

Aspergillosis of the Maxillary Sinus as a Complication of Overfilling Root Canal Material into the Sinus: Report of Two Cases

Pathawee Khongkhunthian, DDS, Dr. med. dent., and Peter A. Reichart, Dr. med. dent.

Aspergillosis of the maxillary sinus is a relatively rare disease in nonimmunocompromised patients. In recent years a number of cases of aspergillosis of the maxillary sinus have been reported in association with overextension of root canals fillings with certain root canal cements. It has been suggested that zinc oxide-based root canal cements might promote the infection with the *Aspergillus* species. In particular *Aspergillus fumigatus* has been found to be associated with the maxillary sinus infection. Radiographically the unique appearance of a dense opacity foreign body reaction in the maxillary sinus was considered a characteristic finding in maxillary sinus aspergillosis. Because this association of overfilling of root canal cements and aspergillosis of the maxillary sinus is not too well known we report two cases of young healthy female patients with the characteristic findings, both radiographically and clinically. In both patients the first maxillary molar was involved. Patients were symptomless and the diagnosis was made accidentally. However at surgical inspection both patients revealed aspergillomas, including the overextended root canal cement. The surgical procedure is described as are the microscopic findings in both cases showing the characteristic branching hyphae and conidophores typical of *Aspergillus*. Overextension into the maxillary sinus with root canal cements has to be avoided; material has to be removed from the sinus because otherwise aspergillosis infection may ensue.

Aspergillus species belonging to the *Ascomycetes* class of fungi are extremely common in the environment. Although approximately

900 species are described only a few species are fungal pathogens in humans. For example *Aspergillus fumigatus*, *Aspergillus flavus*, *Aspergillus niger*, and *Aspergillus terreus* are reported to cause infection in humans. Microscopically *Aspergillus* can be identified as a filamentous structure with a diameter of 2 to 4 μm and with separated hyphae. *Conidia* are often inhaled and can be isolated from open air.

In nonimmunocompromised patients aspergillosis of the paranasal sinuses is a relatively rare disease. It is purely an opportunistic infection. Clinically it can be divided into three forms: (i) noninvasive, (ii) invasive, and (iii) allergic variants.

1. The noninvasive form called *Aspergillus mycetoma*, aspergilloma, or fungus ball occurs mostly in healthy individuals. Usually only one sinus, especially the maxillary antrum, is affected symptomatically or asymptotically. In one study 81 *A. fumigatus* infections of the paranasal sinuses were found among 600 patients treated for maxillary sinusitis (1). Loidolt et al. (2) reported that ~10% of all patients who undergo surgery for chronic sinusitis are found to have an aspergilloma. It has been suggested that intrusion of root-filling materials into the maxillary sinus may predispose to noninvasive aspergillosis (3, 4). Radiographically the unique appearance of a dense opacity foreign body reaction in the maxillary sinus is considered a characteristic finding. These objects called foreign bodies, concretions, or antroliths are usually in the center or near the orifice of the maxillary sinus.
2. The invasive form of *Aspergillus* infection in immunocompromised patients occurs in the lung tissue via blood vessels and causes necrotic bronchopneumonia. In the paranasal sinuses invasion leads to bony destruction (5). Severe invasion cases are also called fulminant aspergillosis (5). Early diagnosis and proper treatment in these cases are very important, because this invasive infection may take a fatal course.
3. The allergic form was first described by Katzenstein et al. (6). Symptoms are the same as in allergic bronchitis. It usually presents in young adults with a history of asthma and intranasal polyps. Clinically this condition results in obstruction and a chronic parasinusitis like the noninvasive form and does not respond to conventional medical management.

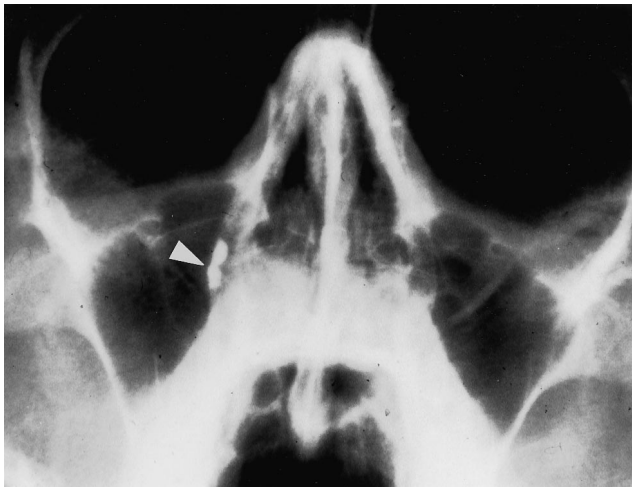


FIG. 1. Water's view showing a radiopaque mass (arrowhead) opposite the hiatus semilunaris, a characteristic finding in aspergillosis of the maxillary sinus.

CASE REPORT 1

A healthy Caucasian woman of 25 yr of age complained about tooth #3, which was sensitive to chewing after root canal treatment several years ago. Extraoral examination showed no asymmetry of the face, no swelling, or lymph node involvement. Intraoral examination showed no swelling or sinus tract in the region of tooth #16. The tooth was sensitive to percussion. After radiographic examination (panoramic radiography, Water's view) it was found that the root fillings of tooth #16 extruded into the maxillary sinus. Moreover a dense well-defined radiopaque mass near the opening to the nasal cavity was observed (Fig. 1). The tentative diagnosis was aspergillosis of the maxillary sinus with apical periodontitis of tooth #16 due to overextension of the root canal material. Treatment involved periapical surgery with retrograde filling of the buccal roots of tooth #16, antroscopy, and removal of the foreign body from the maxillary sinus. Surgery revealed a yellowish mass with a diameter of 6 mm. Histological examination showed aspergillosis with the root canal cement at the center of the mass and some calcification (Fig. 2). Fungal culture revealed *A. niger*. Healing was unremarkable.

CASE REPORT 2

A 25-yr-old Caucasian woman complained about pain due to percussion of tooth #14. Root canal treatment dated 4 yr previously. Clinical examination did not show any pathosis. Orthopantomography showed a radiopaque mass in the left maxillary sinus opposite the hiatus semilunaris (Fig. 3). Findings were confirmed by Water's view (Fig. 4). Tooth #14 had to be extracted. Antroscopy was performed via the alveolar socket and the foreign body was removed. The oroantral fistula was closed in a standard manner using a buccal mucosal flap (Rehrmann technique). Histology (undecalcified specimen) showed aspergillosis and calcification. Healing was uneventful.

DISCUSSION

Aspergillosis of the paranasal sinuses has been regarded as a rare disease. However during the last 10 yr an increase in the

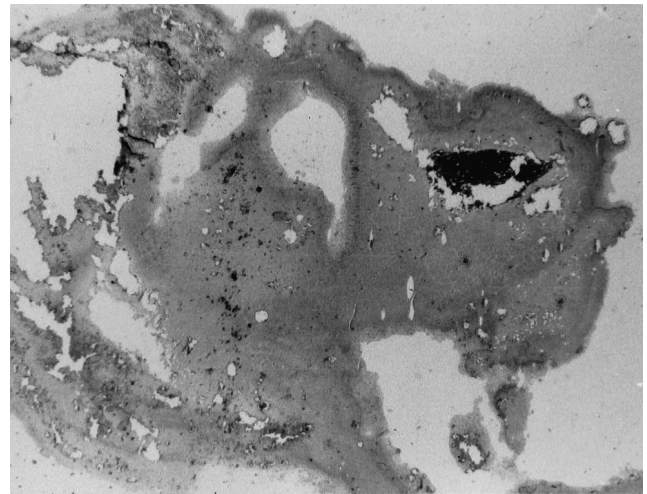


FIG. 2. Histological undecalcified section of aspergilloma with root canal material (black). H&E $\times 20$.

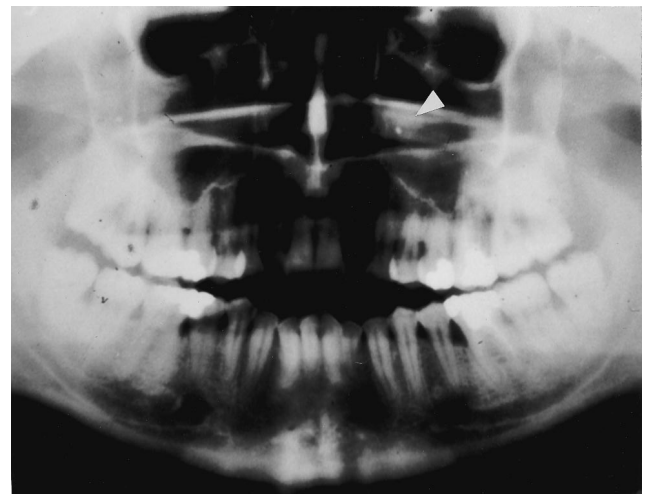


FIG. 3. Panoramic radiograph (left side) showing a small radiopacity in the maxillary sinus representing root canal material that has been transported close to the natural foramen of the sinus over the years (arrowhead).

number of cases has been reported. Approximately more than 10% of all patients with chronic sinusitis are found to have an aspergilloma (1, 2). It has been suggested that root canal treated teeth with overextension of the root canal sealer into the sinus might be the main etiological factor for aspergillosis of the maxillary sinus in healthy patients (3, 4).

One of the components of root canal sealers that is considered to be a growth factor for aspergillus is zinc. Beck-Mannagetta et al. (4) demonstrated that maxillary sinus aspergillosis is in most cases caused by excess root-filling materials that contain zinc oxide and formaldehyde. Experimental studies with fungus cultures revealed considerable acceleration of the growth of different aspergillus species in the presence of zinc oxide in the culture medium (3). These authors also found that all of the 35 patients had either overextension of the filling in root canal-treated teeth or previous extraction (3). These findings were confirmed in a study by Legent et al. (7), who reported 85 cases of aspergillosis of the maxillary sinus, of which 85% were believed to be related to overextended root canal sealer in maxillary teeth (7).

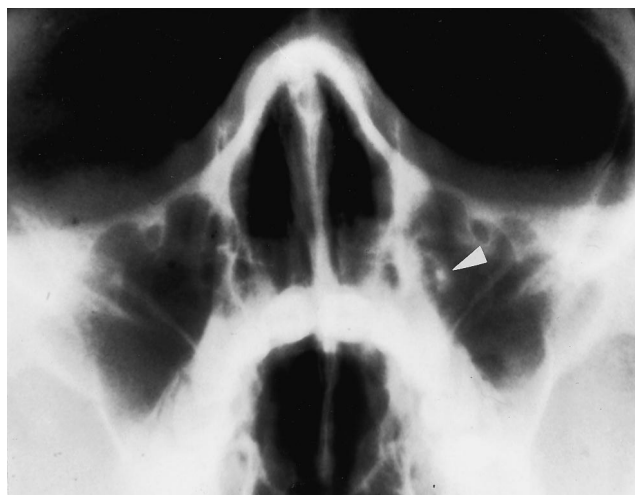


FIG. 4. Water's view of the same patient showing the radiopaque mass high up in the sinus.

However, Odell and Pertl (8) tested five root canal sealers (pure zinc oxide-eugenol, Grossman's sealer, Quick set, Kalzinol, Sealapex, and AH26) and found that all of the sealers showed antifungal activity against *Aspergillus*. They suggested that zinc release is unlikely to be responsible for the association between zinc oxide-based cement and aspergillosis, but the possibility of contaminated root canal sealer introducing aspergillus spores into the sinus should be considered (8). Eugenol has fungicidal and fungistatic activities against hyphae and blastospores of *Candida albicans*, *Cryptococcus neoformans* (9), and *Aspergillus parasiticus* (10). Odell and Pertl (8) concluded that *Aspergillus* species strains tested were susceptible to the antifungal effects of eugenol and eugenol-containing cements, but this effect was reduced during setting.

Radiographic findings of paranasal aspergillosis are specific and typical for the diagnosis of the disease. Within a homogeneously clouded or clear antrum one or more round to oval radiodense objects can be seen on radiographs, such as an orthopantomogram or paranasal sinuses's view (Water's view). Maxillary sinus aspergillosis without sinusitis is always found accidentally and is related to previous overextension during root canal treatment.

According to Stammberger et al. (11), Kopp et al. (12), and Tanaka et al. (13), these concretions consist of tertiary calcium phosphate or calcium sulfate and are deposited in the necrotic parts of the mycelium. The authors assumed that these radiographic signs are a result of the mycotic metabolism and correspond to "aspergilloma." Some authors showed a similarity of these substances to zinc oxide contained in the root filling material (3, 4). Krennmair and Lenglinger (14) showed that the use of CT densitometry can subdivide the aspergilloma into organic (<1,500 Hu)

and inorganic (>1,500 Hu) materials that was useful in the differentiation between a dental and an aerogenic pathogenesis of maxillary sinus aspergillosis.

The suggested treatment for the maxillary sinus aspergillosis in healthy patients is surgical removal of the mycotic masses. It shows no tendency to recur after successful removal of the masses (3–5, 12, 14, 15). The use of systemic antimycotic therapy in the noninvasive form of maxillary sinus aspergillosis is not required; however in the invasive form the use of systemic antimycotics and total debridement of the maxillary sinus are recommended.

Dr. Khongkhunthian is affiliated with the Department of Restorative Dentistry, Faculty of Dentistry, Chiang Mai University, Chiang Mai, Thailand. Dr. Reichart is affiliated with the Department of Oral Surgery and Dental Radiology, Center for Dentistry, Charité, Humboldt University, Berlin, Germany. Address requests for reprints to Dr. Pathawee Khongkhunthian, Department of Restorative Dentistry, Faculty of Dentistry, Chiang Mai University, 50200 Chiangmai, Thailand.

References

1. Grigorin D, Brambule J, Delacretaz J. La sinusite maxillaire fungique. *Dermatologica* 1979;159:180.
2. Loidolt D, Mangge H, Wilders-Trushing M, Beaufort F, Schauenstein K. In vivo and in vitro suppression of lymphocyte function in aspergillus sinusitis. *Arch Otorhinolaryngol* 1989;246:321–3.
3. Beck-Mannagetta J, Necek D, Grasserbauer M. Zahnaerztliche Aspekte der solitaeren Kieferhoehlen-Aspergillose. *Z Stomatol* 1986;83:00–00.
4. Beck-Mannagetta J, Necek D, Grasserbauer M. Solitary aspergillosis of maxillary sinus, a complication of dental treatment. *Lancet* 1983;8361:1260.
5. McGill TJ, Simpson G, Healy GB. Fulminant aspergillosis of the nose and paranasal sinuses: a new clinical entity. *Laryngoscope* 1980;90:748–54.
6. Katzenstein A, Sale S, Greenberger P. Allergic aspergillosis sinusitis: a newly recognized form of sinusitis. *J Allergy Clin Immunol* 1983;72:89–93.
7. Legent F, Billet J, Beauvillain C, Bonnet J, Miegerville M. The role of dental canal fillings in the development of aspergillus sinusitis: a report of 85 cases. *Arch Otolaryngol* 1989;246:318–20.
8. Odell E, Pertl C. Zinc as a growth factor for *Aspergillus* sp. and the antifungal effects of root canal sealant. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1995;79:82–7.
9. Boonchird C, Flegel TW. In vitro antifungal activity of eugenol and vanillin against *Candida albicans* and *Cryptococcus neoformans*. *Can J Microbiol* 1982;28:1235–41.
10. Karapinar M. Inhibitory effects of anethole and eugenol on the growth and toxin production of *Aspergillus parasiticus*. *Int Food Microbiol* 1990;10:193–9.
11. Stammberger H, Jakse R, Beaufort F. Aspergillosis of the paranasal sinuses. *Radiology* 1985;156:715.
12. Kopp W, Fotter, Steiner H. Aspergillosis of the paranasal sinuses. X-ray diagnosis, histopathology, and clinical aspects. *Ann Otol Rhinol Laryngol* 1985;93:251.
13. Tanaka H, Sakae T, Mishima H, Yamamoto H. Calcium phosphate in aspergillosis of the maxillary sinus. *Scan Microsc* 1993;7:1241–46.
14. Krennmair G, Lenglinger F. Maxillary sinus aspergillosis: diagnosis and differentiation of the pathogenesis on computed tomography densitometry of sinus concretions. *J Oral Maxillofac Surg* 1995;53:657–63.
15. Flaworth MS, Herold J. Aspergillosis of the paranasal sinuses; a case report and radiographic review. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1996;81:255–60.