Caldwell-Luc procedure for retrieval of displaced root in the maxillary sinus

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Objective. The aim of this study was to describe the standard diagnostic procedure and the application of the Caldwell-Luc approach for the retrieval of a displaced root from the maxillary sinus and to share our experience in treating this complication.

Study design. Twenty-four patients with a fractured root accidentally displaced into the maxillary sinus were referred by general dentists to our department from 2005 to 2008. All were managed by a standardized diagnostic procedure and a Caldwell-Luc approach. We recorded the age of each patient, the gender, the tooth, the size of root fragment, the type of displacement the delay between displacement and retrieval, the length of operating time, and any complications.

Results. Over a 4-year period, we treated 24 patients, 14 being male and 10 female. Ages ranged from 14 to 55 years (average 26.4). The commonest tooth involved was the maxillary first molar; the length of the root fragments ranged from 3 to 7 mm. Seventeen of these roots were mobile and 7 fixed (4 being located between the sinus membrane and the bone and 3 immobilized by the sinus membrane. Twenty-three of the operations were completed in 30 minutes, and only 2 patients had a temporary complication of sinusitis. No infraorbital paresthesia occurred.

Conclusions. The standardized diagnostic procedure and Caldwell-Luc approach for the retrieval of a displaced root form the maxillary sinus is a safe, simple, and fast method with minimal complications. (Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2011;112:e59-e63)

Displacement of a fractured root into the maxillary sinus is one of the complications of extraction of maxillary posterior teeth. It occurs accidentally and may cause severe problems with oroantral fistula, sinusitis, cellulitis, and subdural empyema.1

Extraction is the commonest surgery in a dental clinic and the dentist should be able to manage this complication. Diagnosis of the displaced root in the maxillary sinus depends on imaging, evaluating the root size, and its location within the sinus. Surgical retrieval is considered first, even though some studies suggest leaving the root fragment in the sinus if it is <3 mm in size and in the absence of sinusitis or other local disease.2 Surgical approaches include retrieval via the extraction socket3 or the Caldwell-Luc approach, which can avoid enlarging the oroantral communication (OAC) and potentially causing an oroantral fistula. We reviewed the literature and found the standard Caldwell-Luc operation to be well documented, although most papers did not describe in detail the application of the Caldwell-Luc approach to root retrieval. The aim of the present paper is to describe the standard diagnostic and surgical procedure and to share our experience of retrieval of roots displaced into the maxillary sinus.

MATERIAL AND METHODS

Basic Patient Data

This retrospective study reviews those patients referred to our department from general dental practices because of root fragments displaced into the sinus during extraction of maxillary posterior teeth.

Four oral surgeons were involved, with lengths of experience in oral and maxillofacial surgery ranging from 4 to 20 years; they treated these patients following a standardized diagnostic and surgical plan. Each surgeon treated ≥3 cases. We recorded the gender and age of each patient, the tooth extracted, the root fragment size, root location, and whether the root was mobile or fixed in position, the delay between extraction and referral to our department, presence of infection, complications of operation, and the length of operation.
time. This retrospective study was exempted by the Institution Review Board.

**Standardized diagnostic procedure**

On presentation to our clinic, the patient with a root displaced into the maxillary sinus has a panoramic radiograph to confirm the presence of the root, its size, and its location. The patient is then asked to shake his or her head and a repeated radiograph was taken to check for any change in position of the root. We have found that the root condition could be divided into 3 types: mobile type: root changed location at 2 different image examination after shaking head position; fixed type A: root located between sinus membrane and bone; and fixed type B: root in the sinus cavity and fixed by adherent membrane. In our view, these types need varying surgical procedures.

**Surgical procedure**

We do not recommend enlarging the OAC to retrieve the displaced root via the extraction socket. We place the patient in the supine position to allow the root to fall into the posterior and narrowest part of the sinus. Surgery is performed under local block anesthesia (posterior superior alveolar nerve, greater palatine nerve, and buccal infiltration from the canine to the first molar). A vestibular incision is made from the canine to the first molar region, and a full-thickness mucoperiosteal flap is reflected to expose the canine fossa. A bone window 4-5 mm in diameter is made distal to the apex of the canine and above the apices of the premolars by 5 mm (Fig. 1); if the root’s smallest diameter exceeds 5 mm this window can be widened, but with care to avoid injury to the infraorbital nerve.

Patients with the 3 different root types are treated differently.

*The mobile type.* We use a straight metal suction tip going from the bone window directly to the posterior sinus, where the root fragment is usually located when the patient is supine (Fig. 2). The suction apparatus is set on high, and it is easy to retrieve the root.

*The fixed types.* We elevate the membrane from the bone first if the root lies between the membrane and the bone (fixed type A). It is usually adjacent to the socket of the extracted tooth and is usually removed without difficulty. If this fails—or if the fixed type B is present (with the membrane adjacent to the root)—we use a curette to loosen the fragment and let it fall into the posterior sinus (Fig. 3), and then we complete the removal as for the mobile type. In using the suction tip or curette, one must be aware of the infraorbital nerve and the anterior superior alveolar artery. The wound is closed primarily. If the patient has no OAC on presentation several days after extraction, it is not necessary to treat the extraction socket.

If the patient presents a few hours after extraction and if the orantral communication is >5 mm, then gelfoam and wound suturing will suffice. If the OAC is <5 mm, gelfoam alone may suffice.
Postoperative care

All our patients are given routine postextraction care. They are warned that nasal bleeding for 2-3 days is possible. They are given antibiotics for 1 week but no decongestant. A soft diet is recommended. Sucking on a straw, sneezing, and noseblowing are to be avoided.

Fig. 2. A, The skull with the anterior wall of the sinus revealed shows that the straight metal suction tip through the hole (bone window) can suck the root fragment out with powerful suction pressure easily, because a movable root fragment will drop into the bottom of the sinus when the patient is in the supine position. B, The computerized tomography scan shows the anatomic topography of the sinus (arrow).

Fig. 3. When the root fragment is unmovable type (A and B, arrow), we use a curette to detach the fragment from the mucosa and let the root fragment drop into the posterior narrow space (C).
Sutures are removed at 1 week. Patients are then seen at 1 day, 1 week, and 6 weeks after the operation and checked for swelling, pain, numbness, nasal discharge, and bleeding.

RESULTS

Over 4 years we treated 24 patients: 14 male and 10 female. Their ages ranged from 14 to 55 years (average 26.4). Teeth extracted were as follows: 15 first molars, 6 third molars, and 3 first premolars. Seventeen roots were of the mobile type. Seven roots were “fixed,” 4 of type A and 3 of type B. Delay in referral: 10 patients were referred several days after the attempted extraction (1 with nasal discharge, none with oroantral fistulas); 14 were referred within several hours, 1 with an oroantral fistula >5 mm. The dentist had attempted removal of the root via the socket but failed. It was treated with gelfoam and suture.

All patients healed without OACs. Two cases developed sinusitis that was temporary. They experienced discharge and fullness after surgery. One was the case with the large OAC, and 1 presented with sinus discharge. Both of these cases settled within 6 weeks. No patients developed infraorbital nerve paresthesia. Some patients had mild pain, swelling, and discharge for a few days.

Operating time from incision to closure: 1 case exceeded 30 minutes, the other 23 were completed in <30 minutes.

DISCUSSION

Extraction is the commonest surgery performed in the dental office. Although most cases are simple, complications can occur. Displacement of a tooth or root fragment into the maxillary sinus is rare: Rothamel et al. recorded only 1 patient in a review of 1,596 cases of maxillary third molar extraction in 2006. This complication can progress to severe clinical and legal problems. In the present study, this complication more commonly happened with the first molar, more often in male patients, similarly to a study by Chongruk. Dentists should be aware of this complication which occurs by accident and often in teeth that appear to be simple extractions on radiographs. We found no detailed description in the literature of the diagnostic procedure and use of the Caldwell-Luc approach, and this led us to collect our data and record our satisfactory results from 2005 to 2008. It is our hope that this paper will alert dentists to the problem and encourage them to manage it themselves.

The Caldwell-Luc approach to the sinus is similar to the operation used to explore disease in the sinus but we do not need to remove the sinus membrane completely. The diagnostic phase confirms the type of root displacement, the size of the root, its location, and whether mobile or not. For root retrieval purposes the access window does not need to be as large as in the classic Caldwell-Luc sinus exploration where a hole of ~2.5 cm may be needed. We suggest that a 4–5-mm hole is adequate to insert a metal suction tip to retrieve a root. Some authors suggest placing the patient in the lateral recumbent or upright position, but we always use the supine position because of the shape of the sinus. This is often described as pyramidal with the base being the medial wall of the sinus and the apex extending into the zygomatic process of the maxilla. With the patient in the supine position, a mobile root fragment will tend to fall into the posterior part of the sinus, facilitating removal with a straight suction tip.

The dentist should be familiar with this procedure and able to handle this complication. Some authors remind the operator to palpate the buccal mucosa adjacent to the extracted tooth before making an incision in case the displaced root lies under the mucosa. This is a variety of fixed type A, but it is uncommon. Careful evaluation of the radiograph is needed to determine the location of the root, such as the ostium of the sinus or below the orbital floor (Fig. 3).

When referral of our patients was several days after extraction and when the dentist had not attempted root retrieval via the socket, we found no OAC. When a patient was referred within a few hours of extraction and after an attempt by the dentist to retrieve the root via the socket, we found a large OAC needing gelfoam and suturing. Some authors recommend copious irrigation via a Caldwell-Luc approach if the irrigation is not productive. We do not recommend retrieval via the socket, because of the risk of permanent OAC and infection. Most of our patients were relatively young, which may explain our few complications. Such complications may include pain, swelling, bleeding, and discharge. Rarely there have been reports of orbital hematoma, visual disturbances, and infraorbital nerve damage.

In the past ten years, endoscopic retrieval of a root (or implant) from the sinus has been reported. This has the advantage of a small bone window (4 mm will suffice), and under direct vision the root can be removed accurately with less risk of injury to the infraorbital nerve or vessels. However, endoscopy is performed under general anesthesia and requires the admission of the patient. Our clinical procedure uses a bone window of similar size, and relying on a knowledge of sinus topography we have similar results.

We use a similar diagnostic and operative procedure to remove a dental implant without difficulty (Fig. 4). It can be applied to other foreign bodies, too. Flanagan reported retrieval of a displaced implant from the sinus.
in 2009. In that case the patient was in the lateral recumbent position (with the involved sinus on the underside) and the sinus was irrigated with normal saline solution while the plastic suction was cut to fit the bone window accurately; the mobile implant was brought out by the irrigation. In contrast, we prefer the patient in the supine position, and the use of the stainless steel suction tip is more convenient. Lubbe et al. recorded transnasal endoscopic removal of a misplaced dental implant as an effective method, with the same disadvantages as the transoral endoscope.

Our diagnostic and treatment procedure is easy and effective. A dentist with basic training can do this with instruments from his office. Only complicated cases need referral to an oral and maxillofacial surgeon.

REFERENCES

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