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CASE REPORT

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Decompression as a conservative treatment for dentigerous cysts in pediatric patients: a clinical case series and literature review

Müjde Gürsu[1,*], Yeliz Kılınç[1], İpek Atak Seçen[2]

[1]Department of Oral and Maxillofacial Surgery, Gazi University Faculty of Dentistry, 06490 Ankara, Turkey
[2]Department of Oral Pathology, Gazi University Faculty of Dentistry, 06490 Ankara, Turkey

***Correspondence**
mujdegursu@gazi.edu.tr
(Müjde Gürsu)

Abstract

Background: Dentigerous cysts are benign odontogenic cysts generally associated with impacted or unerupted teeth. Although more commonly observed in adults, they can also occur in pediatric patients. Decompression offers a conservative treatment option for cyst management in children. This study aims to evaluate the clinical and radiographic outcomes of decompression therapy in pediatric patients with dentigerous cysts, through a case series and a literature review. **Cases**: In this study, four pediatric patients, aged 11 to 14 years, were diagnosed with dentigerous cysts following clinical, radiographic and histopathological evaluations. The following data was collected on each patient: age, gender, cyst location, symptoms, unerupted teeth on panoramic radiographs, and histopathological findings. Decompression therapy was initiated in all cases by placing surgical drains in the affected areas. Clinical examinations and radiographic imaging were performed regularly over a 12-month follow up to assess lesion resolution and associated tooth eruption. All cases demonstrated significant clinical and radiographic improvements. In this study, 3 patients had cystic lesions completely resolved without orthodontic treatment, along with impacted teeth emerging simultaneously within the cyst. In one case, despite the cystic cavity healing completely, the associated impacted tooth could not erupt due to completed root development. All teeth associated with cysts maintained their vitality in all cases. Neither serious postoperative complications nor recurrences of the lesions were observed. **Conclusions**: Decompression therapy is an effective and minimally invasive approach for managing dentigerous cysts in pediatric patients. By promoting lesion resolution and preserving adjacent structures, this technique facilitates bone healing and supports favorable outcomes in children with dentigerous cysts.

Keywords

Decompression; Children; Odontogenic cysts; Impacted teeth

1. Introduction

Dentigerous cysts are among the most prevalent benign developmental odontogenic cysts affecting the jaws, accounting for approximately 15.2% to 33.7% of all odontogenic cysts [1]. Typically, it occurs with impacted, unerupted, or supernumerary teeth [2]. Such cysts are usually observed in the second and third decades of life and rarely occur in childhood. Their prevalence in the pediatric population ranges from 3.56% to 8.64% [3, 4]. Dentigerous cysts are most commonly found around the mandibular third molars, maxillary canine teeth and mandibular premolar teeth [5]. They have been reported to exhibit a predilection for the mandible compared to the maxilla [6]. Dentigerous cysts are generally asymptomatic unless secondary infections occur and are usually detected during routine radiographic examination. On radiographs, they appear as unilocular radiolucent lesions with well-defined sclerotic margins, enclosing the crown of an impacted tooth and attaching to its cementoenamel junction [7]. The formation of dentigerous cysts is attributed to the accumulation of fluid between the reduced enamel epithelium and the developing tooth crown [8]. Such lesions can also cause complications, including delayed eruption, incorrect tooth positioning within the dental arch, tooth displacement, and potential nerve damage [9]. Furthermore, although rare, ameloblastomas and carcinomatous transformations have been documented in association with these cysts [10].

The treatment of a dentigerous cyst includes enucleation, marsupialization and decompression [11]. The preferred treatment method depends on the size of the cyst, its relationship with anatomical structures, localization, the patient's age, and the probability of eruption of the affected tooth [12]. Enucleation, as one of the invasive surgical procedures, may lead to serious potential complications, including facial deformities,

bone fractures, dental losses, and nerve injury, particularly in cases of large cystic lesions [13]. To avoid such complications, decompression may be considered as a first-line treatment to preserve vital structures and reduce cyst size, followed by enucleation if necessary [14]. Decompression entails connecting a cystic lesion to the oral cavity, using a variety of materials and techniques. It is based on making a small opening in the cyst and keeping it open with a drain. In pediatric cases, this minimally invasive surgical approach provides significant benefits, including tooth buds preservation, minimal disruption to skeletal growth, and reduced likelihood of damage to adjacent anatomical structures, such as the maxillary sinus, mandibular canal, and nasal and orbital cavities. Furthermore, a less invasive surgical approach may result in better compliance from both children and their parents [15].

This study aims to evaluate the effectiveness of decompression therapy in the treatment of dentigerous cysts in pediatric patients. Through the presentation of four cases of pediatric dentigerous cysts, this article highlights the importance of conservative treatment methods in managing dentigerous cysts. Additionally, it explores the clinical challenges encountered during treatment and discusses the potential for spontaneous eruption of impacted teeth without the need for orthodontic intervention, aiming to contribute to the growing body of literature on conservative management approaches.

2. Case presentations

2.1 Case 1

An 11-year-old male patient with no systemic diseases presented to our clinic with the complaint of localized pain in the lower right jaw. On intraoral examination, a large restoration was observed on the lower right second deciduous molar, and decay was observed in the distal region of the tooth. The patient's initial and follow-up panoramic radiographs are shown in Fig. 1, illustrating the progression of the lesion over time (Fig. 1). Panoramic radiographic imaging showed a well-defined radiolucent area associated with the roots of the deciduous second molar in the lower right jaw, also encompassing the unerupted permanent second premolar (Fig. 1A). Following clinical evaluation, adjacent teeth, the lower right first premolar and lower right first molar were found to be vital.

After an incisional biopsy was conducted under local anesthesia, the relevant lesion was diagnosed histopathologically as a dentigerous cyst (Fig. 2). Subsequently, the deciduous second molar was extracted, and decompression of the cyst was achieved by placing a surgical drain in the extraction socket (Fig. 3). A twice daily irrigation of the cavity with an isotonic saline solution was recommended. Patient and their guardian were educated about the importance of this procedure. The treatment continued for 3 months (Fig. 1B). Throughout the treatment process, regular follow-ups showed progressive bone filling and eruption potential of the unerupted tooth. For the surgical drain to remain functional and adapt to the healing process, it was periodically shortened and resutured as the cavity shrank. Six months after initiating decompression therapy, a follow-up radiograph showed that the lesion had resolved completely, and the permanent second premolar was erupting (Fig. 1C). At 12-month follow-up, a radiograph showed complete resolution of the lesion and successful tooth eruption (Fig. 1D). Additionally, the permanent mandibular second premolar associated with the dentigerous cyst was evaluated as vital at the end of the treatment. Throughout the treatment, both mandibular first premolar and first molar remained vital. As well, neither the inferior alveolar nor mental nerves showed signs of nerve damage.

2.2 Case 2

An 11-year-old male patient with no systemic diseases was referred to our clinic with the complaint of an unerupted second premolar and a suspected cyst in the upper left jaw. Intraoral examination revealed the extraction of the upper left second deciduous molar. The patient's initial and follow-up panoramic radiographs are shown in Fig. 4, illustrating the progression of the lesion over time (Fig. 4). A radiolucent lesion surrounding the unerupted second premolar was observed on radiography (Fig. 4A). Upon clinical evaluation, the adjacent maxillary first premolar and first molar were found to be vital. An incisional biopsy was performed under local anesthesia and histopathologically, a dentigerous cyst was diagnosed (Fig. 5). Due to the proximity of the unerupted second premolar to the alveolar crest, decompression therapy was applied to the buccal region of the lesion to ensure effective access and management. Irrigation of the cavity with a sterile saline solution was recommended twice a day. Following a 3-month follow up radiograph, continued decompression therapy was indicated (Fig. 4B). A subsequent panoramic radiograph taken after 6 months showed progressive healing of the lesion, and the surgical drain was removed due to increased bone healing at this stage (Fig. 4C). At 12-month follow-up, complete healing of the lesion and full eruption of the upper left second premolar were observed (Fig. 4D). During treatment, no pathological findings were observed in the left maxillary sinus. Vitality testing confirmed that both the affected tooth and the adjacent teeth maintained their vitality.

2.3 Case 3

A 14-year-old male patient visited our clinic for a routine check-up. The patient's initial and follow-up panoramic radiographs are shown in Fig. 6, illustrating the progression of the lesion over time (Fig. 6). Radiographic examination revealed that the lower left second molar was impacted in the mesioangular position, surrounded by a well-defined radiolucent lesion (Fig. 6A). The related lesion also caused root resorption on the lower left first molar. Clinical examination, including vitality testing, revealed that the adjacent lower left second premolar and first molar were vital. No symptoms were observed, such as pain, swelling or paresthesia. Following an incisional biopsy, a dentigerous cyst was diagnosed (Fig. 7). Decompression therapy was initiated, and since there was no existing extraction socket, a surgical drain was sutured to the buccal region of the lesion, which caused challenges during irrigation. However, the patient's compliance with the treatment plan ensured successful progress. Irrigation of the affected cavity was recommended twice daily. A panoramic radiograph taken at the 3-month follow-up illustrates the intermediate

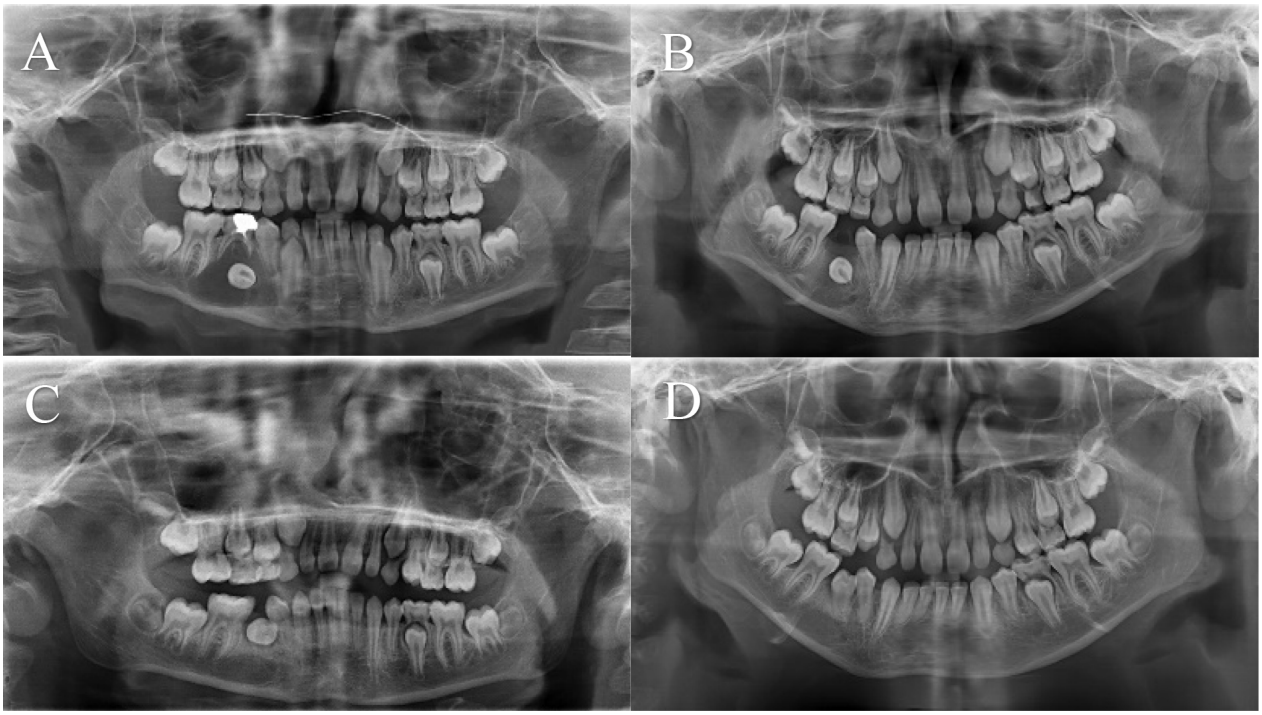

FIGURE 1. Case 1: panoramic radiographic findings during treatment. (A) Pre-operative. (B) Post-operative 3-month follow-up. (C) Post-operative 6-month follow-up. (D) Post-operative 12-month follow-up.

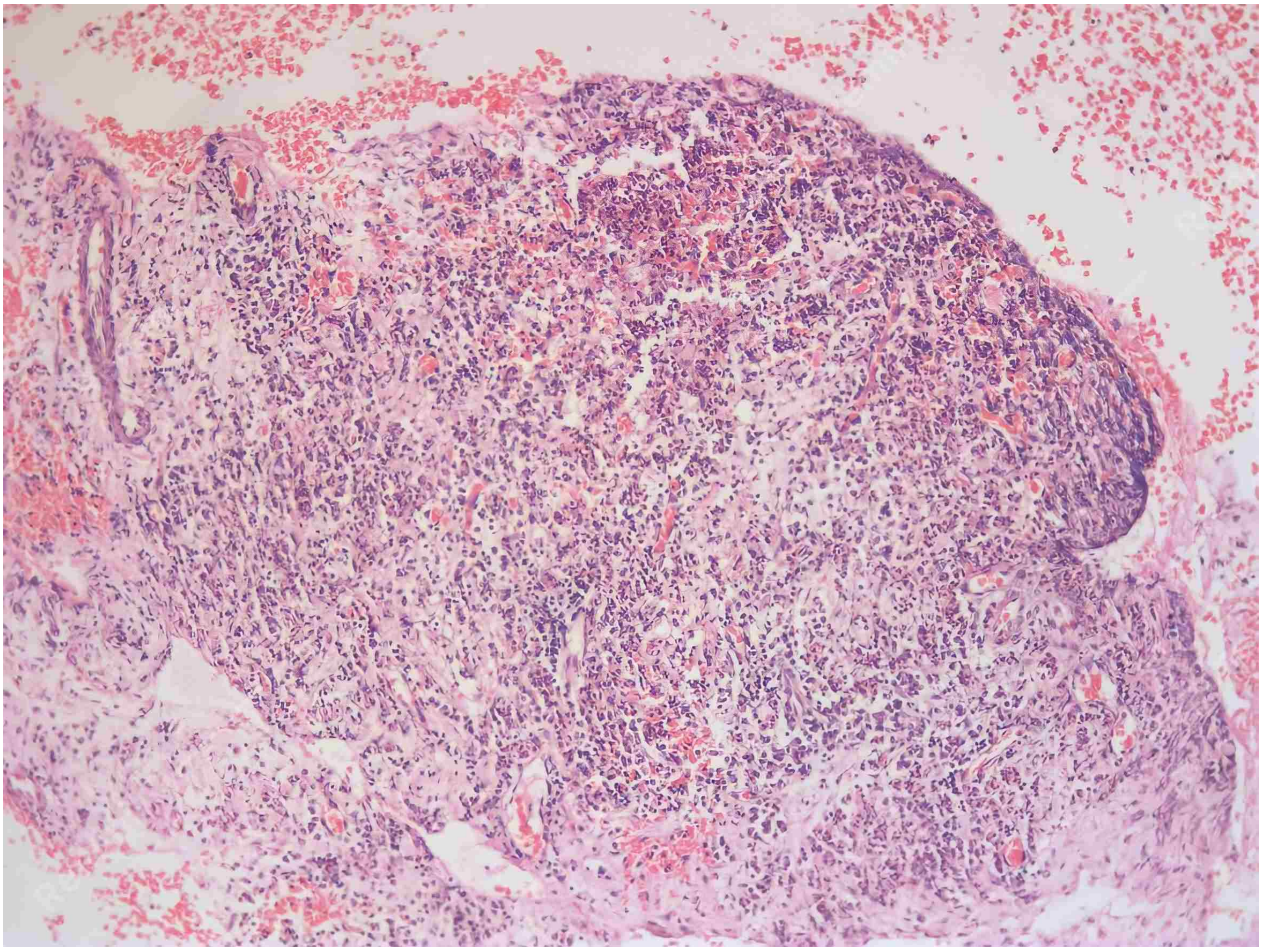

FIGURE 2. Case 1: histological examination. Collagenized connective tissue with dense mononuclear inflammatory cell infiltration beneath a thin, non-keratinized odontogenic epithelium was shown (hematoxylin & eosin, ×100 magnification).

FIGURE 3. Surgical drain. Placement of a surgical drain in the extraction socket for decompression therapy.

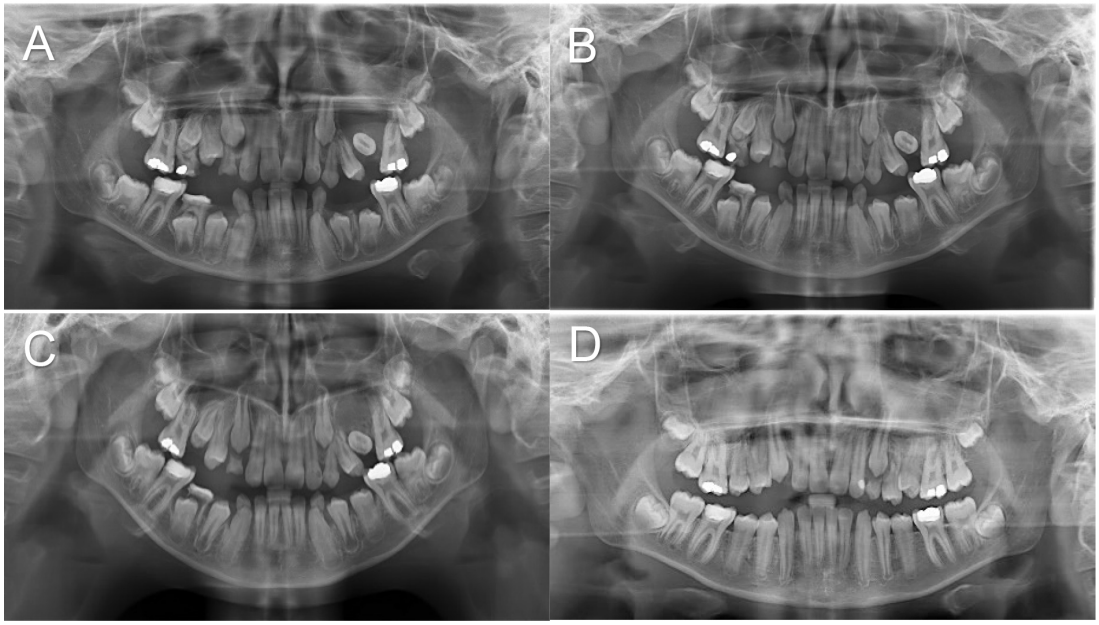

FIGURE 4. Case 2: panoramic radiographic findings during treatment. (A) Pre-operative. (B) Post-operative 3-month follow-up. (C) Post-operative 6-month follow-up. (D) Post-operative 12-month follow-up.

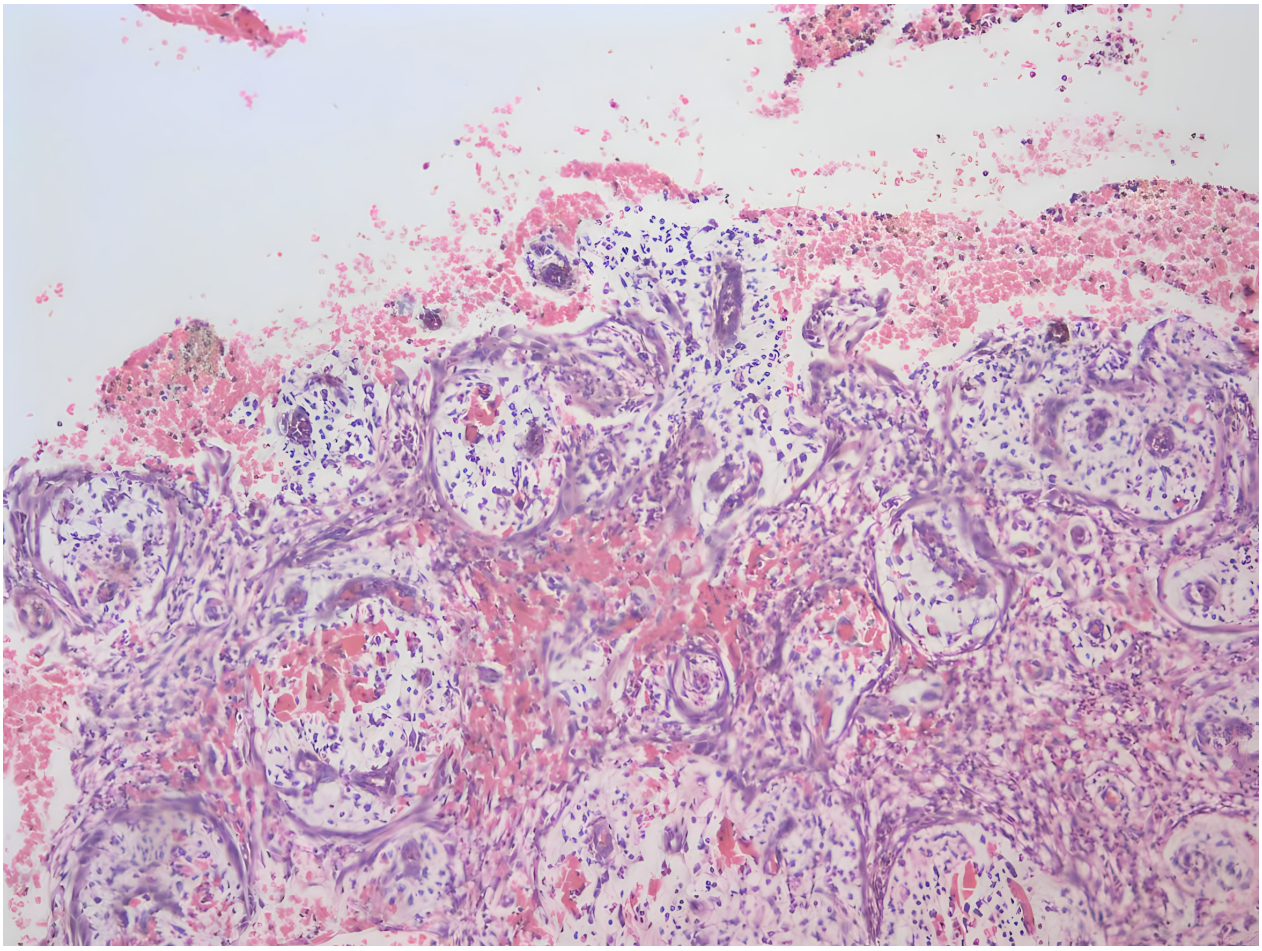

FIGURE 5. Case 2: histological examination. Collagenized connective tissue with dense mixed inflammatory cell infiltration beneath a non-keratinized odontogenic epithelium was shown (hematoxylin & eosin, ×100 magnification).

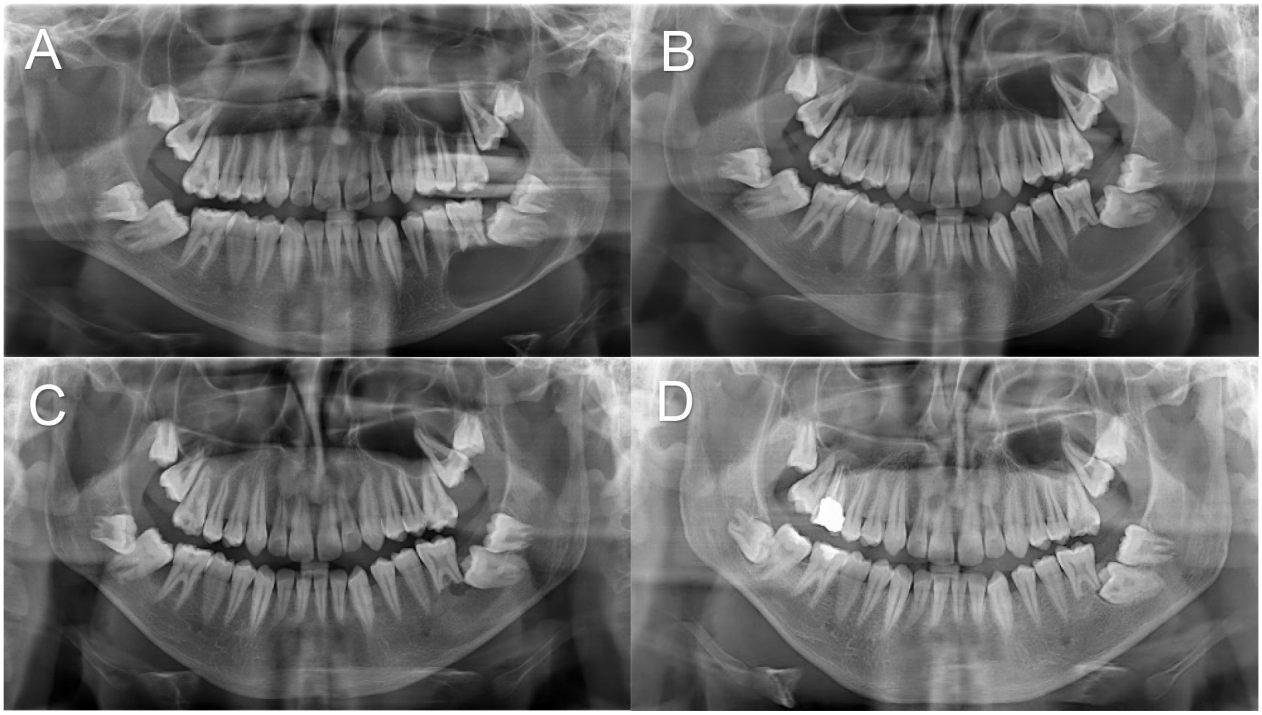

FIGURE 6. Case 3: panoramic radiographic findings during treatment. (A) Pre-operative. (B) Post-operative 3-month follow-up. (C) Post-operative 6-month follow-up. (D) Post-operative 12-month follow-up.

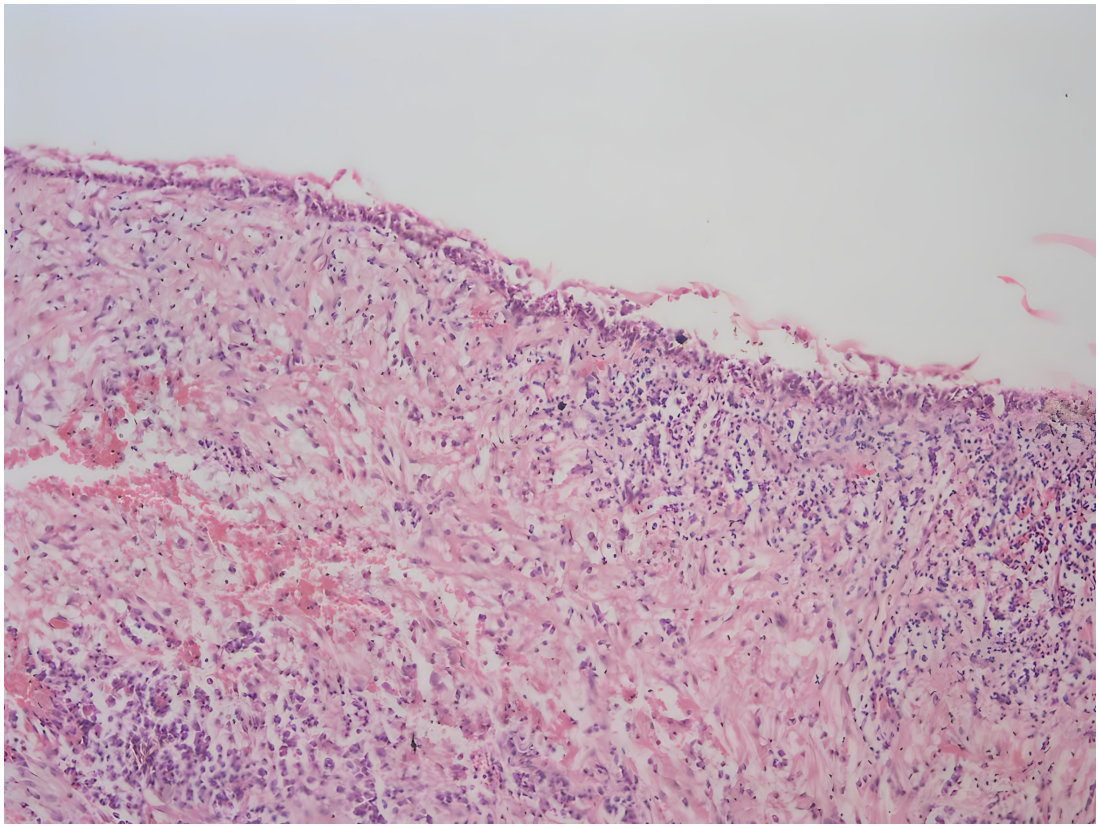

FIGURE 7. Case 3: histological examination. Collagenized connective tissue with focal mononuclear inflammatory cell infiltration beneath a thin, non-keratinized odontogenic epithelium was shown (hematoxylin & eosin, ×100 magnification).

healing progress (Fig. 6B). A panoramic radiograph obtained at the six-month follow-up revealed continued healing and bone regeneration (Fig. 6C). A radiograph taken 12 months after treatment began revealed successful bone regeneration within the cystic cavity (Fig. 6D). Throughout the follow-up period, the lower left second premolar and the lower left first molar with root resorption were observed to remain vital during regular check-ups, and no symptoms were detected. Neither the inferior alveolar nor mental nerves were affected. However, the cyst-associated second left molar was unable to erupt due to completed root development.

2.4 Case 4

A 9-year-old male patient presented to our clinic with the complaint of localized swelling in the lower right jaw. Clinical examination revealed extensive restorations in the deciduous molars on both the right and left sides of the lower jaw. Fluctuant swelling was observed buccally around the lower right second deciduous molar. The patient's initial and follow-up panoramic radiographs are shown in Fig. 8, illustrating the progression of the lesion over time (Fig. 8). Radiographically, a well-defined unilocular radiolucent lesion surrounding the crown of the impacted lower right second premolar was noted. Additionally, this lesion was observed to cause root resorption of the deciduous first and second molars (Fig. 8A). During vitality testing the adjacent lower right deciduous canine and permanent first molar were both identified as vital. Following the diagnosis of a dentigerous cyst after an incisional biopsy, the deciduous first and second molars were extracted (Fig. 9). Decompression therapy was initiated by placing a surgical drain in the extraction sockets. However, during the treatment process, the drain dislodged three times, requiring repeated suturing, which posed a challenge. Additionally, as the eruption of the impacted first and second premolars progressed, the surgical drain was periodically shortened and resutured to adapt to the changing conditions and ensure its functionality. After 3 months, a follow-up radiograph revealed the initiation of eruption of the permanent first and second premolars, and the surgical drain used for decompression therapy was removed (Fig. 8B). After 6 months, the permanent premolars began to erupt (Fig. 8C). Panoramic radiograph taken at 12 months confirmed their complete eruption (Fig. 8D). Throughout the clinical course, there was no evidence of nerve damage to the mental nerve, and no paresthesia was reported. Additionally, both lower right permanent premolars were vital. Further, vitality testing also confirmed that the adjacent permanent first molar and deciduous canine remained vital.

3. Discussion

Odontogenic cysts are pathological cavities found within the bone in the maxilla or mandible, which are typically lined with odontogenic epithelium. These cystic lesions tend to enlarge gradually over time, causing the surrounding bone tissue to expand and threatening the tooth's vitality [16]. Dentigerous cysts are odontogenic cysts commonly encountered in the second and third decades of life, associated with an impacted tooth. They are most frequently associated with the mandibular third molars and maxillary canine teeth [7]. Al Tuwirqi *et*

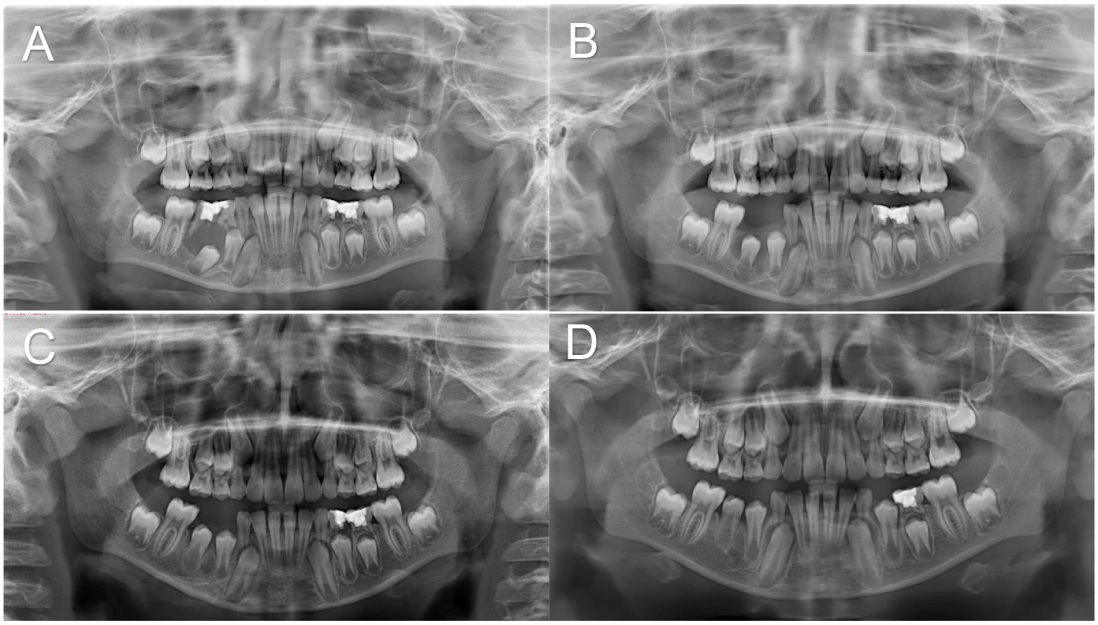

FIGURE 8. Case 4: panoramic radiographic findings during treatment. (A) Pre-operative. (B) Post-operative 3-month follow-up. (C) Post-operative 6-month follow-up. (D) Post-operative 12-month follow-up.

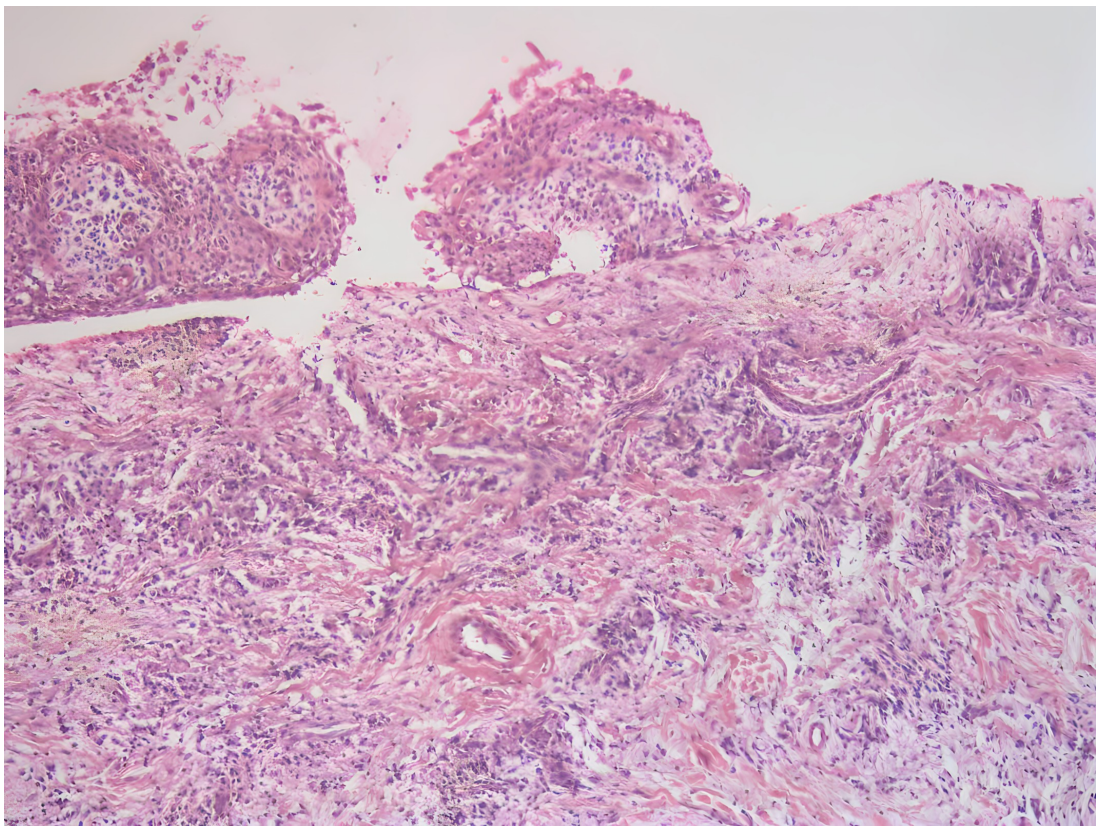

FIGURE 9. Case 4: Histological examination. Collagenized connective tissue with dense mononuclear inflammatory cell infiltration situated beneath a non-keratinized odontogenic epithelium was shown (hematoxylin & eosin, ×100 magnification).

al. [2] reported that the lower left second premolar, closely followed by the lower left first molar, was the most commonly affected teeth in cases of dentigerous cysts in pediatric patients. In addition, Tekkesin *et al.* [17], in their study evaluating 128 pediatric patients with dentigerous cysts, reported that the mandible was affected in 79 cases (61.7%), with the majority (56 cases, 70.9%) occurring in the mandibular molar region. Additionally, most dentigerous cysts were observed in the mixed dentition group (58.6%) [17]. This case report, which involved four pediatric patients, aligns with the existing literature. The majority of dentigerous cysts were located in the mandible (3 out of 4 cases), with one observed in the maxilla. Additionally, three patients were in the mixed dentition phase. Two of the three mandibular cases had dentigerous cysts local-

ized in the premolar region.

As with most odontogenic cysts, dentigerous cysts are typically treated surgically with marsupialization, decompression, and enucleation [18]. Marsupialization and decompression, although used interchangeably in clinical practice, are different surgical techniques [19]. Decompression encompasses marsupialization and includes any surgical technique aimed at reducing intracystic pressure by maintaining the opening of the cyst to the oral cavity using a tube or stent [20]. On the other hand, marsupialization refers to the suturing of the cyst lining to the oral mucosa, forming an opening for drainage. Both approaches aim to decrease the size of the cystic lesion by releasing intracystic pressure, thereby allowing the gradual formation of new bone tissue [13].

In pediatric patients, decompression is preferred due to the high potential for healing and bone regeneration, especially in teeth with incomplete root development and high eruption potential. When compared to enucleation, this procedure offers several advantages, including reducing potential harm to vital structures, preventing pathological fractures, stimulating bone formation, maintaining pulp vitality, and promoting involved teeth eruption when sufficient space is available [18]. An additional advantage of decompression over enucleation in the pediatric population is the avoidance of general anesthesia, which makes it a less invasive and more practical approach.

Decompression duration is associated with the total reduction in cystic cavity volume [14]. Asutay *et al.* [21] recommended that decompression should be maintained until the risk of injury to vital structures during enucleation is eliminated and the size of the cystic lesion decreases. Additionally, Ugurlu *et al*. [22] observed that cystic cavities disappeared in pediatric patients 3–9 months following initial tube placement. In this case series, with the preservation of vital structures, the duration of decompression therapy varied for each patient but was approximately 3–6 months. During this period, all patients showed a reduction in cystic cavity size and progressed bone healing.

According to Anavi *et al.* [23] decompression time in patients under 18 years old is significantly less than that in adult patients. This difference may be explained by the high osteogenic activity observed in children [23]. Moreover, Asutay *et al.* [21] and Nyimi *et al.* [24] suggested that cystic lesions reduction is smaller in older patients. This case presentation aimed to determine dentigerous cysts' response to decompression in pediatric patients. In four pediatric patients who received decompression therapy, the cystic cavity completely healed with bone regeneration.

Generally, enucleation is recommended when the size of cystic lesions decreased sufficiently during decompression. On the other hand, Ugurlu *et al.* [22] successfully treated 34 pediatric cases of dentigerous cysts with decompression without subsequent enucleation surgery. Allon *et al.* [15] also used decompression as a therapeutic intervention for odontogenic cystic lesions in children, with an average reduction of 82%. Khalifa *et al.* [25] reported successful treatment of dentigerous cysts associated with impacted teeth in two pediatric patients using decompression therapy. Bone regeneration was initiated six months after surgery, and panoramic radiographs at one year confirmed complete bone remodeling with no recurrence. In our study, like these previous studies, all patients achieved successful outcomes via decompression therapy, and no patient underwent enucleation treatment. Radiographic evaluation at the 3-month follow-up demonstrated bone healing initiation in all cases. A 12-month follow-up revealed complete healing of the cystic cavities, with no evidence of recurrence.

The challenges of decompression therapy, particularly in the pediatric population, include the long treatment duration, the need for frequent follow-up, and the requirement for high levels of patient compliance. Adhering to long-term decompression therapy and irrigation protocols can be especially difficult for children due to their age-related limitations and varying levels of cooperation. Additionally, decompression therapy has disadvantages such as obstruction, displacement or dislodgment of the decompression tube, difficulties with irrigation, and an increased risk of infection. Moreover, further surgical intervention may be required if residual epithelial linig results in cyst recurrence. Instructions on proper cavity irrigation should be provided to patients and their parents to minimize complications. Any issues they encounter, such as tube obstructions or displacements, should be reported promptly to their clinician [14, 26]. In this case series, similar challenges related to decompression therapy were encountered, including irrigation difficulties caused by dislodging and positioning of the surgical drain. Patients and their families were thoroughly informed about the importance of regular follow-ups and advised to report any complications immediately. The treatment was successful due to the patients adhering to irrigation protocols and attending regular follow-up visits.

The need for orthodontic treatment is among the most significant issues in tooth eruption problems associated with jaw pathologies. Aksoy *et al.* [27] observed that in 15 out of 17 pediatric patients, the cyst completely healed, and permanent teeth erupted without orthodontic treatment. However, in the remaining two cases, orthodontic intervention facilitated tooth eruption. In their meta-analysis, Nahajowski *et al.* [9] reported that spontaneous eruption occurs mostly during the first decade and the early part of the second decade of life. They found that approximately 62% of dentigerous cyst-associated impacted teeth erupted spontaneously after decompression. Further, when the developing root is shorter than half of its mature length, there is a doubled possibility of spontaneous eruption of dentigerous cyst-associated impacted teeth [9]. In the present study, decompression therapy was applied to four patients with dentigerous cysts. In three cases, the impacted teeth associated with the lesion erupted spontaneously without the need for orthodontic treatment. In one patient, however, spontaneous eruption did not occur due to root formation completion. These findings emphasize the influence of root development stages on spontaneous eruption success following decompression therapy.

4. Conclusions

Decompression therapy can be considered an effective treatment method for dentigerous cysts associated with primary teeth in pediatric patients during the mixed dentition period. It can be given preference as a conservative approach in the treatment of pediatric patients as it promotes high rates of healing

and bone regeneration, facilitating the spontaneous eruption of teeth associated with the cyst. Although decompression therapy has few disadvantages, children might benefit from this minimally invasive surgical treatment.

AVAILABILITY OF DATA AND MATERIALS

Not applicable.

AUTHOR CONTRIBUTIONS

MG and YK—designed the study; summarized and analyzed the case series; searched and analyzed the literature. YK—provided help and advice on the study. İAS—analyzed the histopathological images. MG, YK and İAS—wrote the manuscript. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical approval was waived for this case report. Case reports that do not involve experimental or investigational treatments, and where data is presented anonymously with informed consent, are exempt from requiring ethics committee approval. This case report complies with the principles outlined in the Declaration of Helsinki. The patients received standard treatments in accordance with accepted clinical guidelines, and no experimental procedures were performed. Written informed consent was obtained from all patients and their legal guardians for the disclosure of treatment outcomes and the publication of this case report, including associated clinical details and images.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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