur in a hand-piece was positioned perpendicular to the long axis of the root and 3 mm of the root end was shaved away with a minimal bevel. The inspection of the root-end surface was done with a mini-probe using an endoscope as a magnification device.

Root-end cavities were prepared using zirconium nitrate retro-tips (As9D Tip, Satelec, Merignac Cadex, France) driven by an ultrasonic device unit (Piezon Master 600, EMS, Nyon, Switzerland). The root-end cavities were then dried using a paper cone and examined under the endoscope to detect root-face alterations in the resected root end, such as marginal chipping. A zinc oxide EBA-reinforced cement (Super Seal; Ogna Pharmaceuticals, Milan, Italy) was used as root-end filling material. Finally, a fine diamond bur was used to remove the excess filling material.

Following the completion of the root end preparation,

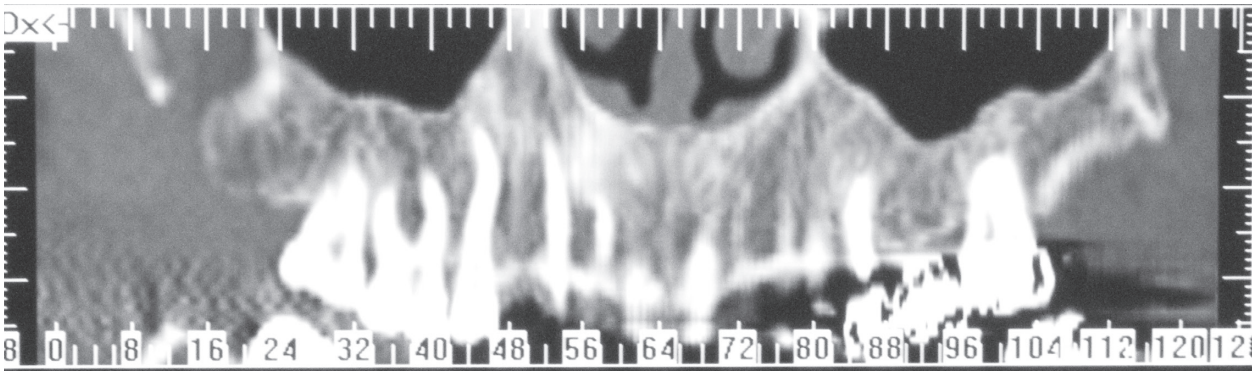

Fig. 6a

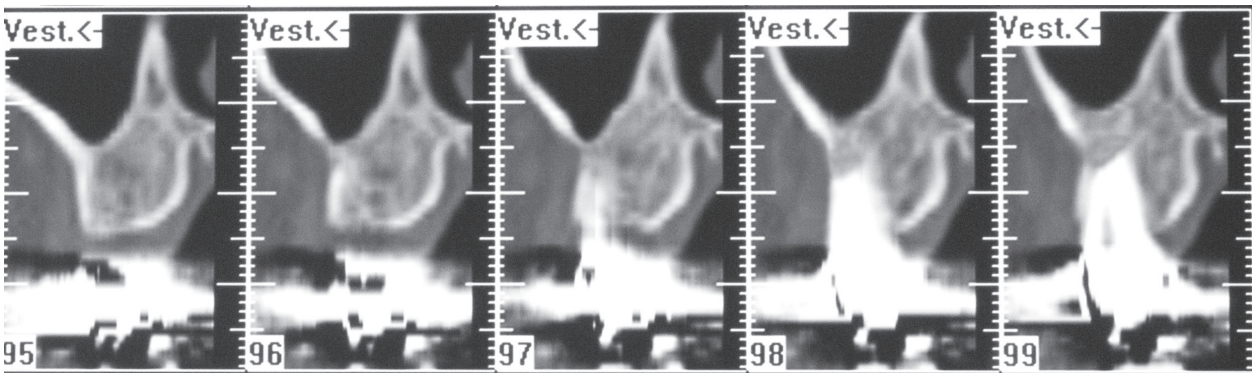

Fig. 6b

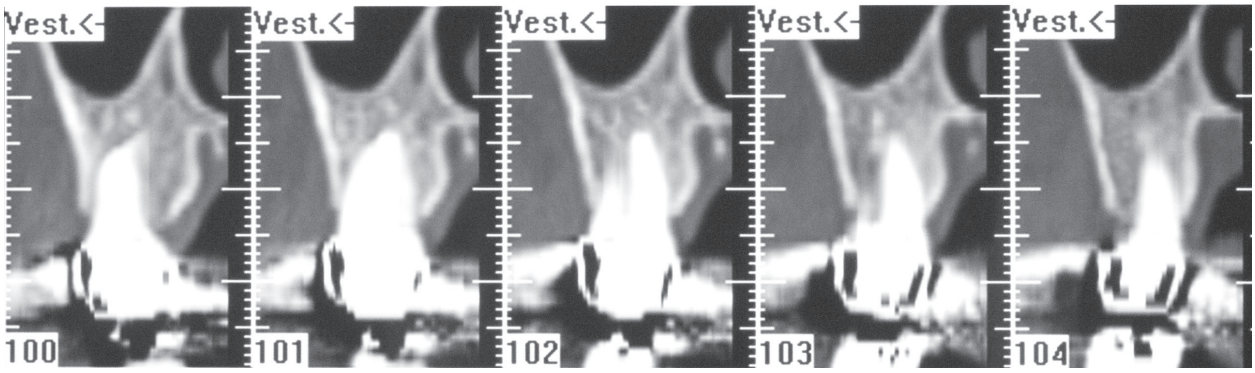

Fig. 6c

Fig. 6 Images from a cone-beam computed tomogram to assess the success of the treatment and to show that the sinus physiology is not altered. a) Panoramic view; b and c) Cross-sectional views.

the hemostatic gelatin sponge was removed from the bone cavity and a small lateral window was prepared, adjacent to the sinus perforation, with a sinus lift diamond bur (DASK Drill #4, Dentium, Seoul, South Korea) (Fig. 4). The sinus membrane was carefully detached using a disk-shape sinus curette (Dome-shape, Dentium, Seoul, South Korea), mobilized, and reflected using an elevator sinus curette (XSE4L, Dentium, Seoul, South Korea) (Fig. 5). The perforation was thus closed by collapsing the sinus membrane. The reflected tissues were re-approximated to their original position, compressed and stabilized, and sutured with non absorbable polypropylene 5-0 (Prolene, Ethicon Inc., Piscataway, NJ, USA). The sutures were removed 7 days following the surgery and healing was uneventful.

Periapical radiographs were taken at each scheduled follow-up clinical appointment (3 and 6 months later) using a paralleling technique. One year later, a CBCT scan evaluation was also performed. Healing was evaluated at the 1-year follow-up according to radiographic and clinical criteria (4). At 12 months after surgery, the patient was asymptomatic. Figure 6, parts a-c, shows 1-year radiographic images of the case. At every scheduled follow-up evaluation, the Schnederian membrane

appeared normal and the sinus physiology was healthy according to criteria recently proposed (5). The histologic diagnosis of the lesion was periapical granuloma.

Discussion

The prognosis of periapical surgery in different studies is influenced by many factors: different surgical procedures and materials, radiographic and clinical evaluation, patient demographics and systemic conditions, local factors such as the teeth involved and their anatomy, quality of previous root canal treatment, and quality of coronal restoration (1,6). During endodontic surgery in the maxillary posterior region, there is a risk of developing maxillary sinus complications due to the proximity of the maxillary molar apices to the Schneiderian membrane (3).

The present case showed the treatment of a maxillary second molar with a periradicular lesion that had invaded the sinus cavity. As general rule, in these cases, precisely verify the physiologic status of the sinus itself prior to the surgical procedure (5), identifying any previous nasal trauma or surgery, nasal respiratory obstruction, and recurrent or chronic naso-sinusal diseases.

For cases with maxillary sinus pathologies, consultation with an ear, nose, and throat (ENT) specialist is recommended. The surgical approach may depend on the ENT diagnosis; if the sinus physiology is not altered, endodontic surgery can be performed as usual. In the present case, the lesion was relatively small and the sinus physiology was not altered, so endodontic surgery was performed.

Oberli et al. proposed a classification based on periapical radiographs that accounted for the position of the periapical lesion with respect to the sinus floor (7). They classified the relationship between the Schneiderian membrane and lesions affecting maxillary molars and premolars into three groups: class I, in which there is a distinct distance between the lesion and the sinus floor; class II, in which the lesion contacts the sinus floor; and class III, in which the lesion extends into the sinus floor. The present case presented as class III according to this classification. When the lesion is inside the sinus cavity, perforation of the membrane is unavoidable. Thus, in such cases, it is of utmost importance that a meticulous technique be used to ensure that foreign material or the resected tooth apex does not enter the sinus, in order to avoid sinus mucosal thickening and signs of sinusitis (3). Jerome and Hill in 1995 (8) described a method by which a hole is drilled in the root apex to secure the root tip with a suture before apicectomy, thus enabling the removal of the inflammatory lesion with the root tip. They recommended using gauze to isolate the area and to prevent retro-preparation debris and retro-fill materials from entering the sinus. Garcia et al. (2) used gauze to block the maxillary sinus and avoid the penetration of foreign bodies, but in their case, the sinus lining was not perforated.

In the present case, an iatrogenic perforation of the Schneiderian membrane was isolated using an absorbable hemostatic gelatin sponge. Spongostan is a gelatin-based sponge that stimulates the intrinsic clotting pathway by promoting platelet activation and the subsequent release of thromboplastin and thrombin. It is indicated for surgical procedures (other than ophthalmic) for hemostasis, when control of capillary, venous, and arteriolar bleeding by pressure, ligature, and other conventional procedures is ineffective or impractical and it may be recommended for the management of perforation of the Schneiderian membrane instead of using gauze. In addition, the creation of a small bone window close to the perforation allowed mobilization of the membrane favoring its collapse, thus ensuring closure of the perforation. This is not a common procedure for the management of perforations in a maxillary sinus augmentation technique; however, the proximity of the tooth affected by the periapical lesion put the maxillary sinus at risk for possible contamination due to remnants of the lesion, which could easily diffuse into the sinus through the perforation. This could lead to sinus infection and possibly impair the regenerative potential of the Schneiderian membrane (9). It has been suggested that trauma to the Schneiderian membrane, such as a perforation, may transiently and unpredictably inhibit ciliar activity (5) and also predispose the sinus to altered mucous composition due to possible bacterial infection.

A previous study has reported that Schneiderian membrane perforation during oral surgical procedures involving the maxillary sinus is not detrimental to the clinical outcome of the treatment (3). However, the impact of a perforation on sinus physiology in terms of the alteration of sinus function and time needed for recovery of proper functionality has never been assessed. In the present case, the procedure adopted for managing the perforation aimed at the prompt reestablishment of normal sinus function.

In the case of good sinus clearance, extend the lifting procedure until collapse of the membrane to minimize the perforation and achieve faster and better membrane healing (10).

To achieve this result, it is usually necessary to enlarge the antrostomy in order to expose a new portion of the sinus membrane (10). The described technique suggested

performing a secondary antrostomy, as a lateral access to the lesion, near the perforation to minimize the enlargement of the sinus access. As a consequence, the bone tissue will be more preserved and faster tissue healing could be expected because a bone bridge is present between the two accesses.

The endoscope used in this case was very thin and small, major characteristic to perform a mini-invasive surgery. Nevertheless the surgical field appeared visible and clear without the necessity of great tissues retractions. As a consequence, in the presented case the patient referred small difficulties in mouth opening and chewing, and mild swelling in the two days after surgery. Also, the patient took only one pain-killer the day after surgery.

Using the endoscope was helpful in both sinus surgery and root-end management. This peculiarity was possible due to the facile adaptability of the magnification device in the surgical field and the ease of changing the magnification degree. Thus, the endoscope is useful during root-end management by eliminating the need for a change of magnification device during surgery, resulting in shorter surgical time. Conversely, when using a microscope, any movement of the microscope itself or of the patient, while increasing the magnitude, will cause the surgical field to become out of focus. In the authors' experience, the microscope is useful but the depth of field using an endoscope is similar to that of the naked eye. Using an endoscope, the surgeon can examine the morphological aspects of the root from almost any direction in a short time. This takes longer using a microscope and it is sometimes very difficult or impossible, especially in the posterior region of the jaws. Using an endoscope, it is also possible to see behind the roots and ascertain the presence of a periradicular lesion and it is especially useful for exploring the sinus cavity, thus obtaining a sound knowledge of the surgical field.

The rod-lens system of the endoscope allows good visualization, even in the presence of irrigation fluids. The surgeon can thus use retrotips with sterile water irrigation to avoid overheating and at the same time to have lens cleaning.

This case showed both a new surgical approach for repairing a sinus perforation during endodontic surgery and the versatility of the endoscope in the case of multidisciplinary surgery.

Randomized clinical trials with standardized protocols and high levels of evidence are needed to confirm the validity of this new minimally invasive endoscopic sinus membrane repair technique.

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