CLINICAL CASE

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Morphology and Microanalysis of Ectopic Tooth Removed from Maxillary Sinus

Budowa makro- i mikroskopowa zęba ektopowego usuniętego z zatoki szczękowej

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Abstract

In a presented case of a 46-year-old woman treated at the Department of Otolaryngology of the Jagiellonian University, we studied the problem of a foreign body as a reason for chronic maxillary sinusitis. The ectopic tooth in the lumen of maxillary sinus was found. After extraction from maxillary sinus, we analyzed the tooth morphology in scanning microscopy and performed microanalysis of the ectopic tooth. There were a lot of developmental disturbances and irregularities in the mineralization process found. Foreign body in maxillary sinus may cause chronic inflammation. Numerous developmental anomalies and abnormalities in the mineralization process observed in our case indicate the influence of the altered environment of the ectopic tooth (**Dent. Med. Probl. 2010, 47, 2, 245–250**).

Key words: tooth ectopy, chronic maxillary sinusitis, foreign body in the maxillary sinus.

Streszczenie

Opis przypadku dotyczy 46-letniej pacjentki Zakładu Otolaryngologii Uniwersytetu Jagiellońskiego leczonej z powodu przewlekłego zapalenia zatoki szczękowej wywołanego ciałem obcym. W świetle zatoki szczękowej znaleziono ząb ektopowy. Po jego usunięciu przeprowadzono badanie w mikroskopie skaningowym i mikroanalizę. Stwierdzono wiele nieprawidłowości rozwojowych i nieregularności w mineralizacji. Ciało obce w zatoce szczękowej może wywołać przewlekły proces zaplny. Wiele zaburzeń rozwojowych i nieprawidłowości mineralizacji wskazuje na wpływ zmienionego środowiska zęba ektopowego (**Dent. Med. Probl. 2010, 47, 2, 245–250**).

Słowa kluczowe: ząb ektopowy, przewlekłe zapalenie zatoki szczękowej, ciało obce w zatoce szczękowej.

Tooth ectopy occurs when the tooth bud, or even the enamel organ alone, is translocated in early stages of its development; the process can be triggered by a trauma undergone at an early age. Under such circumstances, a tooth may develop and erupt in an inappropriate location, sometimes one considerably removed from the tooth's typical place. This occurs most commonly in the nasal cavity or in the maxillary sinus [1–3]; ectopic teeth have been also observed in the nasal septum or the inferior lamina of the orbit. The inheritance of this anomaly is thought to be recessive, with decreased penetrance in girls or with polygenic, multifactorial inheritance. The ectopic teeth most often found in maxillary sinus are the first molar and the canine [4, 5]. The morphology and size of an ectopic tooth usually differ from those of a healthy tooth. While the lack of the ectopic tooth may be observable in the dental arch, such a tooth may also be an extra one. Tooth ectopy is distinct from tooth migration, in which the tooth is being displaced, but remains anchored in the bone. In addition to such developmental anomalies, tooth displacement may also be caused by iat-

rogenic procedures [6]. For example, extraction of an infected tooth may result in a fistula extending into the maxillary sinus or a portion of the tooth lost within the sinus lumen. The root apices of the second molar tooth, separated as they are from the maxillary sinus with the thinnest lamina of bone, are particularly vulnerable to such accidents. A low-located alveolar recess also entails extra risk. Moreover, after maxillary sinus floor perforation, various foreign bodies may be accidentally placed either underneath the mucosa or in the lumen of the sinus itself. A needle or catheter have been found in these locations [7]. All such objects trigger infections, resulting in acute or chronic inflammations of the sinus due to the blockage of its drainage or to infection [5, 8–11]. The most common pathogens found in odontogenic sinusitis besides those responsible for acute or chronic sinusitis (*Streptococcus viridans, Streptococcus pyogenes, Staphylococcus epidermidis, Staphylococcus aureus, Klebsiella pneumoniae, Escherichia coli, Brannomella catarrhalis, Pseudomonas aeruginosa, Streptococcus sanguis, Streptococcus salivarius, Streptococcus mutans, Peptostreptococcus, Bacteroides spp., Fusobacterium, Prevotella, Propionibacterium acne,* also *Aspergillus, Actinomyces*) [12–16]. Assessments of the frequency of sinusitis of dental origin can vary considerably. Melen [17], for example, estimates that as many as 40% of sinusitis cases can be of dental origin. An analysis of sinusitis etiology in 197 patients treated surgically at the Otolaryngology Department indicates, however, that only 10% of all cases were classified as odontogenic. Intra-sinusal foreign bodies were identified in 5% of the patients; dental materials constituted 2%; "pseudo" foreign bodies another 2%; dental or radicular remnants amounted to 1% [7]. The localization of the foreign body may cause problems: the intrasinusal ciliary transport may displace the foreign body changing the radiological imaging [3]. The diagnostic procedures should therefore include not only radiological imaging (X-ray, CT), but also sinusoscopy [17].

Case Report

A 46-year-old woman was admitted to the Department of Otolaryngology Jagiellonian University because of chronic maxillary sinusitis. The patient had been treated for chronic maxillary sinusitis for almost seven years. She complained of pain in projection of the frontal and maxillary sinuses, being more acute in the left maxillary sinus. Previous, conservative medical procedures, including anti-inflammatories, offered merely temporary relief. After the patient's admission standard diagnostic procedures were undertaken, including CT of paranasal sinuses. The CT scan revealed the thickening of the mucosa in both maxillary sinuses, with the polypoid tissue in the left maxillary sinus and the presence of a tooth, located in the lumen of left maxillary sinus. The Caldwell-Luc operation was performed under general anesthesia, and the polypoid mucosa and ectopic tooth were removed. The pathological investigation of the removed material revealed an inflammatory process, with the average presence of eosinophilic cells, and a topically thickened basement membrane of the epithelium. The dimensions of the removed tooth were: 17 × 12 × 9 mm, irregular shape, resembling a molar tooth (Fig. 1). The masticatory surface of the dental crown surface had one bigger dental tuberculum and a few smaller ones. The tooth's three roots were fused together and distended. Following removal, the tooth was subject to a morphological examination in optic microscopy, as well as to electron scanning microscopy, and to a microanalysis in X-ray micro probe.

Morphology

The ectopic tooth was sectioned through the crown and root part:

1. Grinds of 50 μm were prepared for the estimation in optic microscopy. The internal surface of the tooth was steamed with aurum and analyzed in electron scanning microscope (Jeol-JSM-35 CF).

2. The second internal surface was covered with a line of carbon in vacuum; analysis of the elements was performed by means of the X-ray micro-probe JOEL JSM-5005-LU. The results obtained were calculated according to the program MAGIC IV [18]. The control tooth (derived from a person of comparable age) underwent the same procedures.

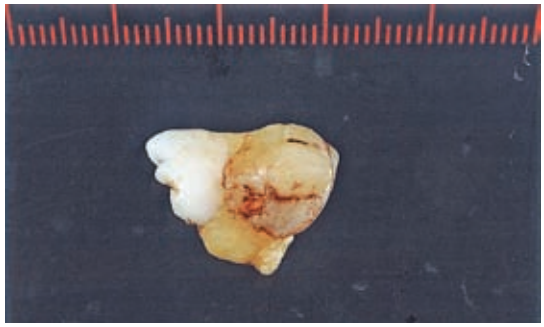

Fig. 1. Macroscopic view of the tooth derived from the lumen of the left maxillary sinus

Ryc. 1. Widok makroskopowy zęba usuniętego z lewej strony zatoki szczękowej

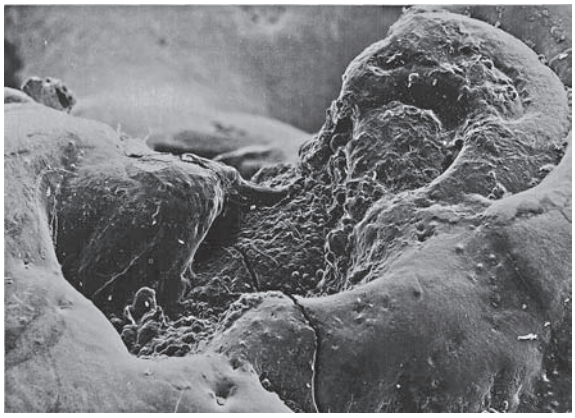

Fig. 2. Scanning electron picture of the superior surface of the dental crown. Distinct crateriform excavation can be observed with a marked lytic lesion (SEM ×530)

Ryc. 2. Obraz w elektronowym mikroskopie skaningowym zewnętrznej powierzchni korony zęba. Widoczne drobne kraterowate zagłębienia (SEM 530×)

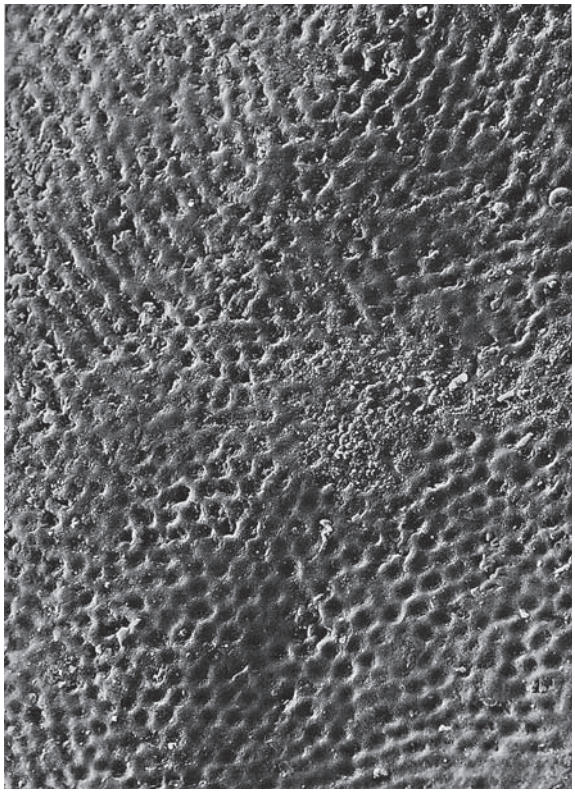

Fig. 3. Scanning electron image of the lateral surfaces of dental crown of the tooth. The lysis of medular part of enamel prisms is present (SEM ×1440)

Ryc. 3. Obraz w elektronowym mikroskopie skaningowym bocznym powierzchni korony zęba. Widoczne ogniska lityczne w rdzeniowej części pryzmatów szkliwa (SEM 1440×)

Fig. 4. Optic microscopy. Abnormal course of enamel dentinal line with enamel indentation of cavernous form into the dentine is well seen. Prismatic bundle system is disturbed here, and the bands of Retzius lines are indistinct (MO ×300)

Ryc. 4. Mikroskopia optyczna. Nieprawidłowy przebieg połączenia szkliwno-zębinowego z jamistymi wypukleniami szkliwa do zębiny. Zaburzony jest układ pęczków szkliwa i prążkowanie linii Retziusa jest niewyraźne (MO 300×)

Morphological Analysis of the Tooth Derived from the Maxillary Sinus

At the superior surface of the dental crown, a crateriform axcavation was visible, with a marked lytic lesion (Fig. 2). The lysis of medullar part of enamel prisms was also present in the lateral surfaces of the dental crown (Fig. 3). Abnormal course of enamel-dentinal line with enamel indentation of cavernous form into the dentine was a significant feature of the grind image. Prismatic bundle system was disturbed here, and the bands of Retzius lines were indistinct. Irregular dentinal tubules were observed in the dentin (Fig. 4). Regular course of enamel-dentinal line cervical part. Strict junction of enamel and cement could also be observed. Cement was excessively extended, it encircled the enamel with a sheath. This was a cellular cement in this case (Fig. 5). Dentine-cement

Fig. 5. Optic microscopy. The strict junction between the enamel and cellular cement, which forms a high cuff, encircling the enamel is present in cervical part (MO ×300)

Ryc. 5. Mikroskopia optyczna. Wyraźne połączenie między szkliwem a cementem komórkowym, który przybiera postać mankietu, widoczne opasujące szkliwo w części przyszyjkowej (MO 300×)

Fig. 6. Optic microscopy. In the root of the tooth, the granular layer distributed in groups communicates with dentinal tubules. Single clusters of cementocytes are also present (MO ×300)

Ryc. 6. Mikroskopia optyczna. W korzeniu zęba warstwa ziarnista Tomesa rozmieszczona w skupiskach kontaktujących się z kanalikami zębinowymi. Widoczne także pojedyncze skupiska cementocytów (MO 300×)

border line of the tooth root was irregular, and the Tomes granular layer distributed in groups communicated with dilated dentinal tubules. The cellular cement layer was wide with single clusters of comentocytes and multiple vascular canals having different directions (Fig. 6, 7).

Microanalysis

The average content of calcium and phosphorus in enamel and dentine of the internal section surface of the tooth removed from the maxillary sinus was a little higher than in the control (Table 1). Magnesium content was significantly lower in the enamel and significantly higher in the dentin, when compared with the control tooth. The proportion of calcium to phosphorus (Ca/P) in both hard tissues was significantly higher in the tooth derived from maxillary sinus, than in the control.

Discussion

Single cases describing iatrogenically induced tooth ectopy have been presented before. The ectopic tooth may cause many symptoms, such as an odontogenic acute and chronic maxillary sinusitis, maxillary cysts involving the sinus, oro-antral fistulae, in our case it was chronic maxillary sinusitis. The ectopic tooth described here was removed from the maxillary sinus and underwent several diagnostic procedures, revealing numerous abnormalities. Features of restricted mechanic pressure and incomplete mineralization of the enamel and other alterations characteristic for the early developmental period of the tooth were observed. The lytic alterations of the enamel could be observed to the tooth's exposure to acidic environment. Moreover, not only was the tooth completely mineralized, but the mineralization was, in fact, excessive. The microanalysis showed increased calcium and

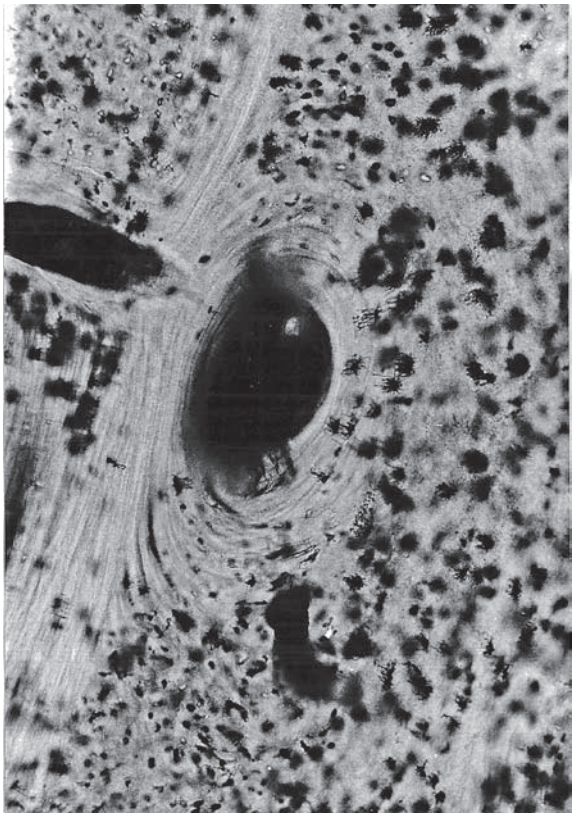

Fig. 7. Optic microscopy. Series of vascular canals in cement, classic lamellar Havers' system (MO ×300)

Ryc. 7. Mikroskopia optyczna. Szereg kanałów naczyniowych w cemencie, typowy warstwowy układ Haversa (MO 300×)

phosphorus content and their abnormal ratio. Irregularity of Retzius enamel lines and deficiency of Tomes granular layer may have resulted from improper histogenesis as well as from enamel and dentin mineralization. Prominent vascular canals could be due to developmental disturbances. Distinctly, extended cellular cement was an evidence of cementocytes hyper activity, as could be observed in the reconstructive process, where cement played a basic role. Finally, anomalous magnesium content indicated irregularities in the mineralization process.

In conclusion, the altered environment in which the ectopic tooth developed influenced its morphology and mineral balance. Moreover, the case presented here confirms the obvious observation that foreign body in the maxillary sinus can cause its inflammation.

Table 1. The average content of elements in enamel and dentine in the internal section surface of the tooth removed from the maxillary sinus and the control tooth

Tabela 1. Procentowy skład pierwiastkowy szkliwa i zębiny w części wewnętrznej zęba usuniętego z zatoki szczękowej i w zębie kontrolnym

Elements (Pierwiastki)	Enamel (Szkliwo)		Dentine (Zębina)	
	tooth derived from the maxillary sinus (ząb usunięty z zatoki)	control tooth (ząb kontrolny)	tooth derived from the maxillary sinus (ząb usunięty z zatoki)	control tooth (ząb kontrolny)
Ca	45.818	42.610	42.964	38.768
P	22.615	21.503	21.460	19.511
Mg	0.195	0.328	0.797	0.528
Ca:P	2.026	1.982	2.002	1.986

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