The treatment of different odontogenic cysts in children only using acrylic appliance-guided decompression: A long-term clinical study

Çocuklardaki farklı odontojenik kistlerin yalnızca akrilik aparey kullanılarak yapılan dekompresyonla tedavisi: Uzun dönemli klinik çalışma

Enes Ozkan[1], Bilal Ozmen[2]

[1] Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Istanbul Medeniyet University

[2] Department of Pedodontics, Faculty of Dentistry, Ondokuz Mayıs University

Abstract

Aim: Various odontogenic cysts may rarely occur in the jawbones during childhood, including radicular cysts, dentigerous cysts, and odontogenic keratocysts. Treatment for such cysts ranges from conservative approaches to radical surgical procedures. The present study evaluates the effect of the decompression alone method for treating various odontogenic cysts in children.

Methods: A retrospective cohort study was performed that included pediatric patients who applied to the pedodontics clinic between 2014 and 2016. Data such as age, gender, anatomical location, reasons for admission, histopathological diagnosis and dimensions of the cysts, and associated teeth were recorded. All odontogenic cysts were treated using the decompression method with an acrylic obturator. All patients were evaluated clinically and radiologically one, three, six, and 12 months after the operation and annually thereafter.

Results: As a result of the pathological examination, it was determined that 10 of the 16 odontogenic cysts were dentigerous cysts, 5 were radicular cysts and 1 was an odontogenic keratocyst. The patients consisted of 4 girls and 12 boys, with a mean age of 108.68±21.01 months. The average duration of the decompression was 7.3±1.41 months and the average follow-up was 9.6±2,56 years. In four patients, spontaneous eruption of the impacted permanent teeth was not observed; these were erupted using orthodontic treatment. In two cases of dentigerous cysts, the impacted teeth were extracted and the cyst was enucleated. In the remaining 14 cases, the permanent teeth erupted (spontaneous+orthodontic guided) successfully (87.5%), and the cysts healed completely after decompression treatment.

Conclusion: To avoid developmental problems, conservative procedures should be preferred for the treatment of odontogenic cysts in children. Decompression therapy using an acrylic obturator is an effective treatment for odontogenic cysts in pediatric patients; this approach protects and maintains permanent teeth. However, new clinical studies with larger sample sizes are needed to support these results.

Keywords: Appliance; child; decompression; dentigerous cyst; radicular cyst; odontogenic keratocyst

Öz

Amaç: Çocukluk çağında çene kemiklerinde nadir olarak radiküler kist, dentigeröz kist ve odontojenik keratokist gibi odontojenik kistler meydana gelebilir. Bu tür kistlerin tedavisi, konservatif yaklaşımlardan radikal cerrahi prosedürlere kadar farklı şekillerde yapılabilir. Bu çalışmanın amacı, çocuklarda çeşitli odontojenik kistlerin tedavisi için akrilik obturator kullanılarak yapılan dekompresyon yönteminin uzun dönemli başarısını değerlendirmektedir.

Yöntemler: 2014-2016 yılları arasında pedodonti kliniğine başvuran pediatrik hastalar çalışmaya dâhil edildi. Yaş, cinsiyet, anatomik yerleşim, başvuru nedenleri, kistlerin histopatolojik tanıları ve boyutları, ilişkili olduğu dişler gibi veriler kaydedildi. Odontojenik kistler akrilik obturatör ile dekompresyon yöntemi kullanılarak tedavi edildi. Tüm hastalar operasyondan bir, üç, altı ve 12 ay sonra ve sonrasında yıllık olarak, klinik ve radyolojik inceleme ile değerlendirildi.

Bulgular: Patolojik inceleme sonucunda toplam 16 odontojenik kistin 10'u dentigeröz kist, 5'i radiküler kist ve 1'i odontojenik keratokist olduğu tespit edilmiştir. Çalışmaya dâhil edilen hastalar 4 kız ve 12 erkekten oluşmaktadır ve ortalama yaşları 108,86±21,01 aydır. Dekompresyon tedavisinin ortalama süresi 7.3±1,41 aydır. Hastalar ortalama olarak 9,6±2,56 yıl takip edildi. Dört hastada gömük daimi dişlerin spontan sürmesi gözlenmedi, bunlar ortodontik tedavi ile sürdürüldü. İki dentigeröz kist vakasında gömülü dişler çekildi ve kist enükle edildi. Kalan 14 vakada daimi dişler (spontan+ortodontik) başarıyla sürdü (%87,5) ve dekompresyon tedavisi sonrası kistler tamamen iyileşti.

Sonuç: Çocuklarda odontojenik kistlerin tedavisinde gelişimsel problemlerden kaçınmak için konservatif prosedürler tercih edilmelidir. Akrilik obtüratör kullanılarak yapılan dekompresyon tedavisi, pediatrik hastalarda odontojenik kistler için etkili bir tedavidir ve bu yaklaşım kistlerin spontan olarak iyileşmesinin yanısıra daimi dişlerin başarılı bir şekilde sürmesini de sağlayabilir. Ancak bu sonuçların desteklenmesi için daha geniş örneklem boyutlarına sahip yeni klinik çalışmaların yapılmasına ihtiyaç bulunmaktadır.

Anahtar Sözcükler: Aparey; çocuk; dekompresyon; dentijeröz kist; radiküler kist; keratokist

Received/*Geliş* : 10.11.2022
Accepted/*Kabul*: 20.12.2022

DOI: 10.21673/anadoluklin.1202049

Corresponding author/*Yazışma yazarı*

Enes Özkan

Istanbul Medeniyet University, Faculty of Dentistry, Department of Oral and Maxillofacial Surgery, İstanbul, Türkiye
E-mail: drenesozkan@gmail.com

ORCID

Enes Özkan: 0000-0002-8182-9042
Bilal Özmen: 0000-0002-4435-288X

INTRODUCTION

During childhood, various age-specific changes occur in the maxillofacial bones. Pathological lesions, similar to those found in adults, may also occur in children. Radicular cysts, dentigerous cysts, and odontogenic keratocysts are the most common pathologies in the jawbones of pediatric patients (1).

Radicular cysts (52.3% of cases) the most common type of jaws cysts, result from the proliferation of Malassez epithelial tissue remnant due to inflammation after pulp necrosis (2). Although they are frequently associated with permanent teeth in the third decade, they are rarely seen in patients with primary teeth (0.5-3.3% of all radicular cyst cases) (2,3). The most common etiological causes of radicular cysts during primary dentition are dental caries and trauma (3). In primary teeth, the second molar is the most common causative agent of radicular cysts (2). These cysts grow slowly and may cause large expansions. On a radiograph, they are indicated by well-defined unilocular radiolucent regions, typically in the roots. After appropriate treatment, these cysts do not usually recur. Primary teeth with radicular cysts may be extracted (4).

Dentigerous cysts develop between the enamel epithelium and enamel and are caused by enlarged follicles in impacted teeth (5,6). These are the most common type of odontogenic developmental cysts (5). Dentigerous cysts may be developmental or inflammatory. Developmental dentigerous cysts are more common in the second and third decades; the inflammatory type usually appears in the first and second decades (7). In the first decade, the incidence of dentigerous cysts is around 4-9% (8). They are usually associated with a nonvital immature primary tooth (9). Dentigerous cysts are usually asymptomatic and are detected incidentally. On a radiograph, these cysts are indicated by a well-defined sclerotic unilocular radiolucent area around an unerupted tooth (10). They are always associated with an impacted tooth or tooth bud (5). The pain usually occurs when there is a secondary infection in the cyst (5).

Odontogenic keratocysts (OK) typically have a parakeratinized squamous epithelium and a destructive character. OKs usually occur in the ramus and angulus regions of the mandible. On a radiograph, they are indicated by well-defined multi- or unilocular areas, making them difficult to distinguish radiographically from other cysts and tumors of the jaws (11). OKs have a high recurrence rate (up to 62%) and are rare in children (12).

Conventionally, these cysts are treated by enucleation of the cyst and extraction of the involved tooth, if any. Conservative surgical procedures such as decompression (Thomas procedure) are preferred if the cyst is large and involves important anatomical structures or if it involves permanent teeth in a young patient (13). In 1947, Thomas demonstrated a method for draining and irrigating the cyst by placing a tube through a window in the cyst wall (14). This approach is used to regress the cyst; it can then be removed more easily due to the reduced pressure. After this treatment, impacted teeth may move towards the occlusion due to the decrease in pressure and erupt passively. When an impacted tooth does not erupt spontaneously, orthodontic treatment methods should be used. (15). This clinical study reports the results of decompression treatment of different odontogenic cysts in the pediatric population.

MATERIAL AND METHODS

The retrospective cohort study was approved by İstanbul Medeniyet University Göztepe Prof. Dr. Süleyman Yalçın City Hospital Clinical Research Ethics Committee (Date: 07.04.2021, Decision no: 2021/0252) and carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki). Among the patients who applied to Ondokuz Mayıs University Faculty of Dentistry Pedodontics Clinic between January 2014 and December 2015, 16 pediatric patients with cystic lesions in the jaw, without any systemic disease, drug use, and parafunctional habits, and who were able to comply with the treatment were included in the study. Informed consent forms were obtained from the parents of all patients, in which they consented to voluntarily participate in the study. Participants' demographic information and the diagnoses, cyst locations, sizes, associated symptoms, and additional treatment requirements of the cysts are recorded. After analyzing the data with descriptive statistical analysis, the relationships between categorical variables and numerical data were analyzed with the

Table 1. Demographic data for patients and characteristics of odontogenic cyst

Sex	Age (month)	Follow-up Period (month)	Cyst Type	Jaw	Associated tooth	Impacted tooth	Size (mm)	Symptoms	Radiograph records	Ort
F	99	120	DC	Max	64-65	23-24	32.83	Decay, swelling	OPG+CBCT	+
M	136	84	DC	Man	-	33	47.55	Delayed eruption	OPG+CBCT	-
F	110	144	DC	Man	85	45	35.43	Decay, pain	OPG	-
M	93	120	RC	Man	75	35	21.65	Pain, decay	OPG	-
M	78	156	DC	Man	-	36	33.43	Swelling, pain	OPG	-
M	102	120	DC	Max	55	11-12-13	41.23	Swelling, pain, delayed eruption	OPG+CBCT	+
M	139	120	RC	Man	75	35	40.92	Decay, pain	OPG	-
M	115	120	OK	Man	-	43-44-45	63.47	Regular visit	OPG+CBCT	-
F	95	108	DC	Max	65	24	31.45	Decay, swelling	OPG+CBCT	+
M	132	108	DC	Man	-	33	46.85	Delayed eruption	OPG	-
F	117	96	DC	Man	84	44	34.51	Decay	OPG	-
M	98	96	RC	Man	74	34	22.15	Pain, swelling, decay	OPG	-
M	73	72	DC	Man	75	35	31.95	Swelling, pain	OPG+CBCT	-
M	95	84	DC	Max	55	14-15	40.63	Swelling, pain, delayed eruption	OPG+CBCT	+
M	135	108	RC	Man	75	35	41.52	Decay, pain	OPG	-
M	122	84	RC	Man	85	44-45	61.49	Decay, pain	OPG	-

M: Male, F: Female, mm: milimeter, RC: Radicular cyst, DC: Dentigerous cyst, OK: Odontogenic keratocyst, Max: Maxilla, Man: Mandible, OPG: Orthopantomography, CBCT: Cone beam computed tomography, Ort: Orthodontic treatment, Size refers to the largest size of the detected cyst after calibration on the OPG film.

independent t-test, and the relationships between two categorical variables were analyzed with the Pearson chi-square test.

All patients were evaluated with an intraoral and radiological examination (Orthopantomograph in regular visits; Cone Beam Computed Tomography or occlusal radiography if needed). The shrinkage of the cysts and the eruption of impacted teeth were followed on routinely taken panoramic films. Decompression therapy was administered to all patients. To reach the cysts, cyst-related primary teeth were extracted in 15 patients, while a buccal window was opened in one patient. Once the cysts were accessible, the cystic epithelium closest to the socket was excised. The excised cyst epithelium was sent for pathological examination, and the cystic cavity was irrigated with physiological saline. An appropriately sized plastic drain was fixed to the window. Care was taken to extend the drain into the cystic cavity. The drain was left in place for three weeks. The cystic capsule was not sutured to the oral mucosa. After three weeks, epithelization was completed, the drain was removed and alginate impressions were taken. To prevent spontaneous closure of the window and also adjacent teeth from tipping, removable acrylic obturators were made (Fig 4). The obturators were individually designed and stabilized based on the condition and number of teeth present. After the operation, parents were advised to irrigate the cystic cavity daily. Monthly follow-ups were conducted to check the compliance of the obturator and to irrigate the cystic cavity. The obturator was left in place until the radiograph indicated that the cystic lesions were completely healed and the tooth erupted spontaneously. Follow-ups were conducted in the first, third, sixth, and twelfth months after the operation and annually thereafter. Patients were evaluated radiologically and clinically during these check-ups.

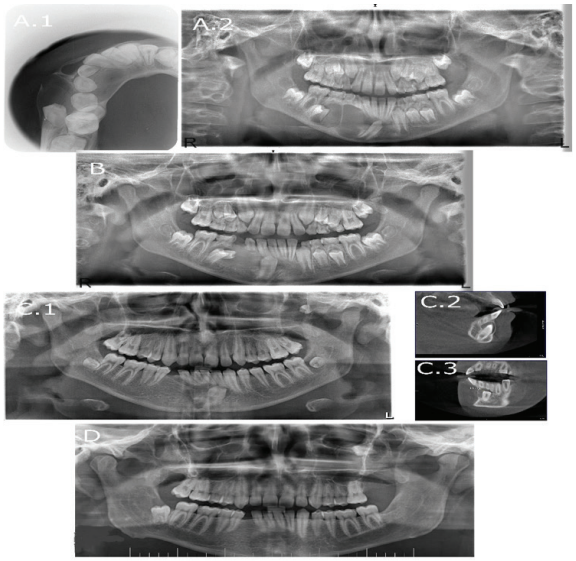

Figure 1. Treatment of large odontogenic keratocyst with decompression

A.1. An occlusal radiograph shows the buccal expansion and multilocular appearance of the odontogenic keratocyst and the location and position of the impacted tooth. **A.2.** Here, migration was observed: of 43 towards the mesial and of 44 and 45 towards the distal. B. Tooth 84 was extracted, and an obturator was placed in this area. Seven months after the operation, a radiograph shows bone regeneration and migration of the teeth to their original occlusion area. **C.1.** Thirty-six months after the operation, 44 and 45 have fully erupted; however, 43 has migrated mesially again. **C.2.** In the sagittal section of CBCT, cystic formation was observed around the canine. Tooth extraction and cyst enucleation were performed after an orthodontic consultation. **D.** All cystic areas were completely healed 120 months after the operation, and 28 and 48 were impacted. The cystic formation in the distal of 48 was striking. Enucleation treatment was planned to treat this cystic formation.

RESULTS

The characteristics of cysts and the demographic data were recorded (Table 1). A total of 16 pediatric patients (four girls and twelve boys, mean age 9.6) with eleven developmental (one keratocyst, ten dentigerous cysts) and five inflammatory (radicular) cysts were treated and followed up for a mean of 108,75 months (Fig 1, Fig 2, Fig 3). Of the 16 systemically healthy patients included in this study, four were female and twelve were male (female-to-male ratio = 1:3). While the mean age of boys was 105.2 months, it was 109.8 months for girls ($p>0.05$). The distribution of cysts between girls and boys was not significantly different. In terms of all cysts, there was no significant difference in the sizes of cysts located in the maxilla (36.5 mm) and mandible (40.1 mm). In addition, the mean size of dentigerous cysts is 37.6 mm, while the mean size of radicular cysts

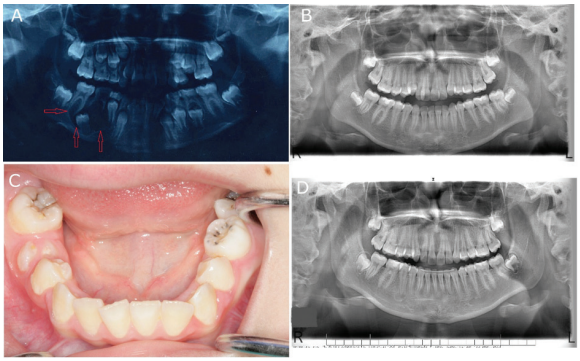

Figure 2. Treatment of radicular cyst with decompression

A. A radiograph shows that the radicular cyst, which is thought to be triggered by deep dentin caries in 85, has caused migration of 45. **B**. Premolar teeth have spontaneously occluded 24 months after decompression therapy, and no recurrence has been observed. **C.** Intraoral view 18 months after the operation. **D.** From a panoramic radiograph taken 84 months after the operation, a cystic formation was detected at the apical site of 45.

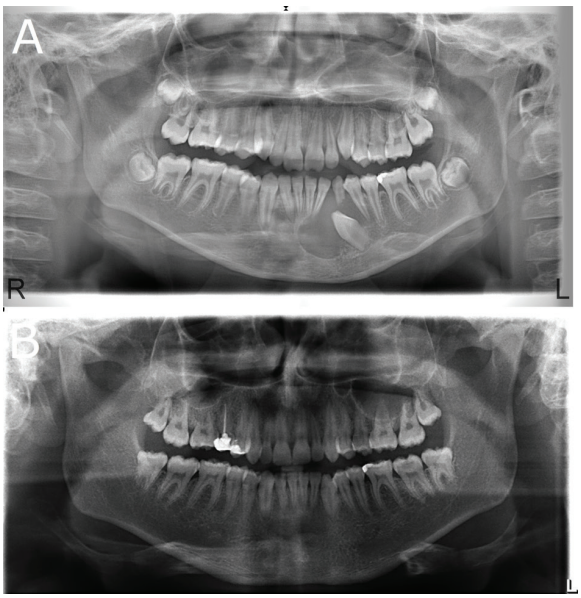

Figure 3. Treatment of large dentigerous cyst with decompression

A. A dentigerous cyst associated with 33 was detected; 31, 32, and 34 were vital. **B.** Eighty-four months after decompression, the cyst had healed and had taken its place in occlusion. No recurrence was observed.

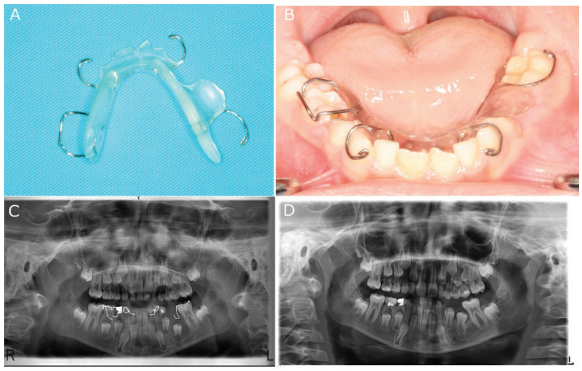

Figure 4. The use of acrylic obturator in decompression

A. Acrylic obturators, which hold the window into the cyst open and prevent the adjacent teeth from tipping, were used during the decompression treatment. Obturators should be worn until the cyst heals and the teeth erupt to prevent closure of the window. **B.** The obturator should be reharmonized with the teeth in case of an incompatibility. **C.** Image of a radicular cyst in the left lower jaw with the obturator in place. **D.** Rapid ossification and rapid eruption were observed three months after decompression.

is 37.5 mm (p>0.05). The mean age at which dentigerous cysts were detected was 103.7 months, while radicular cysts were 117.4 months (p>0.05).

Eleven of the cysts were associated with one tooth, and five cysts (1 keratocyst, 3 dentigerous cysts, 1 radicular cyst) were associated with two or more unerupted teeth. The patients were referred to our clinic with the following primary complaints: 45% with swelling (all radicular cysts in the buccal region); 19% with decay; 18% with pain (10% radicular cysts, 8% dentigerous cysts), 11% with tooth eruption, and 7% with crowding of teeth. The remaining cysts (19%) were asymptomatic and were detected during regular examinations. In all cases of radicular cysts, deep dentin caries was present in the primary teeth adjacent to the cyst (Fig 2). Radiographic examinations showed that all unerupted teeth associated with the cyst had inclined in different directions (Fig 1, Fig 2, Fig3).

The patients received decompression treatment with obturators for an average of 7.3 months. All primary teeth associated with a cyst were extracted at the beginning of the decompression treatment. The impacted permanent teeth did not erupt spontaneously in four cases (all in dentigerous cysts); these have erupted through orthodontic treatment. In two cases (both dentigerous cysts), impacted teeth were extracted and the cyst was enucleated after an orthodontic consultation. In the remaining ten cases (1 keratocyst, 5 radicular cysts, 4 dentigerous cysts), the permanent teeth erupted spontaneously, and the cysts healed completely. In one keratocyst case, recurrence was observed during the spontaneous eruption of the mandibular canine; therefore, the affected tooth was extracted and the cyst was enucleated. In the same patient, the cystic formation was noticed in different locations. As the formation of multiple keratocysts was suspected, the patient was referred to the genetics department to be evaluated for Gorlin Goltz (Fig 2). However, no syndromic findings were reported. Abnormal lymph node involvement was not observed in any participants.

DISCUSSION AND CONCLUSION

To promote ideal and stable occlusion in the mixed dentition period, it is very important to ensure that teeth erupt according to the eruption guidance (16). Low mineral content in primary teeth and bone tissue (17), poor eating habits, and inadequate mouth care may cause infections and cysts to develop rapidly in these teeth (18). Odontogenic cysts are usually asymptomatic and are rare in children, but they can grow very large if untreated. Due to the small size of children's jaws, cysts may frequently involve neurovascular structures and permanent tooth buds. It is important to treat such cysts conservatively to preserve these anatomical structures (19). However, untreated cysts are associated with a high risk of conditions such as impacted teeth, mobility in adjacent teeth, pathological bone fractures (9), asymmetry, malalignment, transformation, and malocclusion (5). Different methods of treating cysts offer various advantages and disadvantages. When treating cystic lesions, various factors such as the patient's age, cyst size and location, soft tissue involvement, treatment history, and a histological variant of the cyst are considered (20, 21). When there is mixed dentition, enucleation is preferred for small cystic lesions, while marsupialization/decompression is preferred for large ones or those adjacent to important anatomical structures (20, 22). Marsupialization/decompression is a leading treatment option for pediatric patients with high tissue regeneration capacity and tooth eruption potential. This approach

leads to lower rates of morbidity and allows the cystic cavity to heal gradually in more normal bone contours (20). The key to this method is removing the pressure from the cystic cavity (22). Therefore, the surgeon should suture the cyst epithelium to the oral mucosa (marsupialization) or place an obturator to ensure that the window in the cyst wall remains open for a long time (decompression). If the cystic cavity is large and the predicted recovery period is long, the use of an obturator is preferred (20). Another advantage of using an obturator is that the cavity of the extracted primary teeth can be preserved. In all patients included in this study, obturator-assisted decompression was preferred since the cysts were large and were associated with permanent tooth buds. In this study, cystic lesions in 16 pediatric patients aged six to eleven were successfully treated with decompression alone. The criteria for successful treatment were complete healing of cystic lesions, no recurrence for at least five years, and complete eruption of the associated teeth, either spontaneously or through orthodontic treatment. 62.5% of the impacted teeth erupted spontaneously, while 25% required orthodontic treatment. In our study, 87.5% of cystic lesions were successfully treated with decompression. Decompression therapy was effective in all patients except the two cases of dentigerous cysts. As we stated in our report, the success rate of decompression therapy is also quite high in the literature (22). Acrylic obturators have been shown to be successful in a radicular cyst case series (22). In the results of marsupialization treatment of dentigerous cysts seen in 35 pediatric patients, it was observed that orthodontic treatment was applied in 24% of the cases because there was no spontaneous tooth eruption, and spontaneous eruption occurred in 34% of the cases and the cysts were healed (23). It has been used successfully in the treatment of all odontogenic cysts seen in pediatric patients. It has been reported that the decompression method can also be used successfully in the case of keratocyst, the teeth erupted spontaneously and the cyst was completely healed, and no recurrence was encountered in the 5-year follow-up (11).

One disadvantage of the decompression method is the need for regular irrigation to keep the cystic cavity clean; thus, this method requires patient compliance (22). In addition, stabilizing the obturators used for decompression can be challenging in young patients. In the monthly follow-ups, we found that the compatibility of the obturators was impaired. This was found to be caused by the loosening of the clasps or erupting teeth. However, they were quite compatible in the use of the obturator. However, obturators play a critical role in the successful treatment of these cysts, as they protect the opening in the cystic cavity and act as placeholders. The advantages of this approach include the low morbidity rate, preservation of the permanent tooth follicles and bone, and promoting of healing that follows normal bone contours. Therefore, this conservative approach to treating odontogenic cysts should always be considered, especially in patients with mixed dentition (8). To limit the total radiation dose, none of the patients in the present study received CBCT during the initial surgical procedure, as decompression was planned as the primary treatment. Therefore, a two-dimensional radiographic examination of cystic lesions could be performed. CBCT was used to determine the precise location of the teeth to have erupted orthodontically or prior to cyst enucleation and the extraction of impacted teeth. Routine radiographic checks were conducted using OPGs.

The characteristics of the cystic lesions in this study are similar to those reported in the literature. Although many case series of cystic lesions in adults have been reported, there are few studies of cysts in children (23). Because odontogenic cysts are rare in children. For example, only 1% of all radicular cysts occur in children. These cysts may be less common in children because of the relatively short duration of primary dentition. Although there is sufficient time for cyst development in the jaw between the ages of zero and 12, it is believed that periapical infections in primary teeth can easily drain into the maxillary sinus or gingival region, thus preventing the formation of inflammatory cysts (2). The low rate of radicular cysts originating from these teeth can be explained by spontaneous healing of the lesion following extraction of primary teeth, the low rate of biopsy to diagnose these lesions, and a lack of attention to radiolucent lesions in the apical areas of primary teeth during examinations (3). One study of children under 16 years of age reports that 5% of 4,406 cases of radicular cysts occurred in this population; radicular cysts were the most common pathological

lesion after mucous cysts and apical granuloma (24). Besides radicular cysts, dentigerous cysts are the other common odontogenic cysts in children (25). Jones et al. (24) found that 238 of a total of 519 cysts in children were radicular cysts, 157 were dentigerous cysts, and 71 were keratocysts (the ratios of all pathological lesions were 5.4-3.56-1.61). In a study conducted on Turkish children, 4.8% of 472 pathologic lesions were radicular cysts (70% of these were in the mandible) and 3.1% were dentigerous cysts (of which 53.3% were in the maxilla) (26). In this study, it is seen that dentigerous cysts are more numerous. It can be said that this situation is caused by the small sample size or the diagnostic dilemma between the dentigerous cyst and the radicular cyst (25).

In children, radicular cysts are most common in the mandibular molars (67%), maxillary molars (17%), and anterior teeth (3%). Radicular cysts in children in the anterior region often occur due to trauma; in the posterior teeth, they are often associated with caries (22). Pulp treatment has also been identified as a causal factor in the development of radicular cysts in primary teeth. Phenol compounds are sometimes used for the histopathological examination of radicular cysts associated with primary teeth; the substances used for endodontic treatment of these teeth trigger antigen stimulation and cause the cyst to grow more aggressively. The large apical foramen of primary teeth may help trigger these pathologies after endodontic treatment. Therefore, after endodontic treatment of primary teeth, follow-ups to check for potential pathologies are recommended. All of the radicular cysts in this study were associated with caries in the mandibular primary molar (2). The most common symptoms of radicular cysts in children are pain, expansion of the buccal cortex, well-defined unilocular radiolucency, and displacement of permanent teeth (27). Most of the patients in this study were referred to our clinic due to primary complaints of swelling and pain. Radicular cysts originating from primary teeth have been reported in patients aged 3 to 19 years, but they are frequently detected between the ages of 7 and 9 (2). They are more common in boys (22). In this study, all patients with radicular cysts were boys; their mean age was 9.86 years.

In children, dentigerous cysts can be confused with radicular cysts. Since radicular cysts may also involve permanent dental crowns, clinical radiographic and histopathological correlation require for a definitive diagnosis (2, 22). In pediatric patients, inflammation that spreads from the root apex of the primary tooth can lead to the development of an inflammatory dentigerous cyst, similar to a radicular cyst, around the unerupted permanent tooth (28). Pathological examinations of all dentigerous cysts in this study showed significant inflammatory cell infiltration. Due to these features, dentigerous cysts and radicular cysts may be misdiagnosed. One of the most important clinical conditions associated with radicular and dentigerous cysts is that the cysts prevent the eruption of permanent teeth and can even cause permanent teeth to migrate. It is seen that dentigerous cysts may cause mesiodistal displacement of unerupted teeth, while radicular cysts more frequently cause displacement of unerupted teeth inferiorly in the lower jaw and superiorly in the upper jaw. This may be caused by intracystic pressure, but it does not cause pathology in the tooth crown or root formation.

Odontogenic keratocyst is a very rare cyst in children. While the conventional treatment of odontogenic keratocysts is enucleation due to the potential for recurrence, marsupialization/decompression treatment is recommended especially in the mixed dentition period (29,11). Studies show that decompression management is a successful technique in the treatment of odontogenic cysts in children. In a study conducted on 23 non-syndromic pediatric patients, keratocysts were successfully treated with the decompression method (29).

The most important limitation of this study is the small sample size. In particular, there is only one case of odontogenic keratocyst. However, since odontogenic cysts are rarely seen in children and this study was conducted in a single center, the sample size was like this. Another limitation is that the reduction in cyst sizes and the orientation of the impacted teeth in the 3D plane were not calculated during the follow-ups. Since CBCT imaging is needed for this, we did not consider giving our patients an additional dose of radiation. The most critical aspect of this report is that it demonstrated the long-term treatment results of a large odontogenic cyst, which is rarely seen in children

and has a high potential for recurrence. In addition, another strength of this study is using the same technique in treating different odontogenic cysts and reporting the results simultaneously.

To avoid developmental problems, conservative procedures should be preferred for odontogenic cysts in children. Decompression therapy using an acrylic obturator as a placeholder has successfully been used to treat various odontogenic cysts in pediatric patients; this approach protects and maintains permanent teeth. Since asymptomatic inflammatory cysts can grow very large in children, routine dental checks and early treatment of any dental caries are crucial.

Conflict-of-interest and financial disclosure

The authors declare that they have no conflict of interest to disclose. The authors also declare that they did not receive any financial support for the study.

REFERENCES

1. Bodner L. Cystic lesions of the jaws in children. Int J Pediatr Otorhinolaryngol. 2002;62(1):25–9.
2. Nagata T, Nomura J, Matsumura Y, et al. Radicular cyst in a deciduous tooth: a case report and literature review. J Dent Child. 2008;75:80-4.
3. Mass E, Kaplan I, Hirshberg A. A clinical and histopathological study of radicular cysts associated with primary molars. J Oral Pathol Med. 1995;24:458-61.
4. Penumatsa NV, Nallanchakrava S, Muppa R, Dandempally A, Panthula P. Conservative approach in the management of radicular cyst in a child: case report. Case Rep Dent. 2013;2013:123148.
5. Taysi M, Ozden C, Cankaya AB, Yildirim S, Bilgic L. Conservative approach to a large dentigerous cyst in an 11-year-old patient. J Istanb Univ Fac Dent. 2016;50:51-56.
6. Kirtaniya BC, Sachdev V, Singla A, Sharma AK. Marsupialization: a conservative approach for treating dentigerous cysts in children in the mixed dentition. J Indian Soc Pedod Prev Dent. 2010;28:203-8.
7. Delbem AC, Cunha RF, Afonso RL, Bianco KG, Idem AP. Dentigerous cysts in primary dentition: Report of 2 cases. Pediatr Dent. 2006;28:269-72.
8. Deboni MC, Brozoski MA, Traina AA, Acay RR, Naclério-Homem Mda G. Surgical management of dentigerous cyst and keratocystic odontogenic tumor in children: a conservative approach and 7-year follow-up. J Appl Oral Sci. 2012;20:282-5.
9. Bhardwaj B, Sharma S, Chitlangia P, Agarwal P, Bhamboo A, Rastogi K. Mandibular Dentigerous Cyst in a 10-Year-Old Child. Int J Clin Pediatr Dent. 2016;9:281-4.
10. Kalaskar RR, Tiku A, Damle SG. Dentigerous cysts of anterior maxilla in a young child: a case report. J Indian Soc Pedod Prev Dent. 2007;25:187-90.
11. Morankar R, Bhatia SK, Goyal A, Gulia P. Conservative management of keratocystic odontogenic tumour in a young child with decompression and an intraoral appliance: 5-year follow-up. BMJ Case Rep. 2018;2018:bcr2017221563.
12. Zecha JA, Mendes RA, Lindeboom VB, et al. Recurrence rate of keratocystic odontogenic tumor after conservative surgical treatment without adjunctive therapies - A 35-year single institution experience - A 35-year single institution experience. Oral Oncol. 2010;46:740–2.
13. Alnofaie H, Alomran O, Ababtain R, Alomar A. Spontaneous Eruption of a Deeply Impacted Premolar After Conservative Treatment of an Associated Dentigerous Cyst: A Case Report. Cureus. 2019;11:e6414.
14. Castro-Núñez J. An Innovative Decompression Device to Treat Odontogenic Cysts. J Craniofac Surg. 2016;27:1316.
15. Berti Sde A, Pompermayer AB, Couto Souza PH, Tanaka OM, Westphalen VP, Westphalen FH. Spontaneous eruption of a canine after marsupialization of an infected dentigerous cyst. Am J Orthod Dentofacial Orthop. 2010;137:690-3.
16. Harokopakis-Hajishengallis E. Physiologic root resorption in primary teeth: molecular and histological events. J Oral Sci. 2007;49:1-12.
17. Boot AM, de Ridder MA, Pols HA, Krenning EP, de Muinck Keizer-Schrama SM. Bone Mineral Density in Children and Adolescents: Relation to Puberty, Calcium Intake, and Physical Activity. J Clin Endocrinol Metab 1997;82:57–62.
18. Gandhi S, Franklin DL. Presentation of a radicular cyst associated with a primary molar. Eur Arch Paediatr Dent 2008;9:56–9.
19. Moturi K, Puvvada D, Kotha PR. A Novel, Minimally Invasive Technique in the Management of a Large Cyst Involving the Maxilla in a Child: A Case Report. Cureus. 2018;10:e2503.
20. Nawaz MS, Yazdanie N, Faheemuddin M. Rehabilitation of a cystic mixed dentition mandible following marsupialization with a multipurpose acrylic splint acting as a space maintainer and an obturator. J Ayub Med Coll

Abbottabad. 2011;23:177-9.
21. Kolokythas A, Fernandes RP, Pazoki A, et al. Odontogenic keratocyst: to decompress or not to decompress? A comparative study of decompression and enucleation versus resection/peripheral ostectomy. J Oral Maxillofac Surg 2007;65:640–4.
22. Uloopi KS, Shivaji RU, Vinay C, Pavitra, Shrutha SP, Chandrasekhar R. Conservative management of large radicular cysts associated with non-vital primary teeth: a case series and literature review. J Indian Soc Pedod Prev Dent. 2015;33:53-6.
23. Koca H, Esin A, Aycan K. Outcome of dentigerous cysts treated with marsupialization. J Clin Pediatr Dent. 2009;34:165-8.
24. Jones AV, Franklin CD. An analysis of oral and maxillofacial pathology found in children over a 30-year period. Int J Paediatr Dent. 2006;16:19-30.
25. Narang RS, Manchanda AS, Arora P, Randhawa K. Dentigerous cyst of inflammatory origin-a diagnostic dilemma. Ann Diagn Pathol. 2012;16:119-23.
26. Gültelkin SE, Tokman B, Türkseven MR. A review of paediatric oral biopsies in Turkey. Int Dent J. 2003;53:26-32.
27. Ramakrishna Y, Verma D. Radicular cyst associated with a deciduous molar: A case report with unusual clinical presentation. J Indian Soc Pedod Prev Dent. 2006;24:158-60.
28. Shibata Y, Asaumi J, Yanagi Y, et al. Radiographic examination of dentigerous cysts in the transitional dentition. Dentomaxillofac Radiol. 2004;33:17-20.
29. Ozturk G, Dogan S, Gumus H, Soylu E, Sezer AB, Yilmaz S. Consequences of Decompression Treatment With a Special-Made Appliance of Nonsyndromic Odontogenic Cysts in Children. J Oral Maxillofac Surg. 2022;80(7):1223-37.