

CASE REPORT

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Endo-Antral Syndrome and Various Endodontic Complications

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The purpose of this paper was to examine the varied impact of the pathological spread of dental sepsis into the adjacent maxillary sinus. This complex of tissue destruction is called Endo-Antral Syndrome; the usual radiographic diagnostic features are identified in the paper. The four different cases presented serve to illuminate a few of the many diagnostic and treatment challenges involved. Emphasis is placed on the utilization of a keen sense of wariness when endodontically treating maxillary posterior teeth whose apices are close to the sinus. Dental examination should include an appraisal of antral health prior to root canal therapy to best plan treatment and to establish a base line against which to judge subsequent developments.

The pathological disruption of both periapical and adjacent antral tissues resulting from endodontic infection has been well documented (1-7). This spread of pulpal disease beyond the confines of the dental supporting tissues into the maxillary sinus is called Endo-Antral Syndrome (EAS). It has been shown that the closer the apex of a pulpally involved tooth is to the floor of the sinus, the more likely and the greater the impact on the antral tissues. The findings that usually characterize the EAS are: (i) pulpal disease in a tooth whose apex approximates the floor of the maxillary sinus; (ii) periapical radiolucency on pulpally involved tooth; (iii) radiographic loss of the lamina dura defining the inferior border of the maxillary sinus over the pulpally involved tooth; (iv) a faintly radiopaque mass bulging into the sinus space above the apex of the involved tooth, connected neither to the tooth nor the lamina dura of the tooth socket (representing a localized swelling and thickening of the sinus mucosa); and (v) varying degrees of radiopacity of the surrounding sinus space (comparison with contralateral sinus often helpful). The variable presentation of the EAS can create both diagnostic and therapeutic difficulties, because all cases do not always evidence all five features. Clinical impressions seem to indicate that most cases of EAS respond satisfactorily to nonsur-

gical root canal treatment. For those cases refractory to routine conservative management, a suitable surgical approach is recommended.

The purpose of this paper is to illuminate some unusual and variable cases whose treatment and outcomes all differed.

CASE 1

A 44-yr-old female presented with a history, provided by her dentist, which indicated that the upper right first molar (#3) had been restored 6 yr previously with a possible pulp cap (Fig. 1A). The patient did not report any particular symptoms related to this tooth, but had a long-standing troublesome sinus infection. Her daily pharmaceutical regimen was Uniphyl (a controlled release bronchodilator), Premarin (estrogen replacement), Lopid (a lipid regulator), Buspar (an antianxiety agent), Elavil (an antidepressant), Atrovent (a bronchodilator), Hismanal (a long-acting selective histamine antagonist), Tylenol/aspirin (one daily), Cipro (a fluoroquinolone broad spectrum antibiotic), an over-the-counter decongestant, and allergy shots periodically.

Clinical examination revealed marked bilateral nasal congestion that correlated with the patient's sense of congestion and fullness. Palpation of the buccal vestibule opposite tooth #3 produced tenderness, which contrasted with lack of palpation tenderness elsewhere. Tooth #3 failed to respond to ice, whereas the teeth on either side felt the cold. Whereas the radiograph shows signs of an intact lamina dura and ligament space, the surrounding sinus space is relatively opaque—a finding compatible with congestion related to her sinus infection—and the compact bone delineating the floor of the maxillary sinus is absent. The radiograph also shows a large calcification occupying most of the pulp chamber in tooth #3.

The patient was informed that, based on all of the above, tooth #3 contained a degenerating or necrotic pulp, for which root canal therapy was indicated. Furthermore, she was informed that progression of untreated pulpal disease would probably impact unfavorably on her chronic sinus condition. She decided to proceed with root canal treatment, which was completed uneventfully (Fig. 1B). The patient was lost to follow-up until 4 yr later when I was notified by her dentist that her sinus problems had worsened and tooth #3 was symptomatic (Fig. 1C). The radiograph at this time shows considerable deterioration with all the classic signs of an

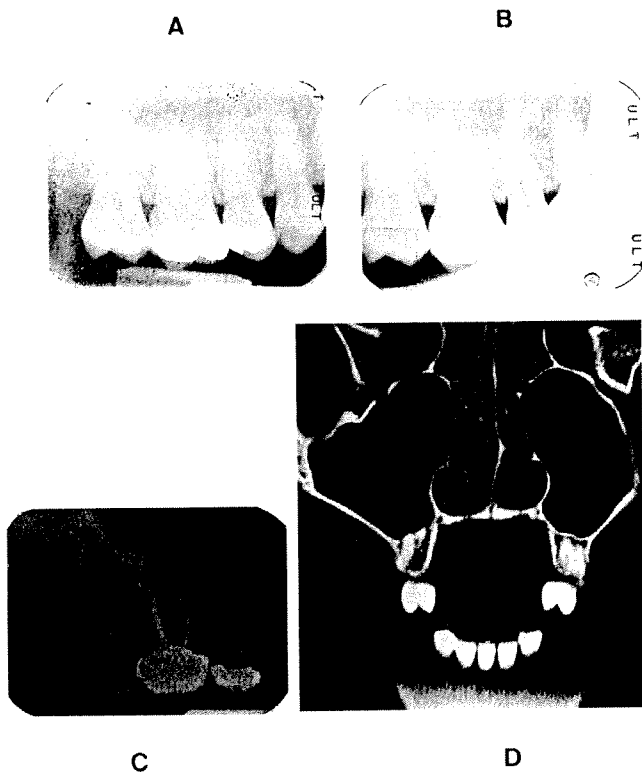


FIG 1. Shows development of an acute EAS subsequent to root canal treatment. (A) Pretreatment radiograph shows sinus space opacity, lack of definitive osseous floor of sinus, large calcification in pulp chamber, but intact lamina dura and normal ligament space over roots. (B) Radiograph immediately after root canal filling of tooth #3. (C) Radiograph 4 yr postroot canal filling. The complex of radiographic signs of an acute EAS are now present: periapical radiolucency with loss of much of the lamina dura over the roots, loss of all remnants of osseous floor of sinus over tooth #3, a large radiopaque mass bulging into the sinus space above the apexes of tooth #3 (representing a localized swelling of the antral mucosa), and surrounding antral space is relatively opaque. (D) CAT scan vividly shows details of localized mucosal swelling and loss of osseous floor of sinus over tooth #3 (compare with contralateral normal side).

EAS. In addition, as part of a renewed medical work-up, a computerized axial tomography (CAT) scan was taken (Fig. 1D). During subsequent antral surgery, tooth #3 was removed.

Study of Fig. 1, C and D, reveals the extent of the local sinus mucosal swelling surrounding the apexes of tooth #3, as well as the relative merits of both radiographic techniques. The remarkable visualization of the mucosal swelling and adnexa on the CAT scan demonstrates how usefully this technology can supplement routine periapical films. Nonetheless, the obvious correlation between the image of mucosal swelling on the periapical film and on the CAT scan seems to validate the predictability of the periapical to show this type of mucosal change.

CASE 2

A 28-yr-old female with an unremarkable medical history presented with the chief complaint of constant low-grade pain in the right maxilla. Although she was unable to exactly pinpoint the location, she focused mainly on the premolar area. The discomfort was of a few years duration and definitely had its origin following

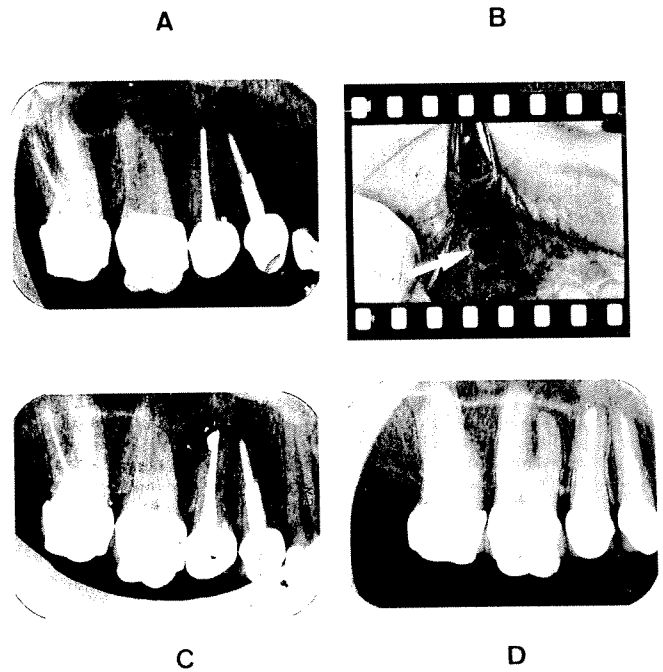


FIG 2. This is an example of a subtle EAS after apicoectomy on tooth #4 performed during an acute abscess with resultant chronic pain of long-standing. (A) Radiograph at original case presentation with constant pain in maxillary right posterior. The osseous floor of the sinus over the apex of tooth #4 is just barely visible; but, all other features, including the antral space, are within normal limits. (B) Photograph of defect as found on elevation of exploratory flap: no evidence of soft tissue within bony cavity, and underside of antral mucosa (arrow) denuded of bone seen at the base of defect. (C) Radiograph immediately following placement of an apical amalgam seal. (D) Radiograph 6 yr 2 months after exploratory surgery showing restitution of normal periapex and osseous sinus floor. The patient continues to remain pain-free.

a most traumatic dental episode. She was living in Thailand with her husband, who was an official with the U.S. State Department, when she developed a severe toothache in her upper right second premolar (tooth #4). She consulted a local Thai dentist (there were no American health facilities available) who proceeded with root canal treatment. By the next morning, her condition had worsened with diffuse facial swelling and agonizing pain. She returned to the dentist who informed her that he must immediately perform surgery. Her recollection of the apicoectomy was clearly nightmarish, because the local anesthetic was ineffective. Eventually, she seemed to heal with recovery of the soft tissues, but was left with constant low-grade pain in the area.

Clinical examination of the area failed to disclose any abnormal findings. Periodontally, there were no pockets, none of the teeth were percussion positive, and palpation especially of the buccal vestibule did not find any locus of tenderness.

The radiograph shows extensive, very satisfactory, restorative and endodontic procedures (Fig. 2A). There were well-fitted full-cast crowns on teeth #2 through #5, and what appears to be gutta-percha root canal fillings in teeth #2 and #5, with essentially normal periapexes. The root canal filling in tooth #4 resembles a silver point, along with signs of two coronal pins, suggest a buildup under the full crown. In addition, the apical area of tooth #4 shows minor variations in the bone pattern, a faded but still discernible osseous sinus floor, and a clear (radiolucent) antral space. Con-

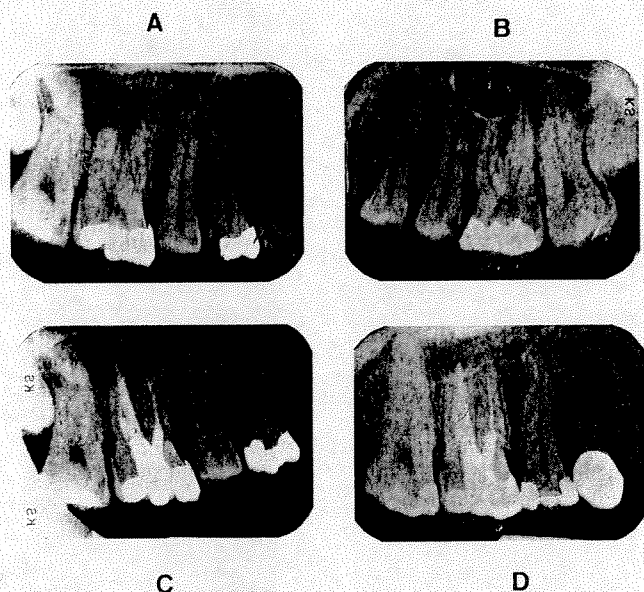


FIG 3. An example of an EAS case that responded satisfactorily to nonsurgical root canal treatment, except for an unresolved antral opacity. (A) Radiograph shows all the typical signs of an EAS related to tooth #3, except swelling of the antral mucosa. (B) Radiograph of the normal contralateral side that allows graphic comparison of the extent of pathological alteration on tooth #3. (C) Radiograph of the immediate postroot canal filling. (D) Radiograph taken 5 yr 4 months after root canal filling shows complete restitution of normal periapex and floor of sinus, except for persistent antral space opacity.

sidering the history of apicoectomy on tooth #4, the findings herein failed to clarify the etiology of the pain, and thus it remained indeterminate. With the patient's enthusiastic encouragement, exploratory surgery was performed. Elevation of a buccal flap revealed a large osseous defect over the apex of tooth #4, with the underside of the antral mucosa visible at the base of the hole (Fig. 2B). There was no tissue of any kind in the bony defect. Access to the tooth apex was obtained, about 3 mm of silver point was removed from the canal, the apical cavity was sealed with zinc-free amalgam, fresh blood from the flap was allowed to accumulate in the defect, the intact sinus mucosa was undisturbed, and the flap sutured (Fig. 2C). Sutures were removed in 7 days. Healing progressed uneventfully, with total elimination of chronic pain. When last examined 6 yr 2 months postsurgery (Fig. 2D), the patient remained pain-free, and the radiograph showed restitution of a normal periapex with regeneration of the osseous sinus floor.

CASE 3

An otherwise healthy 18-yr-old male presented with a chronically abscessed upper right first molar (tooth #3). Clinically, a draining sinus tract was found on the palate lingual to tooth #3, and routine pulp tests confirmed pulp necrosis. The radiograph shows many characteristics of the EAS; the apices of tooth #3 are in extremely close approximation to the maxillary sinus, an area of periapical rarefaction is evident particularly in relation to the palatal apex, the osseous floor of the antrum is lacking, and the sinus space is extremely opaque (Fig. 3A). A radiograph of the contralateral side (Fig. 3B), for comparison purposes, clearly emphasized the extensive pathological alterations on the right side. Nonsurgical root canal treatment was rendered uneventfully with

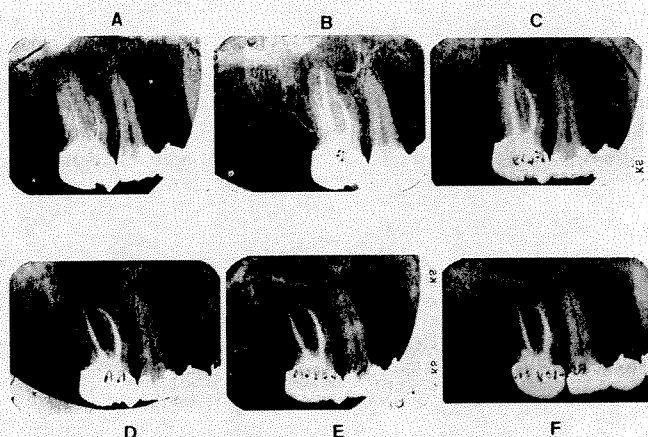


FIG 4. This case presents an extremely long-standing EAS traced to undertreated root canals 30 yr previously. (A) Radiograph at original examination showing all the findings of an EAS, except mucosal swelling. There is no sign of root canal filling in the palatal canal, and buccal canals appear significantly undertreated. Clinically, the patient has a large palatal swelling recurring over the 30-yr period. (B) Radiograph of the immediate postroot canal retreatment. (C) Radiograph 1 yr after retreatment failing to show any repair. (D) Radiograph of the immediate postpalatal root amputation. (E) Radiograph 3 yr 6 months after palatal root amputation shows favorable regeneration of the osseous sinus floor and advanced resolution of the rarefaction on the buccal roots. (F) Radiograph 11 yr after palatal root amputation shows regeneration of a normal periapex and antrum. This area continues to be free of symptoms, especially palatal swelling that has never recurred since root amputation. (Courtesy of Selden, *Oral Surg Oral Med Oral Pathol* 1974;38:623-629.)

prompt closure of the palatal sinus tract (Fig. 3C). The symptom-free patient was last seen for follow-up 5 yr 4 months later, with no sign of recurrence of drainage (Fig. 3D). There does remain one problematical radiographic finding: the antral space continues to show significant opacity, even though all the other original pathological features have healed. The patient rejected medical referral for sinus evaluation.

CASE 4

This is a previously reported case of a 50-yr-old female with an unremarkable health history who was referred by her new dentist for evaluation of the upper right first molar (tooth #3) (Fig. 4A). Of significance, the clinical examination found a palatal swelling extending from close to the midpalatine suture to within 1 cm of the palatal gingival margin of tooth #3. The tooth was firm, and no periodontal pockets were present. The patient indicated that, for more than 30 yr, this periodic swelling had been treated with antibiotics by her physician, for what he had diagnosed as a "sinus condition." The radiograph of tooth #3 shows seriously undertreated root canals—rendered more than "30 yr ago"—and all the features of the EAS, except sign of a swollen sinus mucosa. The recommendation for endodontic retreatment, including the unpredictability of reversing the tissue damage caused by this long-standing infection, was readily accepted. After a number of treatment visits, the canals were filled (Fig. 4B). After 1 yr, during which the palatal swelling recurred (and was treated with antibiotics by her physician), it was acknowledged that retreatment had failed to promote healing (Fig. 4C). Furthermore, clinically and radiographically, the evidence seemed conclusive that the focus of

antral pathosis centered on the palatal root. Although there was no periodontal pocket on the palatal root, vigorous probing established that the palatal root emerged at a sufficiently divergent angle from a coronally high furcal area to permit a root amputation. With the patient's concurrence, the palatal root was amputated uneventfully (Fig. 4D). The procedure involved, sequentially: the elevation of a minor envelope flap on the palate, sectioning of the root, recontouring of the lingual and occlusal surfaces (to minimize occlusal contacts in centric, eliminate contacts in lateral, and create lingual contour compatible with tissue healing), removal of the palatal root, and firm suturing of the flap. It is important to note that no socket curettage was performed after the root was removed. The patient healed without adverse incidence and the palatal swelling never recurred. At the 3 yr 6 months postroot amputation visit, the radiograph shows very favorable regeneration of the osseous floor of the sinus and almost complete resolution of the periapical rarefaction on the buccal roots (Fig. 4E). The patient was last seen 11 yr postroot amputation, and continued to be free of symptoms and radiographically showed total repair of all dental and antral tissues (Fig. 4F). Of further interest, despite the lack of splinting, this functional tooth has remained firm and free of periodontal disease.

DISCUSSION

Many reports have documented that, once root canal sepsis crosses the dental/antral partition, there develops a potential for an increase in the morbidity and mortality from serious infections. Although complications of this severity are rare with modern endodontic techniques, practitioners should be wary of teeth with apices close to the maxillary sinus. It has been shown (1, 7) that, during the acute phase of an EAS, it is likely that in addition to destruction of the osseous sinus wall the mucosal lining of the sinus could be perforated. The potential intrusion of antral mucous into the periapical "wound" is a complication that could forestall healing. The relatively low instance of nonhealing EAS cases after root canal therapy possibly can be attributed to the fact that most patients at the time of treatment do not have an active sinus infection. On the other hand, if sinus infection is present or induced by the dental abscess, then the impact could be a complication contributing to a chronic EAS. Sinus infection is a liability to long-term healing in these cases.

Case 1

This case presents a good example of development of an acute EAS subsequent to root canal treatment in a patient with a severe chronic sinus infection. There were minimal radiographic signs of an EAS at the end of root canal treatment; but, about 4 yr later, they were most evident. Possibly because of the chronic sinus infection, the damaged and vulnerable periapical tissues worsened instead of repaired. A secondary issue with this particular patient was the amazing number and variety of pharmaceuticals taken daily. The impact of the drugs and potentially their complex interactions on the healing capability of her periapical and antral tissues is unclear at best, and, on a speculative basis, was disruptive. Furthermore, it is known that the intensity of sinusitis is augmented by states that increase engorgement of the sinus mucosa, such as anxiety. The conclusion that this patient suffered from chronic anxiety was

evident not only from her medication (Buspar and Elavil), but from her distraught and excitable manner.

Case 2

This case may be an example of the pitfalls of violating basic principles when performing apical surgery, especially in the environment of the maxillary sinus. The first consideration relates to the hazards of surgery during the acute stage of infection. Interference in the profundity of local anesthesia should have mandated rescheduling or an alternative general anesthetic. What bears significantly on the outcome was the danger of spread of infection and even osteomyelitis when performing osseous surgery during acute infection. In the least, operating at this time would likely interfere with bone regeneration, which is what occurred. Compounding the difficulties, the apicoectomy probably created a defective apical seal, allowing increased seepage of sepsis. Even though the antral mucosa was intact at exploratory surgery, it possibly had been perforated by the acute infection or by an operative event, allowing the ingress of mucous. However, once the acute condition has lapsed into a chronic state, the mucosa will usually regenerate, whereas bone is less likely to. Accepting the premise that an apicoectomy was required, the hazards mentioned herein could have been avoided by the use of antibiotics and analgesics to convert the acute flare-up into a chronic state, at which time surgery and local anesthetic could have been more predictable. In addition, placement of an apical seal could have meaningfully enhanced closure of the canal and provided a significantly less toxic environment for bone regeneration. The important supplementary lesson from this case is that we treat patients and not radiographs, and that it is essential to take into account the history and subjective symptoms.

Case 3

The important feature of this case is the failure of the antral space to develop normal lucency. More than 5 yr is certainly more than enough time to heal. Something is possibly abnormal and should be explored. Once repair of the periapical tissues and cessation of drainage are evident, it is now time to refer the patient to an otolaryngologist for evaluation of the continued antral opacity. Parenthetically, it would have been inappropriate to refer the patient before root canal therapy, because the continued spread of dental sepsis into the sinus would have thwarted remedial efforts by the physician.

Case 4

This case raises more questions than it yields answers. Why was there absolutely no change in the EAS following retreatment, but complete resolution and regeneration followed root amputation (without socket curettage)? Would curettage have interfered with healing? Normally pathological tissue removed during periapical surgery seems to hasten healing and is accepted as a routine and integral part of the procedure. Apparently, the conservative approach proved valid, because the case healed completely. It is tempting to impune the quality of the root canal treatment in the palatal root; however, the buccal roots healed after receiving similar therapy. An apicoectomy might have been feasible, but certainly entails increased morbidity risk. For example, if the flap

fails, then an antral-oral defect would be possible. Endodontists should be most selective and cautious in maxillary palatal root apicoectomy, especially if there is evidence of maxillary sinus pathological involvement.

In summary, these cases accent the potential impact that an involved maxillary sinus can have on endodontic therapy. Therefore, it would be of strategic clinical value for the diagnostic pulpal work-up to include the status of the adjacent sinus at the onset of therapy to establish an antral base line against which to judge subsequent developments. Patients should also be sufficiently informed of the findings, including the potential sinus complications and the need for additional treatment.

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