

REVIEW

Erupted Odontoma: A Report of Three Cases and A Review of the Literature

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ABSTRACT

Erupted Odontoma: A Report of Three Cases and A Review of the Literature

Odontomas are most common benign odontogenic tumors composed of enamel, dentine, cement, and pulp tissue. The eruption of an odontoma is extremely rare. It may be associated with some complications such as pain, inflammation of the adjacent soft tissues and delayed eruption of permanent teeth. In this report, clinical and radiographic findings of three erupted odontoma cases and a review of the literature are presented. Three of our patients were male and the oldest was 80 years old. Two of the patients were symptomatic and one was asymptomatic. Panoramic radiographs and cone-beam computed tomography images were obtained. In the literature review, we reached 66 papers published between 1989 and 2020, with a total of 74 cases presented. An erupted odontoma may be associated with pain, inflammation of the adjacent soft tissues, and delayed eruption of permanent teeth. Dentists should pay attention to erupted odontoma because of these serious complications.

KEYWORDS

Odontoma, Erupted odontoma, Odontogenic tumor, Review

ÖZ

Sürmüş Odontoma: Üç Vaka Raporu Ve Literatür Derlemesi

Odontomlar, mine, dentin, sement ve pulpa dokusundan oluşan en yaygın benign odontojenik tümörlerdir. Odontomanın sürmesi oldukça nadirdir. Ağrı, çevredeki yumuşak dokuların iltihaplanması ve kalıcı dişlerin gecikmiş sürmesi gibi bazı komplikasyonlarla ilişkili olabilir. Bu raporda, sürmüş üç odontoma vakasının klinik ve radyografik bulguları ve literatür derlemesi sunulmuştur. Hastalarımızın üçü de erkekti ve en yaşlısı 80 yaşındaydı. Hastaların ikisi semptomatik, biri asemptomatikti. Radyografik incelemede, panoramik radyografiye ilaveten, detaylı bir inceleme yapmak adına konik ışınlı bilgisayarlı tomografi görüntüleri de elde edildi. Literatür taramasında 1989 ve 2020 yılları arasında yayınlanmış ve toplam 74 vakanın sunulduğu 66 yayına ulaştık. Sürmüş bir odontoma, ağrı, bitişik yumuşak dokuların iltihabı ve kalıcı dişlerin sürmesinde gecikme ile ilişkili olabilir. Diş hekimleri, bu ciddi komplikasyonlar nedeniyle sürmüş odontomaya dikkat etmelidir.

ANAHTAR KELİMELEER

Odontoma, Sürmüş odontoma, Odontojenik tümör, Derleme

The term 'odontoma' was first used in 1866 by Broca who defined it as a tumor formed by the overgrowth of complete dental tissue and in 1946 it was classified by Thoma and Goldman.¹ Odontomas, which are considered developmental anomalies (hamartomas) rather than true neoplasms are the most common benign odontogenic tumors and composed of enamel, dentin, cementum, and pulp. Various theories have been suggested for etiology of odontomas: local trauma in primary dentition duration, infectious and/or inflammatory processes, hereditary abnormalities, and any alteration in genetic structures that can affect the tooth development.² Odontomas are the most frequently observed, non-cystic, non-aggressive, usually asymptomatic, odontogenic benign lesions, and among the odontogenic tumors their incidence ranges between 22-67%.³ According to the World Health Organization (WHO) classification in 2017, based upon its radiographic, histopathologic, and clinical features, there are two types of odontoma: complex odontoma (CxOD) and compound odontoma (CpOD).⁴ CpOD present organized dental tissues and might contain tooth-like structures that are named denticles. On the contrary, CxOD is consists of all dental tissues that arrange randomly.⁵ Their detection is usually in the early years of life, between the ages of 6 and 46, and the mean is 23

years old.⁴ The sex predilection is controversial; in some studies CpOD reported more common in males, and CxOD slightly more common in females.⁵ Dilated odontoma represented as a dilatation of the crown and root that cause of a deep enamel-lined invagination and it is a very rare developmental abnormality.⁶ Although it has been described as another type of odontoma by some authors, it was not described as a private asset in the current of odontogenic tumors classification.

Junquera et al.⁷ 'clinically' characterized three types of odontomas: 1) intra-osseous (central) odontoma, 2) extraosseous (peripheral) odontoma occurring only in the soft tissue and 3) erupted odontoma as a result of an intra-osseous odontoma eruption into the oral cavity because of its location coronally to an impacted/erupting tooth or superficially in the bone. The eruption of odontoma in the oral cavity is extremely rare, the first case was reported by Rumel et al.⁸ in 1980. Amado et al.³ reported in a review that eruption occurred in only 1.6% of all odontomas

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cases. An erupted odontoma may be associated with some complications such as pain, inflammation of the adjacent soft tissues, suppuration associated with infection and delayed eruption of permanent teeth.⁹

The present study identified three patients with erupted odontoma and offers a literature review in terms of the principal characteristics of these lesions.

CASE REPORTS

Case 1

A 21-year-old male reported pain after meals for the last three days and slight swelling on the soft tissues of left the mandible for the last one year. The pain was dull, intermittent, exacerbated by chewing and relieved with medication. No relevant medical or family history was reported.

On extraoral examination, a slight swelling was observed on the left cheek, in the region of mandibular angle (Figure 1a). Intraoral examination revealed an ulcerated zone in the left mandible molar region and a partially erupted hard and dental tissue-like mass on the alveolar ridge (Figure 1b). On palpation, the mass had a bone-like tenderness, and swelling was observed in the affected buccal region that accompanied a shallowing vestibular sulcus. Panoramic radiography revealed a well-defined, non-homogeneous radiopaque mass with irregular borders situated in the left mandible body. The mass extended antero-posteriorly from the distal surface of the second premolar to the anterior border of the mandible ramus and supero-inferiorly from the alveolar crest to the lower third of the mandible body (Figure 1c). The axial and coronal cone-beam computed tomography (CBCT) sections showed an irregular radiopacity surrounded by a radiolucent halo above the crown of impacted molar orienting toward the mandible basis (Figure 1d, 1e). The cortical bone perforation was observed at the top of alveolar crest slightly to lingual aspect. The mass was associated with the mandibular canal and caused expansion in both buccal and lingual directions. The approximate size of the mass was 2.9 cm × 1.4 cm × 1.8 cm (dimensions of anteroposterior × buccolingual × superoinferior). The impacted tooth was in close neighborhood of the mandibular canal and caused perforation in the buccal cortical bone (Figure 1f, 1g). The evidence of another molar was not noted, and its absence information could not be obtained from the patient.

Based on the clinical and radiological features, the lesion was pre-diagnosed as CxOD. After the acute symptoms were treated by medication, the patient was referred to the Department of Oral and Maxillofacial Surgery for excision of the lesion. Initially, an incisional biopsy was performed; however, the material obtained was insufficient for histopathological examination. A new operation was carried out for an excisional biopsy under general anesthesia. Histopathological evaluation of the material revealed that it was compatible with CxOD. The lesion was diagnosed as erupted CxOD.

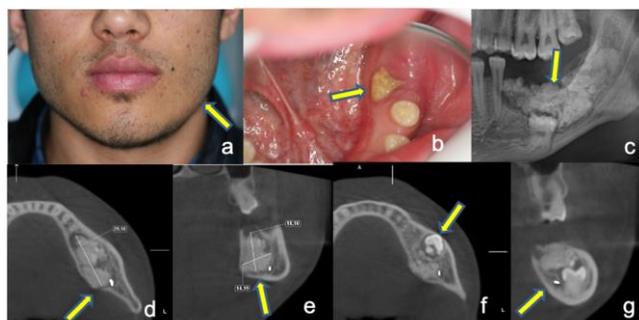


Figure 1

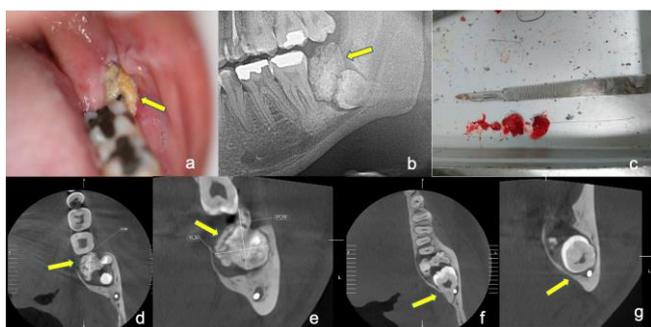
Extraoral view of the swelling of the cheek (arrow) (a), intraoral view of the erupted lesion (arrow) (b), localization of the lesion and impacted tooth on the cropped panoramic radiograph (arrow) (c), axial CBCT section showing the lesion (arrow) (d), coronal CBCT section showing the lesion (arrow) (e), axial CBCT section showing the tooth (arrow) (f), coronal CBCT section showing the tooth (arrow) (g)

Case 2

A 23-year-old male was referred to our department by a dentist because of a lesion located in his left mandible. According to the patient's statement, swelling and purulent exudate started in the left posterior region of his mandible five months ago. No relevant medical or family history was reported.

There were no extraoral findings. On intraoral examination, a partially erupted, yellowish-brown, irregularly shaped solid mass was observed on the left posterior mandibular alveolar ridge. The mandibular left third molar was not observed in the oral cavity (Figure 2a). The mass and the related area were tender on palpation. Panoramic radiography revealed a unilateral, non-homogeneous radiopacity above the impacted left third molar crown, at the distal surface of the second molar and associated with its crown and root (Figure 2b). It also perforated the alveolar crest and extending to the oral cavity. The axial and coronal CBCT sections provided a more detailed view of the lesion. The cortical bones at the top of the alveolar crest and additionally at the lingual and buccal sides were perforated (Figure 2d, 2e). The dimensions of the irregular radiopacity that surrounded with a radiolucent rim were 1.3 cm × 1.5 cm × 1.8 cm (dimensions of anteroposterior × buccolingual × superoinferior). The roots of impacted third molar were towards the basis of the mandible and were in a relationship with the mandibular canal. The impacted tooth was in contact with the mandibular canal and perforated the buccal cortical bone (Figure 2f, 2g)

Based on the clinical and radiological features, the lesion was pre-diagnosed as CxOD. After the acute symptoms were treated by medication, the patient was referred to the Department of Oral and Maxillofacial Surgery for excision of the lesion and the mass was removed (Figure 2c). Histopathological evaluation of the material obtained after the surgery was compatible with CxOD. The lesion was diagnosed as erupted CxOD.

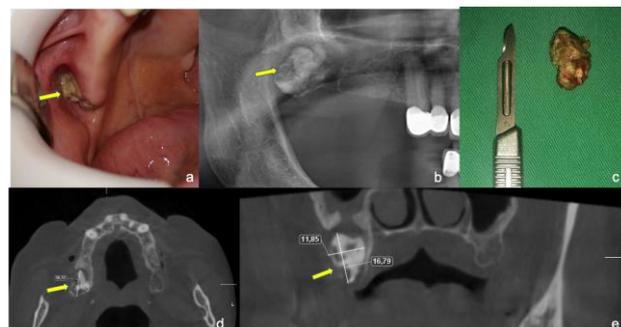
**Figure 2**

Intraoral view of the erupted lesion (arrow) (a), localization of the lesion and impacted tooth on the cropped panoramic radiograph (arrow) (b), macroscopic view of the specimen and impacted tooth (c), axial CBCT section showing the lesion (arrow) (d), coronal CBCT section showing the lesion (arrow) (e), axial CBCT section showing the impacted tooth (arrow) (f), coronal CBCT section showing the impacted tooth (arrow) (g)

Case 3

An 80-year-old male was referred to our department by a dentist because of a bone-hard mass in his maxilla. The primary expectation of the patient was to replace the old upper and lower partial dentures due to their non-adaptation. He also reported that a tooth/bone-hard mass appeared five years ago in the right posterior maxilla region, but it has been asymptomatic so far.

There was no abnormality on extraoral examination. Intraoral examination revealed a partially erupted yellowish hard mass with an irregular surface on the edentulous right tuber region (Figure 3a). On palpation, the mass was bone-hard. Panoramic radiography revealed a unilateral and non-homogeneous radiopacity surrounded by a radiolucent rim in the right tuber region (Figure 3b). The axial and coronal CBCT sections showed perforation in the cortical bone at the top and buccal aspect of the alveolar crest and additionally the mass was in a relationship with maxillary sinus due to perforation on its inferior wall (Figure 3d, 3e). The size of the lesion was approximately 1.6 cm × 1.2 cm × 1.7 cm (dimensions of anteroposterior × buccolingual × superoinferior). The surgical operation was performed intraorally under local anesthesia and the mass was removed (Figure 3c). The histopathological analysis confirmed the diagnosis of CxOD that showed an irregular arrangement of dental tissues such as enamel, dentine, and cementum. The lesion was diagnosed as erupted CxOD.

**Figure 3**

Intraoral view of the erupted lesion (arrow) (a), localization of the lesion and impacted tooth on the cropped panoramic radiograph (arrow) (b), macroscopic view of the specimen (c), axial CBCT section showing the lesion (arrow) (d), coronal CBCT section showing the perforation on the maxillary sinus floor and the lesion (arrow) (e)

LITERATURE RESEARCH

We conducted a literature search at PubMed and Google Scholar using the keywords "odontoma", "erupted odontoma" and "odontogenic tumor". No restrictions were used regarding the language of the papers. The papers published in a foreign language were translated. This research yielded 66 papers relevant erupted odontoma cases between 1989 and 2020. Totally 74 erupted odontoma cases were reported in 73 patients (one patient had bilateral erupted dilated odontomas (Mahmoodi A et al.¹⁰)) (Table 1). The ages of 72 patients ranged between 2 and 68, and the mean age was 20.7. In a paper, two cases that belong to two different patients have been presented; however, the age of one patient was not specified (Bhattacharya PT et al.¹¹). Regarding the sex, 53.4% (n=39) of the patients were female and 46.6% (n=34) were male, that's why we can say the erupted odontoma has no sex predilection. The distribution of jaw involvement was as 47.3% (n=35) in mandible and 52.7% (n=39) in maxilla. Among all cases that we have reviewed, 59.4% (n=44) cases were symptomatic and 40.6% (n=30) were asymptomatic (Table 2). In the reports stated the situation, 74.3% (n=55) of the erupted odontoma cases were associated with an impacted tooth. Size was stated for only 45 cases, and the size of these cases ranged from 0.1 to 10 cm. Nineteen (42.2%) of them were three cm or more in size and could called a giant odontomas. Except one (Sarojini BS et al.¹²), there were 73 cases in which the type was specified. The distribution was as 65.8% (n=48) CxOD, 30.1% (n=22) CpOD, and 4.1% (n=3) dilated odontomas. We have not come across a report that reveals a radiographically different situation other than the classical appearance of an odontoma.

Table 1.**Analysis of erupted odontoma cases reported in the literature**

Author	Number of cases	Age	Gender	Type of odontoma	Location	Size	Symptom	Impacted tooth
1980 Rumel A et al. ⁸	1	17	Female	Complex	Posterior mandible	-	+	Yes
1980 Birnbaum M et al. ¹³	1	68	Female	Complex	Anterior maxilla	1 cm	-	No
1985 Al-sahhar WF-Putrus ST ¹⁴	1	12	Female	Complex	Anterior maxilla	-	+	Yes
1987 Serio FG-Levy BA ¹⁵	1	41	Male	Compound	Posterior mandible	-	+	No
1989 Gomel M-Seçkin T ¹⁶	1	16	Female	Complex	Right posterior maxilla	2 cm	+	Yes
1992 Lopez-Areal L et al. ¹⁷	1	12	Female	Compound	Anterior maxilla	-	-	Yes
1992 White CS-Rogers J ¹⁸	1	32	Female	Compound	Anterior maxilla	-	+	No
1993 Nik-Hussein N-Majid Z ¹⁹	1	8	Female	Compound	Anterior maxilla	-	-	Yes
1998 Kaneko M et al. ²⁰	1	14	Female	Complex	Right posterior mandible	1.5 × 1 cm	-	Yes
1999 Botha PJ ²¹	1	27	Female	Compound	Anterior mandible	-	-	No
2000 Ragalli CC et al. ²	1	59	Male	Complex	Right posterior maxilla	3.5 cm	-	No
2001 Köymen R et al. ²²	1	20	Male	Complex	Right posterior mandible	2 × 2 cm	+	Yes
2001 Ferrer MR et al. ²³	1	22	Female	Complex	Left posterior maxilla	-	+	Yes
2003 Amado SC et al. ³	1	26	Male	Complex	Left posterior maxilla	1cm	-	Yes
2004 Litonjua L et al. ²⁴	1	17	Female	Complex	Left posterior mandible	-	+	Yes
2005 Junquera L et al. ⁷	1	23	Male	Complex	Left posterior maxilla	3 cm	-	Yes
2007 Vengal M et al. ²⁵	1	23	Male	Complex	Right posterior mandible	3.5 × 3.3 cm	+	Yes
2007 Bertolai R et al. ²⁶	1	29	Female	Complex	Posterior mandible	-	+	No
2008 Amailuk P-Grubor D ²⁷	1	15	Male	Compound	Anterior maxilla	2 cm	-	No
2008 Ilief-Ala MA et al. ²⁸	1	2	Female	Complex	Posterior maxilla	-	+	Yes
		11	Female	Complex	Right posterior mandible	2 cm	+	Yes
2009 Serra-Serra G et al. ⁹	3	26	Male	Complex	Left posterior maxilla	1 cm	-	No
		27	Male	Compound	Anterior mandible	-	-	Yes
2009 Shekar S et al. ²⁹	1	15	Female	Compound	Right posterior mandible	0.6 × 0.8 cm	-	No
2009 Vasudevan V et al. ³⁰	1	19	Female	Complex	Right posterior mandible	3 × 3.5	+	No
2010 Chandra S et al. ³¹	1	21	Female	Compound	Right posterior mandible	0.9 × 0.7 cm	-	No
2010 Yildirim U ³²	1	22	Female	Complex	Right posterior maxilla	2 cm	-	Yes
2010 Kodali RM et al. ³³	1	17	Male	Complex	Right posterior mandible	-	+	Yes
2010 Biocic J et al. ³⁴	1	10	Female	Complex	Right posterior mandible	5 × 3 cm	+	Yes
2011 Avinash Tejasvi M ³⁵	1	22	Female	Compound	Anterior mandible	0.5 cm	-	No
2011 Nisha D et al. ³⁶	1	25	Male	Complex	Right posterior mandible	3.5 cm	+	Yes
2011 Wanjari P et al. ³⁷	1	15	Male	Complex	Right posterior maxilla	-	-	Yes
2011 Carvalho CHPd et al. ³⁸	1	25	Male	Complex	Left posterior maxilla	7 cm	-	Yes
2012 Arunkumar K-Vijaykumar NG ³⁹	1	22	Male	Complex	Left posterior maxilla	4 × 3.5 cm	+	Yes
2012 Patil S et al. ⁴⁰	2	25	Male	Complex	Left posterior maxilla	0.5 cm	+	Yes
		22	Male	Complex	Right posterior mandible	0.4 cm	+	Yes
2012 Kaur GA et al. ⁴¹	1	23	Male	Complex	Right posterior mandible	3 × 3 cm	+	Yes

2012 Hegde S-Pal S ⁴²	1	27	Male	Compound	Left posterior maxilla	1.5 × 1 cm	+	Yes
2012 Mahmoodi A et al. ¹⁰	2	22	Female	Bilateral dilated	Right-left anterior maxilla	-	+	Yes
2013 Ali Azhar D et al. ⁴³	1	17	Male	Complex	Left posterior maxilla	-	+	Yes
2013 Padmanabhan M et al. ⁴⁴	1	12	Male	Complex	Left posterior mandible	0.6 × 1.3 cm	+	Yes
2013 Mehta D et al. ⁴⁵	1	15	Female	Compound	Anterior maxilla	-	-	No
2013 Ohtawa Y et al. ⁴⁶	1	10	Female	Complex	Right posterior maxilla	1 cm	-	Yes
2014 Sarojini BS et al. ¹²	2	12	Male	Compound	Anterior maxilla	-	-	No
		16	Female	-	Anterior maxilla	-	-	Yes
2014 Raval N et al. ⁴⁷	1	22	Male	Compound	Anterior maxilla	-	-	Yes
2014 Murphy C et al. ⁴⁸	1	13	Male	Complex	Right posterior maxilla	-	+	No
2014 Lone PA et al. ⁴⁹	2	15	Male	Complex	Left posterior mandible	3.5 cm	+	Yes
		40	Male	Complex	Right posterior mandible	2 × 1 cm	+	Yes
2015 Özcan G et al. ⁵⁰	2	14	Female	Compound	Left posterior maxilla	-	-	Yes
		35	Female	Compound	Anterior mandible	-	-	No
2015 Bagewadi SB et al. ⁵¹	1	22	Male	Complex	Right posterior mandible	3.5 × 4 cm	-	Yes
2015 Bereket C et al. ⁵²	1	19	Male	Compound	Left posterior maxilla	0.1 × 0.1 cm	+	Yes
2015 Kudva A et al. ⁵³	1	23	Female	Complex	Right posterior mandible	3 × 3.5 cm	+	Yes
2015 Venigalla A et al. ⁵⁴	1	6	Female	Compound	Right posterior maxilla	1 × 2 cm	+	Yes
2015 Almeida LE et al. ⁵⁵	1	17	Male	Complex	Right posterior mandible	2 cm	+	Yes
2015 Ahmed KA ⁵⁶	1	24	Male	Complex	Right posterior mandible	-	+	Yes
2015 Bhattacharya PT et al. ¹¹	2	30	Female	Complex	Right posterior mandible	3 × 2 cm	+	No
		-	Female	Complex	Right posterior mandible	4 × 3 cm	-	Yes
2016 de Pró Lizuain C et al. ⁴	1	22	Female	Complex	Left posterior mandible	3.6 × 3 cm	+	Yes
2016 Dutta SR et al. ⁵⁷	1	13	Male	Complex	Left posterior maxilla	10 cm	+	Yes
2016 Sharma G et al. ⁵⁸	1	18	Male	Dilated	Anterior maxilla	-	+	Yes
2017 Hasanuddin S- Reddy ER ⁵⁹	1	7	Female	Compound	Left posterior mandible	-	+	No
2017 Sabir H-Reddy ER ⁶⁰	1	19	Female	Complex	Left posterior mandible	1.4 × 0.9 cm	+	Yes
2017 Swaidan RF ⁶¹	1	16	Male	Complex	Left posterior maxilla	2 cm	+	Yes
2017 Deshpande N et al. ⁶²	1	18	Male	Complex	Right posterior maxilla	3 × 3.5 cm	+	Yes
2018 Katoumas K et al. ⁶³	1	23	Male	Complex	Left posterior mandible	2.5 × 2 × 2 cm	+	Yes
2018 Coşgun A et al. ⁶⁴	1	12	Female	Complex	Right posterior mandible	0.8 × 0.7 × 0.7 cm	+	No
2018 Sulabha AN et al. ⁶⁵	1	16	Female	Compound	Right anterior maxilla	-	-	Yes
2019 Zhuoying C-Fengguo Y ⁶⁶	1	14	Female	Complex	Left posterior maxilla	2.6 × 2.4 × 4.2 cm	-	Yes
2019 Honnegowda DKK et al. ⁶⁷	1	32	Female	Compound	Right anterior maxilla	1 × 1.2 cm	+	Yes
2019 Niazmand M-Mokhtari S ⁶⁸	1	18	Female	Complex	Right posterior mandible	5 × 1 cm	-	Yes
2020 Marcarini KNO et al. ⁶⁹	1	24	Female	Compound	Right anterior maxilla	-	-	Yes

Table 2.**Symptoms of erupted odontoma cases reported in the literature**

Author	Number of cases	Symptom
1980 Rumel A et al. ⁸	1	Pain, infection
1985 Al-sahhar WF-Putrus ST ¹⁴	1	Infection
1987 Serio FG-Levy BA ¹⁵	1	Tongue irritation
1989 Gomel M-Seçkin T ¹⁶	1	Pain, swelling
1992 White CS-Rogers J ¹⁸	1	Malocclusion
2001 Köymen R et al. ²²	1	Pain, swelling
2001 Ferrer MR et al. ²³	1	Pain, swelling, infection
2004 Litonjua L et al. ²⁴	1	Pain, swelling
2007 Vengal M et al. ²⁵	1	Pain, swelling
2007 Bertolai R et al. ²⁶	1	Swelling, Ludwig's angina
2008 Ilief-Ala MA et al. ²⁸	1	Bleeding
2009 Serra-Serra G et al. ⁹	1	Pain, swelling
2009 Vasudevan V et al. ³⁰	1	Pain, swelling
2010 Kodali RM et al. ³³	1	Pain
2010 Biocic J et al. ³⁴	1	Pain, swelling
2011 Nisha D et al. ³⁶	1	Pain
2012 Arunkumar K-Vijaykumar NG ³⁹	1	Pain, swelling
2012 Patil S et al. ⁴⁰	2	Swelling
2012 Kaur GA et al. ⁴¹	1	Pain, swelling
2012 Hegde S-Pal S ⁴²	1	Pain, swelling
2012 Mahmoodi A et al. ¹⁰	2	Pain, swelling
2013 Ali Azhar D et al. ⁴³	1	Pain
2013 Padmanabhan M et al. ⁴⁴	1	Pain, swelling
2014 Murphy C et al. ⁴⁸	1	Infection
2014 Lone PA et al. ⁴⁹	2	Pain, swelling
2015 Bereket C et al. ⁵²	1	Swelling
2015 Kudva A et al. ⁵³	1	Pain, swelling
2015 Venigalla A et al. ⁵⁴	1	Pain, difficult in mouth opening
2015 Almeida LE et al. ⁵⁵	1	Infection
2015 Ahmed KA ⁵⁶	1	Infection
2015 Bhattacharya PT et al. ¹¹	1	Pain
2016 de Pró Lizaín C et al. ⁴	1	Swelling
2016 Dutta SR et al. ⁵⁷	1	Pain, swelling
2016 Sharma G et al. ⁵⁸	1	Pain
2017 Hasanuddin S- Reddy ER ⁵⁹	1	Pain
2017 Sabir H-Reddy ER ⁶⁰	1	Pain, swelling
2017 Swaidan RF ⁶¹	1	Cellulitis
2017 Deshpande N et al. ⁶²	1	Swelling
2018 Katoumas K et al. ⁶³	1	Swelling
2018 Coşgun A et al. ⁶⁴	1	Pain
2019 Honnegowda DKK et al. ⁶⁷	1	Pain

DISCUSSION

Various theories have been proposed regarding the process erupting of an odontoma into the oral cavity.⁹ Considering the eruption of a tooth, the possible mechanism of the eruption of an odontoma is assumed to be the force of the impacted tooth that is located under the odontoma.^{7,30} However, the process seems to be different from tooth eruption due to the lack of the periodontal ligament and root, so it may be inaccurate to say it is an eruption. In cases where the impacted teeth are not observed, the reasons could possibly be the increasing size of odontoma, bone resorption, the sequestration of overlying bone, remodeling of the jaws or reactive growth of the capsule that surrounds the odontoma.^{2,25} The immunohistochemical investigations have suggested that the cellular activity involving the reduced enamel epithelium and the follicle is associated with the eruption. However, a follicle is needed indirectly for the eruption. The follicle provides both the conductance and chemoattraction for osteoclasts that will lead to eruption.⁵³ It means, the possible etiology of the eruption is multifactorial, and it has not been so clear until today.

In the present report, ages of the first and second patients were 21 and 23, respectively which overlap with previous reports, but 80 (case 3) was an extremely late age for an erupted odontoma, and no such case has been reported in the literature before. All our three patients were males. In two cases erupted odontoma were localized in mandible and in one was in maxilla. The reason why our findings about sex and jaw involvement were not in accordance with the literature may be the small sample size.

Clinical indicators of odontoma may include the retention of deciduous teeth, the non-eruption of permanent teeth, pain, the expansion of cortical bone and tooth displacement. Although impacted odontoma is usually asymptomatic, as an exceptional case, erupted odontoma has more serious complications like pain, swelling, and inflammation of adjacent soft tissues or suppuration related to infection.^{7,24} Bertolai et al.²⁶ reported a case of Ludwig's angina associated with an erupted odontoma. In some cases, facial asymmetry²⁵, halitosis¹⁶, malocclusion^{17,19}, and recurrent infection were recorded.¹⁴ When an odontoma erupts, pain and swelling are the most common symptoms.⁵³ In this report, two of the three cases were symptomatic. The first case presented pain and swelling, and the second swelling and purulent exudate. First of all, a symptomatic treatment was applied to our patients who applied to the dentomaxillofacial radiology department with symptoms such as pain, swelling or prulent exudate. After their oral health conditions were stabilized, they were referred to the oral and maxillofacial surgery department. These symptoms were in accordance with the literature.

Impaction and/or altered eruption of the teeth located under odontoma occur because of the obstruction the eruptive trajectory.^{2,9,25} Of 37–87% patients with odontoma show delayed eruption of a permanent tooth.⁴⁶ The probability of this phenomenon rises to 86% in erupted odontomas.⁴⁶ As suggested by Junquera et al.⁷ that most of the erupted odontomas are related to an impacted tooth, the eruptive force of this tooth can play a major role in the eruption of the odontoma. However, Ragalli et al.² suggested that the reactive growth of circumambient capsule of the odontoma may contribute to the eruption. In this report, the first and second cases were associated with an impacted tooth. The eruptive force of these impacted teeth may have played an important role in odontoma eruption. The third case was not associated with an impacted tooth. However, the denture stimulation may have created an eruptive force.

Radiographically odontomas have characteristic features that depend on their developmental stage and the degree of mineralization; the first stage as a radiolucency due to lack of calcification, the intermediate stage as a mixed (radiolucent-radiopaque) lesion because of partial calcification, and at the third stage, the lesion usually appears as a radiopaque mass surrounded by a radiolucent rim that histologically corresponds to connective tissue.⁷⁰ In addition, erupted odontomas exhibit perforation on the alveolar cortical bone. The relation with the oral cavity may cause a peripheral radiolucency as a result of possible inflammation. As the surgical extraction was recommended as soon as they were detected for erupted odontomas, CBCT images can be useful in order to determine the certain of their size and localization in the jaw.⁷¹ So this imaging modality is also valuable for better surgical planning of the impacted lesions because of the reduced risk of damage to surrounding anatomical structures.⁷² In addition, the same applies for impacted teeth associated with odontomas as in our first and second patients. In our three cases, we observed radiopaque masses surrounded by a radiolucent rim compatible with third stage radiographic appearance. Clinical and radiological signs of inflammation in the adjacent tissues were present in the second and third cases.

To prevent cystic degeneration and other acute symptoms, removal of the mass and enveloping soft tissue after the curettage is the common treatment choice. However, there is no general agreement on the best management approach for the impacted tooth associated with odontoma.^{24,73} The treatment options for impacted tooth comprises surgical extraction, fenestration, and posterior orthodontic traction or simple periodic follow-up with clinical and radiological controls to evaluate its course.^{3,74,75} Since treatment results are not widely shared in many cases in the literature, we had to state the general trend. The

surgical operation was performed in the present three cases. In the first and second cases, there were impacted teeth, and these were extracted simultaneously with odontomas.

Odontomas have limited growth potential, and the largest dimension they reach is usually up to 3 cm.⁷⁶ However, in some rare cases, large odontoma⁵¹, also known as giant odontoma⁷⁷, which has a diameter exceeding 3 cm, may be observed on the radiograph.⁷⁶ In a study by Miki et al.⁷⁸, it was reported that only 4.3% of odontomas were to be larger than 3 cm. Only our first patient had a giant odontoma (33.3%) and this rate was close to that of the literature.

It was stated that CpOD and CxOD were not superior to each other in terms of the incidence of erupted odontomas.^{9,53} All of our three cases were CxOD, and this was in line with the published cases in the literature.

Odontomas can also manifest as a part of some syndromes as Gardner syndrome, Hermann syndrome, familial colonic adenomatosis, and basal cell nevus syndrome.¹⁶ However, in the literature, there was no report for an erupted odontoma related to a syndrome. In the three present cases we presented, also there was no history a syndrome.

CONCLUSIONS

We examined three erupted odontoma cases and reviewed published reports about this pathological entity in the literature. The findings we reached as a result of the literature review showed us these:

1. Erupted odontomas were mostly observed in young patients.
2. They were slightly more common in females.
3. Their localization showed a slight predilection for the maxilla.
4. Clinically, the erupted odontomas were usually symptomatic and the dominant features were pain, swelling and infection.
5. The cases were often associated with an impacted tooth.
6. The treatment for the mass was certainly a surgical approach but there was no consensus for the underlying impacted tooth treatment.
7. A little less than half of the erupted odontomas can be larger than three cm (giant odontoma).
8. Their histopathologic type was generally diagnosed as CxOD.

The dentists should be aware of clinical features, radiographic manifestations, and treatment options of this benign lesion to avoid undesirable outcomes. The early diagnosis that follows with an appropriate treatment approach could prevent probable complications.

Ethical Approval: The paper described has been carried out in accordance with Declaration of Helsinki.

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