

The Incidence of Satellite Cysts in Keratocystic Odontogenic Tumors

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ABSTRACT

Renaming of the Odontogenic Keratocyst as the Keratocystic Odontogenic Tumor by the World Health Organization (WHO) is based on the aggressive nature of this lesion. Satellite cysts founded in the walls of the original cysts may give rise to a new lesion formation. The aim of this retrospective study was to identify the existence of specific features according incidence of satellite cysts and the palisading of the basal layer of the epithelium and to establish their mutual correlation. The histopathologic data of Keratocystic Odontogenic Tumor on the basis of new WHO's classification (2005) were analyzed. Prominent palisade basal cell layer was found in 415 (94.75%) and partially absent palisade basal cell layer in 23 (5.25%) cases. Satellite cysts were presented in prominent palisade basal cell layer in 85 specimens (20.5%) and in cases with partial absent of the palisade basal layer in 3 specimens (13%). The higher the frequency of palisading was the higher the frequency of satellite cysts was ($p > 0.05$).

Key words: keratocystic odontogenic tumor, odontogenic keratocyst, satellite cyst

Introduction

The Keratocystic Odontogenic Tumor (KCOT), formerly known as the Odontogenic Keratocyst (OKC) is believed to arise from dental lamina, its remnants or offshoots of the basal layer of oral epithelium. These cysts have been described under variety of names: epidermoid cysts, cholesteatomas, keratocystoma, primordial cysts, dysembryoplasies epidermiques, what made confusion in the diagnostic procedure^{1,2}.

KCOT/OKCs have characteristic histologic feature that can distinguish them from other odontogenic cysts. Histopathologic criteria for diagnosis of KCOT according to the World Health Organization (WHO) classification (Philipsen, 2005) are regular parakeratinized stratified squamous epithelium without rete ridges, well-defined epithelial basal layer with columnar or cuboidal cells frequently containing basophilic nuclei, epithelium, 5–8 cell layers thick, parakeratotic layers with corrugated surface, loss

of characteristic cellular and architectural features in the presence of inflammatory infiltrates³.

Clinically, KCOT/OKC is characterized by aggressive growth and increased tendency to recur. On a radiograph, a keratocyst may assume the appearance of any odontogenic cyst and the treatment varies from enucleation and curettage to osseous resection⁴.

In the past OKC were separated into three histologic categories: parakeratinized, orthokeratinized, or a combination of the two types. The para-keratinized OKC's have been considered to be a keratocystic odontogenic tumour (KCOT) or true OKC while the ortho-keratinized OKC as a orthokeratinizing odontogenic cyst (OOC)³.

An odontogenic keratocyst must be differentiated from other cysts and tumors. If multiple KCOT/OKCs are present, a diagnosis of nevoid basal cell carcinoma syn-

drome(NBCSS) or Gorlin-Goltz syndrome (inherited genetic condition caused by mutation of the PTCH1 gene) should be suspected⁵. The cyst lining seen in the NBCCS-related KCOT/OKC is classically parakeratinized and does not appear to be associated with the orthokeratinized variant of the OKC but may transformed into aggressive neoplasms such as ameloblastomas and squamous cell carcinoma⁶. These cysts arise earlier in patients with NBCCS than in those who are unaffected by the syndrome.

The epithelium can show budding of the basal layer into the underlying connective tissue with formation of detached microcysts, which have been termed daughter or satellite cysts⁷. KCOT/OKC shows a striking tendency to recur after enucleation more often than any other type of jaw cyst and one of the suspected contributing factor for the high recurrence rate is the presence of satellite cysts in the cyst’s wall⁸.

The aim of this retrospective study was to identify the incidence of satellite cysts and the pallsading of the basal layer of the epithelium and to establish their mutual correlation.

Materials and Methods

As a part of international cooperation in 1999. research of histological features of different Odontogenic Cysts encountered over a period of 33 years (1965.–1998.) in the archives of the Pathologic Anatomy Laboratory, Department of Oral Surgery, Department of Dental Pathology School of Dental Medicine, University of Zagreb, Croatia and Institut of Oral Pathology, University of Hamburg, Germany was done. At the time, findings of 443 sporadic Odontogenic Keratocysts from the sample of collected cysts, were selected and evaluated. In this retrospective study, a re-evaluation of histological findings of Odontogenic Keratocysts based on the new WHO clasiffication 2005 which renamed term in Keratocystic Odontogenic Tumors was done. A pallsading of the epithelium basal layer with an incidence of satellite cysts, and their mutual correlation were analyzed. Formalin-fixed, paraffin blocks were sectioned 5 µm in thickness and stained with hematoxylin and eosin. The epithelial linings and surrounding tissues were searched at light microscop examination, magnification 50x, 100x, 200x. Histological features of hematoxylin and eosin slides were reviewed according to the 2005 WHO criteria. Results of histological analysis were obtained, classified into charts and statistically analyzed using a χ^2 -test. The histopathologic reports and slides were revisited, and the parakeratinized variants were considered to be Keratocystic Odontogenic Tumors and the orthokeratinized variety Orthokeratinized Odontogenic Cysts.

Results

Selected 443 cases diagnosed as Odontogenic Keratocyst registered in the archives were re-evaluated. Histopathologic criteria for diagnosis of KCOT according to

TABLE 1
INCIDENCE OF THE PALISADE BASAL LAYER

	Frequency rate	%
Partially absent palisade basal cell layer	23	5.25%
Prominent palisade basal cell layer	415	94.75%
Total number of specimens	438	100.00%

TABLE 2
FREQUENCY RATE OF THE SATELITE CYSTS

	Frequency rate	%
Not present	350	79.91%
Present	88	20.09%
Total number of specimens	438	100.00%

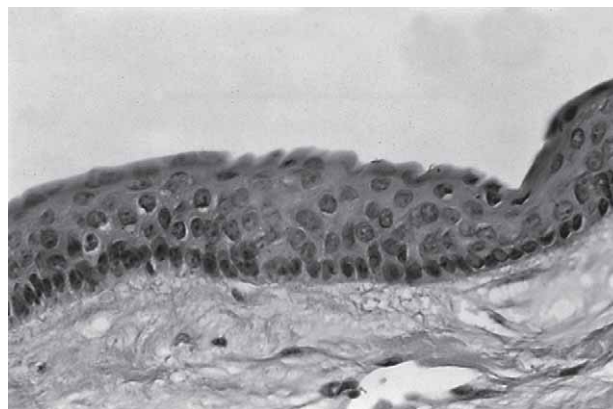


Fig. 1. Histologic appearance of keratocystic odontogenic tumor. Characteristic stratified squamous epithelium with a corrugated parakeratinized surface, (H-E staining, 200x).



Fig. 2. Satellite cyst containing keratin whorls. (H-E staining, 100x).

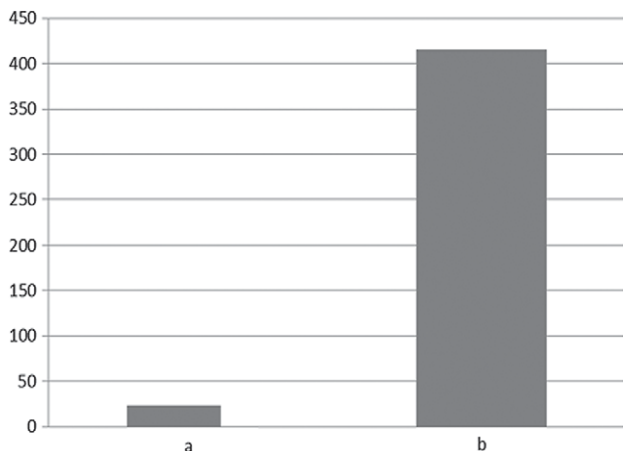


Fig. 3. Frequency rate of the palisade shape of the basal layer of epithelium: partially absent (a) and present (b).

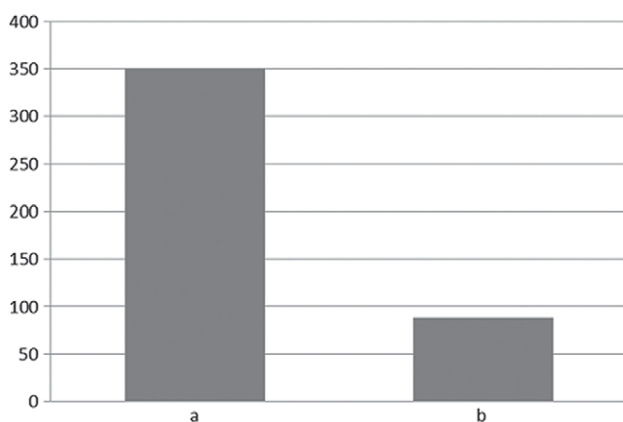


Fig. 4. Frequency rate of the satellite cysts: no present (a) and present (b).

the WHO classification (Philipsen, 2005) was confirmed in 438 cases and 5 cases was selected as a Orthokeratinized Odontogenic Keratocyst. This cases were reclassified to Orthokeratinized Odontogenic Cyst, based on the new WHO classification.

Histological features of KCOT showed a stratified squamous epithelium, six to eight cells in thickness. The epithelium was distinctive for a layer of columnar, palisading, hyperchromatic basal cell. Rete ridges were absent and the luminal surface was parakeratotic with a corrugated appearance. The OOC lining epithelium showed an average thickness of 4 to 8 cells with prominent granular layer beneath the keratinized layer. The basal layer cells exhibited low cuboidal or flat cells with little or no tendency to palisading. Rete ridges were absent.

Parakeratinized epithelium with palisade basal cell layer and corrugated surface of KCOT/OKC was found in all 438 (100%) cases. Prominent palisade basal cell layer was found in 415 (94.75%) and partially absent palisade basal cell layer in 23 (5.25%).

Satellite cysts were found in n 88 cases (20.09%). The satellite cysts were presented in KCOTs with prominent

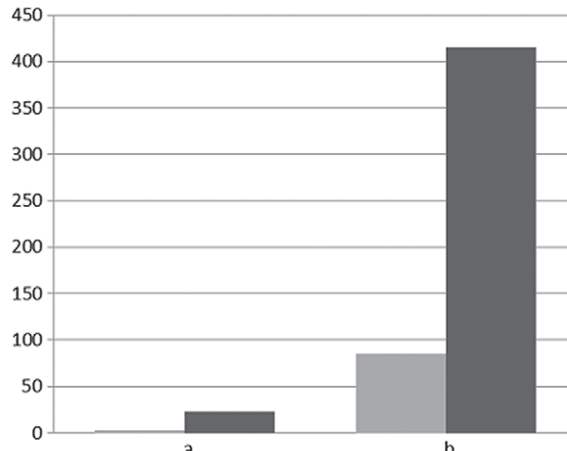


Fig. 5. Interdependence of the palisade shape of the basal layer of the epithelium and the satellite cysts: 3/23 (13%) in partially absent palisade basal cell layer (a) and 85/415 (20.5%) in prominent palisade basal cell layer (b).

palisade basal cell layer in 85 specimens (20.5%) and in cases with partial absent of the palisade basal layer, in 3 specimens (13%).

Discussion

In this retrospective study, incidence of palisading arrangement of basal epithelium and satellite cysts in Keratocystic Odontogenic Tumor/Odontogenic Keratocyst (KCOT/OKC) according to the new WHO classification were evaluated. The World Health Organization has renamed the term Odontogenic Keratocyst (OKC) as Keratocystic Odontogenic Tumor (KCOT), but the term OKC continues to be widely used. The histopathologic features of KCOT/OKC are highly specific and include a uniform cyst lining, hyperchromatic and palisaded basal cell layer, parakeratin production and a flat interface between the epithelium and connective tissue wall^{2,4}. KCOT/OKCs are generally regarded as an intraosseous lesion and grow in an antero-posterior manner penetrate into the bone rather than expand. The main difference between KCOT/OKCs and other jaw cysts are their potentially aggressive behavior⁹. Although the term only indicates the formation of keratin, it is non specific, as keratin formation may be seen even in radicular cysts and dentigerous cysts as a result of metaplasia, it is so well established in literature continues to be in use¹⁰. On a radiograph, a keratocyst may assume the appearance of any odontogenic cyst. There are four different radiological types of KCOT/OKC: replacement type-develops in place of a developing normal tooth which will be absent in the dental arch, envelopmental type- when a tumor/cyst entirely encloses an impacted tooth within the bone, extraneous type- when lesion develops away from the tooth bearing area, collateral type- when lesion develops between the roots of a tooth^{10,11}. Sometimes the KCOT can be located periapically and may mimic the appearance of an endodontic lesion or radicular cysts¹². Most keratocysts are isolated lesions, but also occurs part of the multiple

naevoid basal cell carcinoma syndrome or other syndromes¹³. Recurrence of KCOT/OKC: can occur due to various reasons: presence of satellite cysts, incomplete removal of epithelial lining, form new KCOT/OKC from dental lamina rest, proliferation of basal cells of oral epithelium¹⁴. One of the most interesting histopathological features of KCOT/OKC is the presence of multiple small micro cysts within the connective tissue wall. These small cysts are often known as daughter or satellite cysts¹⁵. Histologically, parakeratinization, intramural epithelial remnants, and satellite cysts are more frequent among KCOT/OKCs associated with Nevoid Basal Cell Carcinoma Syndrome (NBCCS) than in solitary KCOT/OKC¹⁶. In the present study, the basal layer of the epithelium of KCOT was made up of predominantly columnar and somewhere of cuboidal cells with palisading arrangement. Columnar cells were often associated with parakeratinized epithelium while the cuboidal cells were more often seen in association with areas of orthokeratotic linings. The lining epithelium and connective tissue interface was flat without rete-peg formation. Orthokeratinized odontogenic cysts, earlier termed orthokeratinized variant of OKC, showed cuboidal basal layer morphology with loss of palisading of nuclei and distinct granular cell layer with onion-skin-like surface. OOC should be distinguished from KCOT because of differences in histologic features and less aggressive biologic behavior and should constitute its own clinical entity¹⁷. Aggressive surgical treatment is generally recommended for KCOT with NBCCS's syndrome, large KOCT's and recurrent lesions, whereas conservative treatment is done for OOC¹⁸. In this study parakeratinized epithelium with prominent palisade basal cell layer was found in 415 (94.75%) and partially absent palisade basal cell layer in 23 (5.25%). Crowley et al. showed according to old WHO classification that 86.2% of the 449 cases were parakeratinized, 12.2% were orthokeratinized, and 1.6% had features of both form¹⁹. The satellite cysts were presented in 88 cases (20.09%), in prominent palisade basal cell layer in 85 specimens (20.5%) and in cases with partial absent of the palisade basal layer, in 3 specimens

(13%). Considering the fact that they are not found in any other cysts, their finding represents the specific histological feature of the KCOT/OKC. Zhao et al.²⁰ founded the presence of daughter cysts or epithelial islands in the cyst wall in 3/19 (15.79%) primary and 2/19 (10.53%) recurrent lesions. KCOT/OKCs have distinctive histologic feature, that can distinguish them from other odontogenic cysts but may be altered by inflammation²¹. The cystic epithelium exhibited parakeratinization and on few occasions orthokeratinization areas in the epithelium. Sometimes both forms of keratinization may be present in different areas of the epithelial lining. Importantly, these classic microscopic features are often completely lost when the cyst is inflamed and can lead to an incorrect diagnosis. KCOTs associated with NBCCS occur earlier and exhibit a greater tendency to recur than non-syndromic KCOTs^{22,23}. Because of complete removal of KCOT is difficult, including the occurrence of satellite cysts which may be retained during an enucleation procedure, KCOT must have aggressive surgical treatment, compared with another odontogenic cysts, and long-term follow-up is mandatory^{24,25}.

Histological finding of satellite cysts is only informative. The exact number would be known only if it would have made cuts of slides through completely removed tissue sample. Besides traditional hematoxylin and eosin stained microscopic slides, there are currently no additional laboratory methods used routinely in the diagnosis of KCOT. Histological features of parakeratinized epithelium with prominent palisade basal cell layer showed a higher incidence of satellite cysts. The future diagnostic procedures could be used an immunohistochemical and genetic methods for assessing the activity of the basal layer which may reduce or eliminate the need for aggressive surgical management.

Acknowledgements

The authors dedicate this work to †Prof. dr. Karl Donath.

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UČESTALOST SATELITSKIH CISTA KOD KERATOCISTIČNIH ODONTOGENIH TUMORA

SAŽETAK

Promjena imena odontogene keratociste u keratocistični odontogeni tumor od strane Svjetske zdravstvene organizacije (SZO) temelji se na agresivnoj prirodi ove lezije. Satelitske ciste što se nalaze u stijenci izvornih cista mogu dati osnovu za nastanak novih lezija. Cilj ove retrospektivne studije bio je odrediti postojanje posebnih obilježja prema učestalosti satelitskih cista i palisadnog poretka bazalnog sloja epitela te utvrditi njihovu međusobnu povezanost. Pregledani su histopatološki nalazi keratinizirajućih odontogenih tumora na temelju drugog izdanja klasifikacije odontogenih tumora prema SZO (2005). Izrazit palisadni poredak bazalnog sloja epitelnih stanica pronađen je u 415 slučajeva (94,75%) dok je djelomična odsutnost palisadnog poretka bazalnog sloja nađena u 23 slučaja (5,25%). Satelitske ciste pronađene su kod izrazitog palisadnog poretka u 85 slučajeva (20,5%) dok su kod djelomično odsutnog palisadnog poretka bazalnog sloja nađene u 3 slučaja (13%). Što je veća učestalost palisadnog poretka veća je i učestalost satelitske ciste ($p > 0,05$).

