The original method is able to reduce the variability of landmark identification due to the variability of the human anatomy and to reduce the influence of the human error in cephalometric analysis.\(^\text{21}\) We know that\(^\text{23}\) the evaluation of craniofacial morphology and 3-dimensional analysis of the skull are influenced by experience and subjective perception of the examiner. The use of a set of points, instead of single anatomical points, minimizes the anatomical variability and the subjective error.

The most important innovation of this new way to identify skeletal points of construction is the real use of the 3D image of the anatomical structures. In fact, this method lets us take advantage of the 3D reconstruction of the skull and gives the possibility of considering the 3D bone structures, enhancing the reliability and accuracy of the reference points. Next step will be the identification of “volumes,” which is the real evaluation of diagnosis and the final aim of 3D cephalometry.

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**Actinomyces-Associated Calcifications in a Dentigerous Cyst of the Mandible**

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**Abstract:** Actinomyces-associated lesions in the jaw, such as radiocystic and osteomyelitis, have been reported by many authors. The lesions are caused by infection from peripheral sites and can be seen to contain Actinomyces druses on pathologic examination. To our knowledge, no previous reports have described Actinomyces-associated calcification in the jaw, although the lesions in the jaw often include druses. We report here a rare case of Actinomyces-associated calcifications in a dentigerous cyst of the mandible.

**Key Words:** Actinomycosis, Actinomyces-associated calcification, dentigerous cyst, mandible

Actinomycosis is a specific chronic infection caused by Actinomyces species, which are anaerobic or facultative anaerobic, Gram-positive, and filamentous bacteria.\(^\text{1,2}\) Actinomyces are normal inhabitants of the oral cavity and typically have low pathogenicity but become pathologic when gaining access to the subcutaneous tissues. Cervicofacial actinomycosis is most common among 3 forms (cervicofacial, pulmonary or pulmothoracic, and abdominal-pelvic actinomycosis) and accounts for more than half of all reported cases.\(^\text{1,3}\)

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Actinomyces that can cause chronic infections such as periodontitis have been isolated from saliva, salivary calculi, carious cavities, bone sequestrum, and tonsillar crypts. Actinomycosis is often considered an affliction of the soft tissues, but in fact, the process spreads to bone in up to 15% of cases. The mandible is the site of predilection for actinomycotic infection, and the posterior mandible is more frequently involved than the anterior mandible. Actinomycosis-associated lesions in the jaw, such as radicular cyst, dentigerous cyst, keratocystic odontogenic tumor, and osteomyelitis, have been reported by many authors. Radicular cyst or osteomyelitis is caused by infection from peripheral sites and can be seen to contain Actinomyces druses on pathologic examination. To our knowledge, no previous reports have described Actinomyces-associated calcification in the jaw, although the lesions in the jaw often include druses. We report here a rare case of Actinomyces-associated calcifications in a dentigerous cyst of the mandible.

CLINICAL REPORT

A 61-year-old man who visited a dental clinic for right mandibular swelling was diagnosed with right mandibular pericoronitis and was started on antibiotics. Because a panoramic radiograph showed a lesion around the crown of the right impacted third molar of the mandible, the patient was referred to our department for examination of the lesion. The patient had swelling in the right retromolar region and neurosensory disturbance in the right mental region. Another panoramic radiograph was taken and showed alveolar bone resorption caused by severe periodontitis of the right mandibular second molar and multiple small radiopaque spots in a radiolucent lesion that included the crown of right mandibular third molar (Fig. 1). Computed tomography (CT) revealed a radiolucent lesion measuring 20 × 20 × 18 mm and multiple radiopaque spots with a radio density of 1500 to 2000 Hounsfield units, which were considered to be calcifications (Fig. 2). Biopsy was performed under local anesthesia, and the soft tissue lesion was diagnosed as inflammatory tissue on pathology. Therefore, the patient underwent removal of the lesion and the right second and third molars under general anesthesia. Multiple small black pieces of hard tissue were present in the granulation tissue, and the crown surface of the third molar was covered with the same hard tissue (Fig. 3). Histopathologic examination of soft tissue specimen with the third molar revealed that squamous epithelium was infiltrated by inflammatory cells (Fig. 4).

Grocott staining was positive, and tiny filamentous structures were observed at the margin of the hard tissue, and conglomerations of Actinomyces were present with mycelium at their core (Fig. 5). There was no evidence of any foreign body or bony material in the specimens. Because the pieces of black hard tissue were considered to be due to calcareous degeneration associated with Actinomyces druses, the lesion was finally diagnosed as dentigerous cyst with Actinomyces-associated multiple calcifications. Antibiotics (cefazolin 2 g/d for 1 day and cefcapene 300 mg/d for 3 days) were administered from the day of surgery to postoperative day 3. The postoperative course was uneventful without need for additional antibiotics, and there has been no recurrence as of 21 months after surgery.

DISCUSSION

Actinomycosis associated with intrabony lesions such as odontogenic cysts occurs infrequently. The association between Actinomyces and odontogenic cyst formation could be explained in 2 different ways: an apical inflammatory reaction caused by invasion of Actinomyces may have stimulated the odontogenic epithelium, resulting in cyst formation; or after cyst formation, Actinomyces may have proliferated in the hemorrhagic contents, filling the cystic cavity. Most reported cases with Actinomyces-associated periapical lesions had a history of either trauma to the soft tissues or previous endodontic therapy. The incidence of Actinomyces infection in periapical lesions in a large case study ranged from 0.4% (1/256 specimens) to 1.8% (17/963 specimens). In an investigation of 106 Actinomyces-associated lesions of the oral mucosa and jawbones, Kaplan et al found that the incidence of Actinomyces-associated periapical lesions (radicular cyst and periapical granuloma) and dentigerous cyst was 12.3% (13 lesions) and 5.7% (6 lesions), respectively. Sun et al also reviewed 14 cases of actinomycosis in radicular cyst. They found involvement mainly of the maxilla and an incidence of approximately 65%, with equal distribution in the anterior and posterior areas. The mean age of patients in these 2 studies ranged from 37.6 to 42 years, and whereas Sun et al reported an almost equal male-female ratio, Hirshberg et al found a male predominance.

FIGURE 1. Panoramic radiograph shows alveolar bone resorption of the right mandibular second molar and multiple small radiopaque spots in a radiolucent lesion that includes the crown of the right mandibular third molar.

FIGURE 2. Computed tomography shows a radiolucent lesion including multiple radiopaque spots in the mandible.

FIGURE 3. Specimens with multiple pieces of black hard tissue. Arrow indicates granulation tissue; arrow head indicates the third molar.

FIGURE 4. Histopathologic examination of soft tissue specimen with the third molar revealed that squamous epithelium was infiltrated by inflammatory cells.
Actinomycosis is an aggressive and persistent disease capable of invading and destroying bone, although bone involvement is not seen until the later stages of the disease. According to a radiographic study of periapical lesions with and without actinomycotic colonization, *Actinomyces*-associated periapical lesions may be larger than those without actinomycotic colonization. Of patients with cervicofacial actinomycosis, 11.7% to 15% had bone infection such as periodontitis and osteomyelitis. Mandibular osteomyelitis caused by *Actinomyces* is the most common, whereas *Actinomyces*-associated osteomyelitis of the maxilla is rarely described. As an even rarer case, Vigliaroli et al. reported pathologic mandibular fracture caused by actinomycotic osteomyelitis.

A fungus ball is usually composed of hyphae with mucous secretions and cellular tissue debris, and calcifications within the ball may appear as diffuse small nodules, circumferential microcalcifications, or large progressive calcifications making up most of the ball. Ye et al. reported endobronchial aspergilloma presenting radiologically as calcifications without a history of tuberculosis or adjacent calcified lymph nodes and speculated that an *Aspergillus* colony formed the endobronchial fungus ball, in which internal calcification then progress. Calcifications are also often found in patients with maxillary sinusitis, especially fungal sinusitis. The infecting organism is *Aspergillus*, and the calcification is surrounded by the fungal mycelia within the fungal inflammatory tissue. The calcification in fungal sinusitis develops from metabolic deposits of calcium within the mycelial mass. According to a review by Mafee et al., the increased density seen in lesions in cases of chronic mycotic sinusitis is believed to be caused by calcium phosphate and calcium sulfate deposits within necrotic areas of the mycelium. On CT, fine punctate calcifications may appear in the early stage, which become dense as calcium is deposited within the fungal concretion. Fungal calcifications of the paranasal sinus may appear in some cases as well-defined high density similar to that seen with calcium or bone.

*Actinomyces* druses are different from a fungal mycelial mass in terms of filament size but may have a similar pathology and possible calcifications. Although *Actinomyces*-associated calcification is very uncommon, a few reports appear in the literature. In a rare case, Seo et al. reported that primary endobronchial actinomycosis calcified and caused the formation of a calcified endobronchial nodule because there was no evidence of either chronic granulomatous infection such as tuberculosis or foreign body material. Although actinomycosis of the paranasal sinus, such as the maxillary sinus, is also very rare, several cases of actinomycosis have shown focal central calcific density on CT. To our knowledge, there have been no reports of *Actinomyces*-associated calcifications in the jaw that were identified on panoramic radiography or CT, and the present case with multiple calcifications caused by *Actinomyces* druses is the first to be reported in the oral and maxillofacial region.

Pathologic calcification is the abnormal deposition of calcium salts and smaller amounts of other mineral salts in tissue. In the oral cavity, dental calculus represents a major form of calcification, and its development invariably involves plaque bacterial calcification. Plaque absorbs calcium and phosphate from saliva to form supragingival calculus and from crevicular fluid to form subgingival calculus. Generally, subgingival calculus is black, and the color arises from a combination of hemorrhagic elements from the gingival crevicular fluid and black pigmentation from the calcified anaerobic rods. In the present case with multiple black *Actinomyces*-associated calcifications in the mandible, we considered that *Actinomyces* infected the cystic lesion around the crown of the right mandibular third molar from the pathologic periodontal pocket as a result of severe periodontitis of the right mandibular second molar. This corresponds to the second possible explanation of the relation between *Actinomyces* and odontogenic cyst formation mentioned previously, namely, that after the cyst formation, *Actinomyces* proliferated in hemorrhagic contents, ultimately filling the cystic cavity. *Actinomyces* druses then absorbed calcium and other minerals from crevicular fluid, turning the calcifications black like subgingival calculus. Given that the crown surface of the impacted right mandibular third molar was also covered with calcifications and the mass seen radiographically was formed by multiple calcifications, the lesion was finally diagnosed as a dentigerous cyst with *Actinomyces*-associated multiple calcifications. When jaw lesions are found to show calcifications on radiography, differential diagnosis commonly includes adenomatoid odontogenic tumor, calcifying cystic odontogenic tumor, and calcifying epithelial odonto genic tumor. Pericoronal radiolucencies are characteristic of dentigerous cyst and some other odontogenic lesions, but the presence of the multiple radiopacities within the lesion in this case made a radiographic diagnosis of dentigerous cyst difficult. Therefore, surgeons should take *Actinomyces*-associated calcifications in the jaw into consideration when odontogenic lesions with calcifications are found radiologically.

Antibiotic treatment with penicillin and/or its derivatives is the basic form of therapy against actinomycosis. Although routine antibiotic administration for several to 12 months has been recommended, the modern approach to treatment is more individualized, and the exact antibiotic regimen and duration of treatment depends on the infection site, severity of disease, and the patient’s general condition and response to treatment. However, treatment of actinomycosis in the oral and maxillofacial region is focused on surgical debridement including the area of the source of the infection to reduce the numbers of organisms and change the anaerobic environment that is vital for the survival of these organisms. According to a review by Wong et al., orocervical disease has been cured after short courses of 2 to 6 weeks of antibiotics (oral and intravenous) combined with surgical drainage. In intraoral actinomycosis, Stenhouse et al. reported that prolonged antibiotic therapy was not required when the infected material was surgically removed from the site. Similarly, Hirshberg et al. stated that the outcome of patients with periapical actinomycosis was better and curettage of the lesion combined with a short course of antibiotics was sufficient to induce healing without complications in most cases. Fergus and Savord reported that a patient who received antibiotics had recurring symptoms until the lesion was surgically removed. These reports suggest that antibiotic treatment alone is not enough if *Actinomyces* are not eliminated and surgical treatment with or without antibiotics should be performed after early diagnosis. In the present case, there was no recurrence 21 months after surgery with short-term antibiotic administration.

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Effects of Radiofrequency and Intranasal Steroid Treatments on Respiratory and Olfactory Functions in Nasal Obstruction

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Objective: This study aimed to compare the effectiveness of radiofrequency ablation (RFA) and intranasal steroid (INS) treatments on respiratory and olfactory functions in patients with inferior concha hypertrophy and chronic nasal obstruction.

Study Design and Setting: This was a prospective clinical trial performed at a tertiary referral center.

Methods: We assessed patients with nasal obstruction between July 2011 and February 2012. The severity of the nasal obstruction in both groups was determined before treatment and 3 months after using a visual analog scale. For the purpose of an objective test, assessment was performed by the acoustic rhinometry. Using Sniffin’ Sticks for test odor identification, the discrimination and thresholds were assessed in both groups.

Results: The visual analog scale score after treatment was significantly lower in each group. Radiofrequency ablation treatment significantly improved the right minimal cross-sectional area 1 (MCA1), mean MCA1, and volume 1, as well as the right MCA2, mean MCA2, volume 2, and total volume. In the INS group, improvement was detected for the left MCA1, mean MCA1, and volume 1. Minimal cross-sectional area 2, volume 2, and total volume improved significantly after RFA treatment, but not after INS treatment.

Conclusions: Although RFA may be more effective in the posterior region of the nasal cavity, INS and RFA used in the treatment of inferior concha hypertrophy both had favorable effects on respiratory function. Intranasal steroid treatment provided improved discrimination and total score values, whereas RFA treatment improved only odor identification.

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