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## COMPARATIVE STATISTICAL ANALYSIS OF THE INCIDENCE OF ODONTOGENIC CYSTS

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This monocentric retrospective study is based on an assessment of 392 odontogenic cysts in 344 patients from the Clinic for Oral, Maxillofacial, and Facial Plastic Surgery at Ludwig Maximilian University Munich, Campus Innenstadt. All histologically confirmed odontogenic cysts (radicular cyst, follicular cyst, eruption cyst, residual cyst, and lateral periodontal cyst) were included. The study aimed to examine odontogenic cysts in adult and pediatric patients within an entire population and in two separate groups over an eleven-year period, using different criteria and comparing results with previous studies. Cases were evaluated based on cyst distribution, gender distribution. Radicular cysts (57.9 %) and follicular cysts (33.17 %) were more frequently diagnosed in this study. The residual cyst (5.1 %), eruption cyst (2.8 %), and lateral periodontal cyst (1.03 %) occurred much less frequently. These findings essentially confirmed the results of previously published studies.

**Key words:** odontogenic cysts, epidemiology, diagnosis, age, statistical analysis

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## ПОРІВНЯЛЬНИЙ СТАТИСТИЧНИЙ АНАЛІЗ ЗАХВОРЮВАНОСТІ НА ОДОНТОГЕННІ КІСТИ

Моноцентричне ретроспективне дослідження засноване на оцінці 392 одонтогенних кіст у 344 пацієнтів із клініки щелепно-лицьової та лицьової пластичної хірургії Мюнхенського університету Людвіга-Максимиліана, Кампус Інненштадт. Були включені всі гістологічно підтвержені одонтогенні кісти (радикулярна кіста, фолікулярна кіста, кіста прорізування, резидуальна кіста та латеральна періодонтальна кіста). Були вивчені одонтогенні кісти у дорослих та дітей у межах усієї популяції та у двох окремих групах протягом одинадцятирічного періоду з використанням різних критеріїв та з порівнянням результатів з попередніми дослідженнями. Випадки оцінювалися на основі розподілу кіст та гендерного розподілу. Найчастіше діагностувалися радикулярні кісти (57,9 %) та фолікулярні кісти (33,17 %). Значно рідше зустрічалися резидуальна кіста (5,1 %), кіста прорізування (2,8 %) та латеральна кіста пародонту (1,03 %). Ці дані підтвердили результати раніше опублікованих досліджень.

**Ключові слова:** одонтогенні кісти, епідеміологія, діагноз, вік, статистичний аналіз.

Odontogenic cysts, which in general dental practice are increasingly detected incidentally during routine radiography, represent an important aspect of maxillofacial pathology [8, 13]. Clinical and epidemiological studies can provide accurate data on the incidence of various forms of cysts in different populations, which is very important for the development of an optimal strategy for the treatment and prevention of this pathology.

Determination of risk groups using such data allows to take timely measures to reduce the overall morbidity and socio-economic harm that can bring the most aggressive forms of odontogenic cysts and their recurrent lesions. And in this context, repeated dynamic studies are a reliable source of reliable information for health authorities and doctors themselves. At the same time, it should be noted the contradictory results obtained in demographic and clinical studies on the detection and study of the above-mentioned dental pathology in different countries [8, 9]. The odontogenic cysts were divided into two major groups according to the WHO classification: inflammation-related and development-related cysts [13]. Numerous earlier publications showed a clear dominance of inflammation-related cysts [1, 3].

In contrast, developmental cysts were diagnosed more frequently than inflammation-related cysts in pediatric patients [5, 6, 10]. This difference is explained by the fact that in children, retained teeth are still in the developmental phase and therefore have the potential to form a development-related cyst. In contrast, inflammation-related cysts develop due to persistent chronic inflammation. Adults with inadequate oral hygiene often present with periodontal or carious damage to teeth over an extended period, promoting the formation of inflammation-related cysts [3]. The ratio of individual cyst entities was similar in different patient cohorts in many studies [1, 8, 10].

In retrospective analyses from different regions of the world, radicular cysts were more frequently diagnosed than other cyst entities [9, 12]. The main cause for the development of a radicular cyst is persistent chronic inflammation of a tooth. This development could be related to multiple factors. The residual cyst occurs as a late consequence of incomplete removal of radicular cysts [14]. Therefore, the above-mentioned factors also apply to this entity. Here, the quality of work or experience of the practitioner may play a role. Lateral periodontal cysts and eruption cysts were mostly described in the literature with significantly lower percentage shares than other odontogenic cysts [4].

Numerous studies have identified follicular cysts as the most frequently occurring and radicular cysts as the second most common odontogenic cysts in pediatric patients [10, 12]. This result can be explained by the varying prevalence of inflammatory odontogenic diseases in different study cohorts. To make some contribution to the solution of this serious problem of modern practical dentistry, we planned a study with the main purpose of investigating the prevalence of various odontogenic cysts and comparing the results obtained with the results of similar studies conducted by scientists from different countries.

**The purpose** of the study was to perform a comparative statistical analysis of five categories of odontogenic cysts, evaluating frequency in relation to patient age.

**Materials and methods.** The basis of this monocentric retrospective study comprised a total of 392 odontogenic cysts in 344 patients from the Clinic and Polyclinic for Oral, Maxillofacial, and Facial Surgery at Ludwig Maximilian University, Campus Innenstadt, treated on an outpatient, inpatient, and day patient basis between January 1, 2003, and June 1, 2014.

**Inclusion Criteria:** all patients with histologically confirmed odontogenic cysts (radicular cyst, follicular (dentigerous) cyst, eruption cyst, residual cyst, and lateral periodontal cyst) treated at the Clinic and Polyclinic for Oral, Maxillofacial, and Facial Surgery at Ludwig Maximilian University, Campus Innenstadt, on an outpatient, inpatient, and day patient basis were included. The Institute of Pathology, Ludwig Maximilian University, Munich examined and histologically evaluated the excised tissues. The age and gender distribution of the entire patient cohort and individual cyst types were determined.

The relationship between the age and gender of patients with odontogenic cysts was analyzed. Patients were divided into two main groups: a) 0–16 years and b) over 16 years. Additionally, patients were also divided into decades of life. Radiological evaluation and determination of cyst localization were carried out using preoperatively created panoramic layer images (OPT), dental X-ray images, bite images, lower jaw overview images according to Clementschitsch, digital volume tomography (DVT), magnetic resonance tomography (MRT), and computed tomography (CT). The description in the respective operation report was also used to determine localization.

The statistical analysis used SAS 9.3 software (SAS Institute, Cary NC). Other software programs, such as Microsoft Word® 2007 (word processing), Microsoft Excel® 2007 (tabular presentation of patient data), and Microsoft PowerPoint® 2007 (graphical presentation of results), were also utilized. A descriptive analysis of all collected patient data was performed.

**Results of the study and their discussion.** Although many studies conducted since 2005 have often analyzed keratocystic odontogenic tumors and odontogenic cysts, we did not include keratocystic

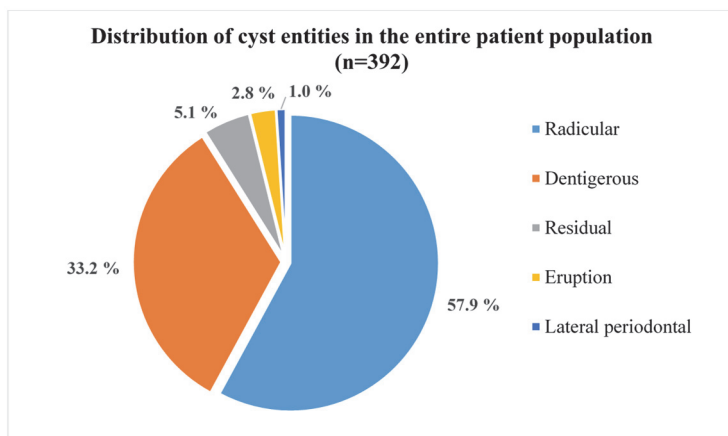


Fig. 1. Distribution of cyst entities in the entire patient population (n=392)

odontogenic tumors according to the 2005 classification. The examined odontogenic cysts were divided into two major groups according to the WHO classification: inflammation-related and development-related cysts.

The analysis of the patient cohort predominantly revealed radicular and follicular cysts, constituting 91.07 % (n=357 cysts) of the total.

Residual cysts represented 5.1 % (n=20 cysts). Eruption cysts (2.8 %, n=11 cysts) and lateral periodontal cysts (1.03 %, n=4 cysts) occurred infrequently (Figure 1).

The results showed a clear dominance of inflammation-related cysts, accounting for 63.01 %. In contrast, developmental cysts were diagnosed more frequently than inflammation-related cysts in pediatric patients. This difference is explained by the fact that in children, retained teeth are still in the developmental phase and therefore have the potential to form a development-related cyst. In contrast, inflammation-related cysts develop due to persistent chronic inflammation.

Radicular and follicular cysts were diagnosed more frequently in adults (93.21 %, n=316) and pediatric patients (77.36 %, n=41). Fig. 2 depict the cyst distribution in children.

All cystic lesions were classified into two groups: inflammation-related and development-related cysts. Inflammatory cysts occurred more frequently in this cohort, constituting 63.01 % (n=247 cysts), compared to development-related cysts at 36.99 % (n=145 cysts).

This result can be explained by the varying prevalence of inflammatory odontogenic diseases in different study cohorts. In the adult population, inflammatory cysts were also more prevalent, accounting for 68.44 % (n=232 cysts) compared to development-related cysts at 31.56 % (n=107 cysts). Conversely, developmental cysts dominated in children, comprising 71.7 % (n=38).

Distribution of cyst entities in the pediatric patient population (n=53)

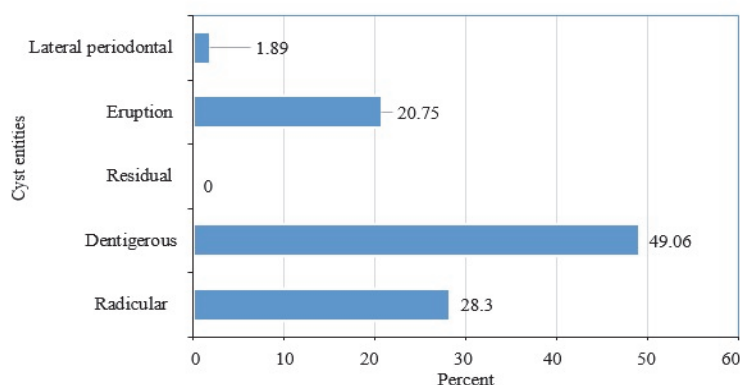


Fig. 2. Distribution of cyst entities in the pediatric patient population (n=53)

The current classification (WHO 2017) proposed various additions, deletions and modifications of lesions based on evidence and molecular studies. A significant change in the latest 2017 classification was the re-inclusion of odontogenic cysts. They were eliminated from the 2005 version, but in the 4th classification odontogenic cysts were again added with certain modifications (the changes made to the classification of cysts). Thus, in our work, as the other researches, we decided to use the new classification to be able to compare our data to the recent studies [13].

The main cause for the development of a radicular cyst is persistent chronic inflammation of a tooth. This development could be related to multiple factors such as the quality of oral hygiene, the quality of home oral hygiene habits, dietary habits, early detection and timely treatment of carious lesions, the age of patients, mental and physical health, socio-economic aspects, patient compliance, inadequate or missing care of teeth with trauma history, and the professional skills of dentists [3, 7].

One of the studies related to the prevalence of odontogenic cysts and tumors was conducted by Izgi E, et al (2021), who investigated this data in a sample of Turkish population between 2008–2018 and compared the data with latest reports.

The retrospective study showed that among a total of 739 biopsy-conducted lesions, 467 (63.19 %) were odontogenic cysts, 43 (5.82 %) were benign odontogenic tumors, and 7 (0.95 %) were malignant tumors, the rest of 222 cases were defined as others. So, this work confirmed the high prevalence of odontogenic cysts compared the other odontogenic lesions [9].

With the purpose to assess the relative frequency, clinicopathological features, treatment, and follow-up of odontogenic cysts, Almazyad A, et al (2023) studying 372 cases of odontogenic cysts from the archive of several medical centers in Saudi Arabia. According to their results, the apical radicular cyst accounted for half of the cases, followed by dentigerous cyst (29.3 %) [1]. So, these data demonstrated the similarity with ours, in which the radicular cysts predominated.

In the other work, Alqadi S, et al (2023) a retrospective cohort analysis of patients diagnosed with cystic lesions between 2016 and 2023 conducted. They collected clinical, radiological, pathological, and odontogenic data and revealed that from 16 young patients with dentigerous cysts, females comprised 56.2 % of the cases, with the right side predominating (62.5 %) [2]. We did not evaluate gender and localization of odontogenic cysts, which may have partially limited our study.

Eruption cysts were mostly described in the literature with significantly lower percentage shares than other odontogenic cysts (20.75 %). Some authors reported that eruption cysts were the second most frequently occurring lesions in the pediatric group, as well as radicular cysts associated with primary teeth are rare. [12]. EC usually presents in the first or second decades of life, with the average reported age about 7 years, that is why they predominate among children [11]. On the other hand, was described a higher incidence of radicular cysts than follicular cysts in the pediatric group [7, 10].

Residual cysts are relatively rare inflammatory cysts of the jaws. They are essentially radicular cysts without the presence of the offending dentition. Residual cysts were evaluated separately from radicular cysts in our study, and their proportion was 5.9 %. These lesions can destroy bone within the jaws without any symptoms, they can mimic more aggressive cysts and tumours on radiographs. Titinci F. et al.

Distribution of cyst entities in the adult patient population (n=339) was as following: radicular cyst 62.54 % (n=212), dentigerous cyst 30.67 % (n=104), residual cyst 5.9 % (n=20), eruption cyst 0 % (n=0), lateral periodontal cyst 0.89 % (n=3).

Thus, the ratio of individual cyst entities was similar in different patient cohorts in many studies. The latest investigations based on modern classification, which makes diagnostic process and choice of treatment easier.

(2020), studying 64 histopathologically confirmed residual cysts, found that the majority of lesions were observed in older adults (46.8 %) [14]. In our work, residual cysts were not registered at all in the pediatric population, which confirms the idea that this type predominates in adults.

Lateral periodontal cysts were mostly described in the literature, and they represented significantly lower percentage shares than other odontogenic cysts (0.6 % to 2 % of the odontogenic cysts). Most cases affect adults in their 5th to 7th decades of life, with no gender or a slight male predilection [4]. The percentage of lateral periodontal cyst in our cohort was 0.89 % in adults and 1.89 % among children, which supports the data of other authors.

### Conclusions

1. In our cohort, radicular cysts as in retrospective analyses from different regions of the world, radicular cysts were more frequently diagnosed than other cyst entities. Radicular and follicular cysts were diagnosed more frequently in adults (93.21 %) and pediatric patients (77.36 %).

2. An association between odontogenic cystic lesions and patient age was found. In the adult population, inflammatory cysts were more prevalent (63.01 %), conversely, developmental cysts dominated in children (36.99 %).

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