



Panoramic radiography features of complex odontoma in impacted teeth: a scoping review

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ABSTRACT

Objectives: This review article is aimed to determine panoramic radiograph images of complex odontoma images involving impacted teeth.

Review: This study is a scoping review consisting of English or Indonesian articles of complex odontoma in impacted teeth and published in 2010 – 2021. The article search databases used were PubMed, Science Direct, EbscoHost, and Clinical Key with the keyword “(((Complex Odontoma) AND Impacted teeth) AND panoramic radiograph).” The selected articles were screened by checking the publication year, duplicating articles, reading the titles and abstracts, and the entire article's contents. The total search results for articles based on keywords obtained were 621 articles, then 11 articles were

used. In all articles covered, the number of impacted teeth is 45, dominated by 32 maxillary and mandibular molars. The majority of lesions formed on the maxillary and mandibular posteriors were not associated with other abnormalities. The majority of the lesions affect the growth of the surrounding teeth and extend to the surrounding jawbone.

Conclusion: Panoramic radiographs of Complex Odontoma involving impacted tooth in the form of a homogeneous radiopaque lesion with an oval or irregular shape with a lesion density more significant than bone and surrounding tissue. A well-defined radiolucent lesion surrounds this radiopaque lesion in the form of a connective tissue capsule.

Keywords: Complex odontoma, impacted teeth, panoramic radiograph

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INTRODUCTION

Odontoma is one of the most common types of odontogenic tumors.¹ The term odontoma was first introduced by Paul Broca in 1867.² Odontoma is an odontogenic tumor formed due to impaired development of the epithelium and mesenchymal cells of the tooth-forming tissue.³ Odontoma cases occur about 22-67% of all odontogenic tumor cases globally and often involve impacted teeth in roughly 59.1% of all odontoma cases.^{4,5} Epidemiology of odontoma occurs in Caucasians about 65% and 5.3-11.6% occurs in the population of India.⁶ The development of odontoma lesions is non-aggressive, asymptomatic, and its growth can affect the surrounding tissue.⁷

WHO in 2005 odontomas classified odontomas into two types, namely compound and complex odontomas.⁸ Compound odontomas consist of normal tooth tissue arranged in a regular pattern so that the image of the lesion is like a large number of small tooth structures.⁹ Complex odontomas are irregular masses of calcified tooth tissue surrounded by a connective capsule tissue and mature odontogenic epithelium.^{10,11} Compound odontoma cases occurred in 63.6% of the maxillary

anterior and 36.4% in the posterior lower jaw.¹² Men and women have the same potential for odontoma cases.⁷ The incidence of compound odontomas is around 9-37% under 20 years old, and complex odontoma cases are about 5-30% at 20-30 years old.¹² Odontoma cases can occur at any age, especially in the second decade.¹³

Panoramic radiography has a wide field of view to visualize the two arches, making it practical for viewing odontoma cases.¹⁴ Buyukcavus et al. said that panoramic radiographs are used as routine radiographic examinations to consider the appearance of odontomas.¹⁵ Compound Odontoma radiographic features in radiopaque lesions resembling dental denticles arranged in a regular pattern with clear and firm boundaries and surrounded by radiolucent lesions.¹⁶ Radiographic examination of complex odontomas is well-defined radiopaque lesions surrounded by radiolucent zone.¹³ The shape of the lesion is irregular with a corticated margin and occurs in varying sizes. Growth of complex odontomas often involves unerupted permanent teeth, erupts in the mouth, extending to the maxillary sinus, nasal cavity, and

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floor of the orbit.¹⁷

The irregular shape of the complex odontoma lesion is still difficult to distinguish from other radiopaque lesions in determining the radiographic diagnosis.¹⁸ Deborah et al., in their study, there was a wrong radiographic diagnosis of Florid Cemento-osseous Dysplasia to complex odontoma.¹⁹ Research by Fatemeh et al. sees the image of a foreign body in the form of pulpotomy material, namely ZOE, buried due to tooth resorption. The radiopaque lesion resembled a complex odontoma, resulting in a misdiagnosed radiopaque.²⁰ This was due to not paying attention to the characteristic radiographic features of a complex odontoma with other radiopaque lesions. Barrera et al. said that the calcification of odontoma could be seen through radiographic examination.¹⁷ The initiation stage is the radiolucent lesion due to lack of calcification. The partial calcification stage is an intermediate radio lesion. The final stage is a radiopaque lesion surrounded by a radiolucent ring lesion.²¹ This final stage of calcification is commonly wrong to diagnose.

Based on the radiographic diagnosis error description, the authors are interested in researching the panoramic radiographic image of complex odontoma involving impacted teeth through the Scoping Review method. This research is aimed to determine the appearance of a complex odontoma involving an impacted tooth through panoramic radiography by reviewing the literature discussing the case. This study can be used as a guideline in determining the description of a complex odontoma involving an impacted tooth on panoramic radiographs as a supporting examination in determining the radiographic diagnosis of the lesion.

REVIEW

This research is qualitative descriptive research with Scoping Review method. The sample used was articles with inclusion criteria discussing cases of complex odontoma involving impacted teeth, articles in English or Indonesian, and published in 2010-2021. Articles were obtained by searching through the Pubmed, Science Direct, EbscoHost, and Clinical Key databases. The search strategy uses "Boolean Operators" with the keywords "(((Complex Odontoma) AND Impacted teeth) AND panoramic radiograph)." Data extraction was carried out using Preferred Reporting Items for Systematic Review and Meta-analysis Scoping Review (PRISMA-Scr). The research instruments used were the internet, Microsoft Word, and scientific article search engines. This review was conducted from January – March 2021. The research topics were determined through research questions using PICO: Population, namely patients with a diagnosis of complex odontoma involving impacted teeth, Intervention, which was a panoramic radiograph, there was no comparison in this study, and Outcome in the form of determining the diagnosis of complex odontoma on impacted

teeth through panoramic radiographs of the location, size of the lesion, the typical appearance of the lesion, and involvement with the lesion or other abnormalities.

Assessment of article quality is based on the Level of evidence and Scimago Journal Rank criteria. Level of evidence is the assessment of scientific evidence based on the study design used through the Strength of Recommendation Taxonomy (SORT) level. Scimago Journal Rank is a scientific evidence assessment system based on the number of citations used by other scientific articles in a certain period. Data analysis was carried out using the thematic analysis principle, namely identifying and analyzing themes or problems from various studies and then interpreting the conclusions from these themes. Tables and narratives will present the data.

SEARCH AND SELECTION OF STUDIES

After being selected from a predetermined search engine, the search results through keywords were 621 articles, consisting of 39 articles from Pubmed, 234 articles from Science Direct, 273 articles from Ebsco Host, and 75 articles from Clinical Key. The filtering of articles based on the year published 2010-2021 is 136 articles. The second screening is selecting duplicate articles so that we obtain the 118 articles. The third screening was carried out based on the title and abstract so that 31 articles were accepted. Furthermore, 11 articles were obtained by examining the entire article's contents to be used as research samples. The article search process is shown in Figure 1.

STUDY CHARACTERISTICS

Table 1 shows the characteristics of the studies used in the selected articles. The type of study design from the articles obtained is a retrospective cohort of 3 articles^{22,23} and 8 case report articles.²⁴ Based on the Level of evidence assessment, the articles used were at level 2 and level 3. There was 1 article conducted in Greece, two articles undertaken in Turkey, one article in Brazil, four articles in India, one article in Korea, one article was done in Romania, and one article conducted in Indonesia.

Table 2 shows the characteristics of the participants that the cases of Complex Odontoma involving impacted teeth mainly were women. There is one article with a participant age range of 2-13 years²², two articles with a participant age range of 12 years^{27,32}, one article reports on participants aged 14-58 years²⁴, two articles contain participants aged 22 years.^{28,30} Each article reports on participants aged 23, 24, 28, and 42 years^{25,26,29,31}. There are no articles that state the involvement of other abnormalities in these participants. Eight articles are not accompanied by the duration of the complaints of Complex Odontoma lesions. One article described one year of complaint, 1 article for one month, and four days in 1 article. Most of the impacted teeth involved occurred in the maxillary and mandibular molars.

Table 3 shows the characteristic panoramic radiographic appearance of Complex Odontoma

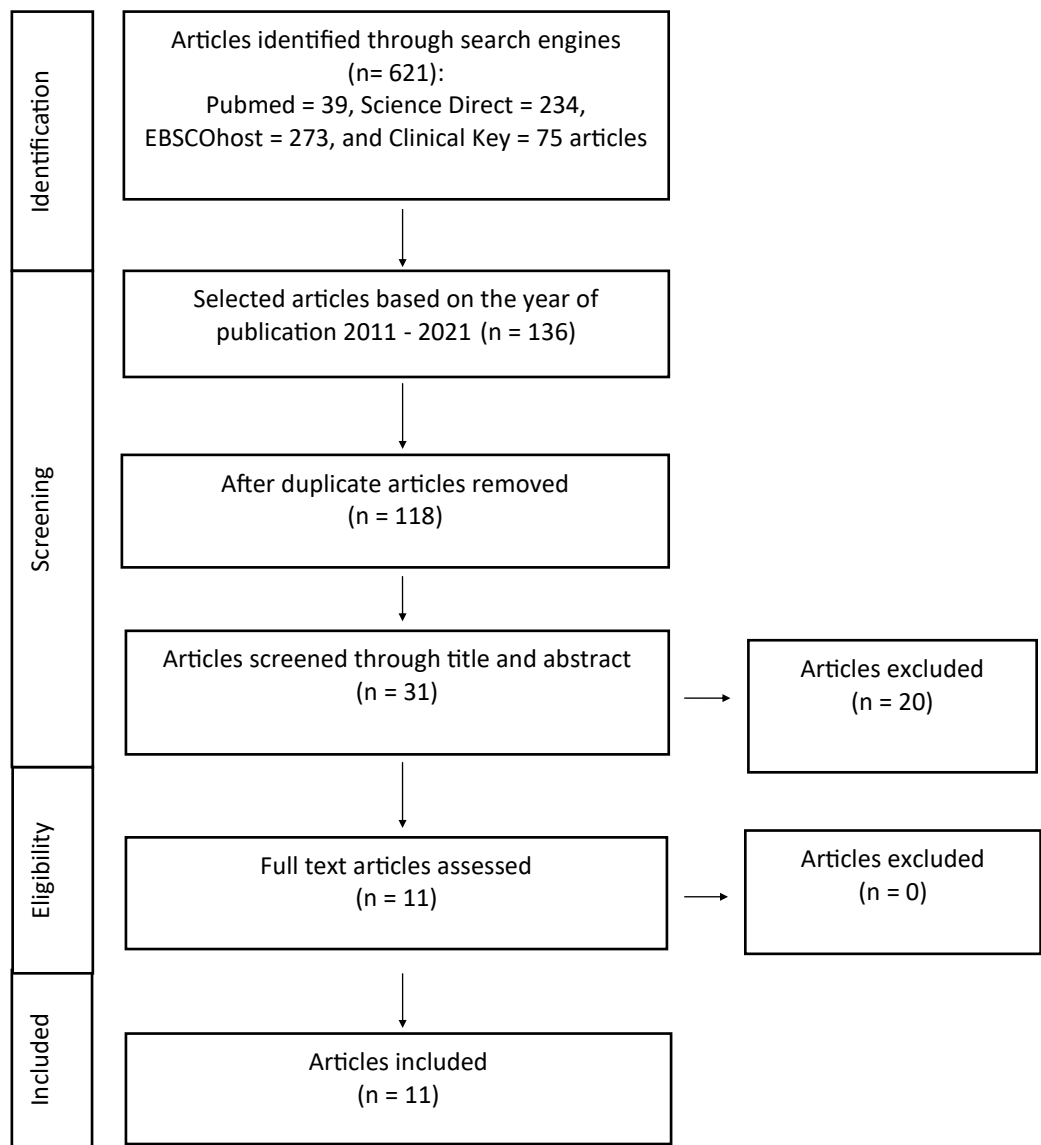


Figure 1. Search results for articles according to PRISMA flow diagram

lesions in impacted teeth. Based on the results obtained, the characteristics of Complex Odontoma lesions are homogeneous radiopaque lesions surrounded by a radiolucent zone. One article had round lesions, seven had irregular lesions, two had oval lesions, and one had multilocular lesions. There is one article with lesions penetrating to the maxillary sinus. One article with eight samples causes several impacts: malposition teeth, delayed eruption of permanent teeth, and lacerations. Two articles with lesions were causing root resorption of surrounding teeth. One article has a lesion extending to the coronoid process and causing a shift in the mandibular canal, and 1 article with an expanding lesion causing thinning of the cortical bone.

DISCUSSION

Based on the results of the analysis of articles, the panoramic radiographic appearance of Complex

Odontoma involving impacted teeth was obtained in the form of a homogeneous radiopaque lesion with oval or irregular shape and bordered by a radiolucent lesion with a density of the resulting radiopaque lesion greater than the teeth and bone. This radiopaque appearance consists of hard tooth-forming tissue, namely enamel, dentin, and cementum, but morphologically it does not resemble the shape of a tooth.^{25,30,31} This lesion shows a tubular wall of dysplastic dentin surrounding the central core in the form of an oval-shaped space formed by the decalcification of mature enamel.²⁷ Between these walls, there are irregular curved slits in the form of an enamel matrix that produces an epithelium and connective tissue capsule. The radiographic image is a radiolucent lesion.²⁶⁻²⁸

The development of complex odontoma lesions greatly affects the surrounding tooth tissue, significantly disrupting eruption and impaction of teeth. Research by Avsever et al.²⁴ and Maltagliati et al.³³ stated that 70% of the growth of complex

odontoma was very influential with impacted teeth. The three retrospective cohort studies in this study found that complex odontoma cases involving impacted teeth were 72%, 50%, and 45.4%, respectively. Studies by Satish et al.³⁴, da Silva et al.⁵, and Pippi³⁵ found that approximately 83% of cases of complex odontoma occurred involving the maxillary and mandibular molars. This statement is consistent with the article covered that the majority of teeth involved were 32 molars of the 45 total impacted teeth that were affected due to the development of the lesion.

Complex Odontoma lesions are known indirectly by accidental radiographic examination. The development of complex odontoma lesions

that are getting bigger can cause swelling without being accompanied by pain or pain for the sufferer. Panoramic radiographic examination of articles covered^{22,25,29,31} shows that the lesion involving the impacted tooth is getting bigger and cortical bone expansion occurs and causes shifting of the surrounding teeth and facial asymmetry. This statement is similar to the research of Jagadish et al.³⁶ and Buyukcavus et al.¹⁵ that the development of a large complex odontoma can cause swelling in the area of growth of the lesion, resulting in facial asymmetry. Other effects from the lesion in this study were malposition and dilaceration of adjacent teeth, extension to the maxillary sinus, pushing impacted teeth into orbit, and root resorption of

Table 1. Search results for articles according to PRISMA flow diagram

Author	Year	Title	Study Design	Country	Q	Reference
Iatrou et al. ²²	2010	Retrospective analysis of the Characteristics, Treatment, and Follow-up of 26 Odontoma in Greek Children	Retrospective Cohort	Greece	Q2	22
Bereket et al. ²³	2015	Complex and Compound Odontoma: Analysis of 69 cases and a rare case of erupted compound odontoma	Retrospective Cohort	Turki	Q3	23
Avsever et al. ²⁴	2021	The Prevalence, anatomic locations, and characteristics of the odontomas using panoramic radiographs	Retrospective Cohort	Turki	Q1	24
Bueno et al. ²⁵	2019	Unusual Giant Complex Odontoma	Case Report	Brazil	Q3	25
Talari et al. ²⁶	2012	Fusion of Complex Odontoma with Permanent Mandibular Molar	Case Report	India	Q2	26
Nammalwar et al. ²⁷	2018	Rare Case of Bilateral Complex Odontoma Associated With Mandibular Bicuspid	Case Report	India	Q1	27
Kamala et al. ²⁸	2011	Complex Odontoma associated with permanent teeth	Case Report	India	Q4	28
Park et al. ²⁹	2018	Giant Complex Odontoma in the Posterior Mandible	Case Report	Korea	Q2	29
Calin, D.L. ³⁰	2018	Radiographic Characteristics of Complex Odontoma Located in The Poster Region of Upper Jaw	Case Report	Romania	Q2	30
Nasution et al. ³¹	2018	Analisis Gambaran Complex Odontoma pada Radiografi Panoramik	Case Report	Indonesia	N/A	31
Shetty et al. ³²	2013	Complex Odontoma associated with Maxillary Impacted Central Incisor	Case Report	India	Q2	32

Table 2. Characteristics of participants

	Participant Characteristics	Articles	References
Number of participants	1 – 5 participants	8	24 - 31
	6 – 10 participants	1	22, 23
	11 – 15 participants	1	21
Gender	Men	5	24 – 27, 29
	Women	3	28, 30, 31
	Men and women	3	21 – 23
Age	Children (2 – 10 years old)	1	21
	Teenage (11 – 19 years old)	2	26,31
	Adult (20 – 60 years old)	8	22 – 25, 27 – 30
Time	4 days	1	27
	One month	1	25
	One year	1	24
	N/A	8	21-23, 26, 28-31
Involvement of other abnormalities	N/A	11	21-31
Number of teeth			
Impacted teeth involved	Anterior maxilla	6	21, 31
	Anterior mandible	4	21
	Maxillary premolar	N/A	N/A
	Premolar mandible	2	26
	Maxillary molar	12	21, 23, 29
	Molar mandible	21	21, 22, 24, 25, 27, 28, 30

surrounding teeth.

Several previous studies have found a relationship between the patient's age, which increases the size of the lesions that form. In addition, most Complex Odontomas are formed in elderly patients.^{33,37} This statement is different from this research in that young patients found large lesions and older patients found small lesions. There is no specific age preference for the incidence of complex odontoma. Still, Kodali et al.²¹ and Jadav et al.³⁸ said that the average case of Complex Odontoma occurred in the second decade of life.

The formation pattern of Complex Odontoma lesions has no variation, and the form of lesions is an irregular pattern. All articles included found lesions that formed resembling irregular amorphous masses in the form of irregular tooth-forming enamel and dentin tissue. These tissues are derived from the developmentally impaired tooth or the impacted tooth involved. The radiolucent ring is derived from the epithelium of odontogenic and surrounding soft tissue. The studies of Zhuoying et al.³⁹ and Matsuo et al.⁴⁰ found the lesion shape on panoramic radiographs similar to this study.

Involvement of other abnormalities may occur

with complex odontoma formation, but this is very rare. This study did not find any other abnormalities involved in the formation of complex odontoma lesions. A complex odontoma lesion in the articles covered is derived from an abnormality of the tooth-forming tissue. However, Meddeb et al.⁴¹ and Wanjari et al.⁴² found cases of complex odontoma formation associated with dentigerous cysts. This result happens because the complex odontoma lesions that are formed can interfere with tooth eruption. It will cause the development of cystic lesions from the tooth epithelium. However, there was no significant difference in the panoramic radiographic appearance of the complex odontoma lesion involving the cystic lesion.

In diagnosing Complex Odontoma lesions using panoramic radiographs, it is necessary to know the differential diagnosis with other similar radiopaque lesions, such as Osteoma, Periapical Cemental Dysplasia, Ameloblastic Fibro-Odontoma, and Cementoblastoma.²⁴⁻²⁶ Osteoma is a well-defined radiopaque lesion formed from sclerotic bone on the trabeculae, usually developing on the posterior lingual of the mandible. Osteomas in the late stages of development are very easily confused with

Table 3. Characteristics of the interpretation of complex odontoma lesions involving impacted teeth

Internal Structure	Border	Shape	Size	Surrounding Tissue	Location
Radiopaque	Radiolucent	Round	Average diameter: 1-3 cm	Impacted teeth (11, 12, 23, 26, 27, 33, 37, 42, 43, 47, 61, 62, 74, 75) Penetrate to maxillary sinus	Three cases in the maxillary anterior region, two cases in the posterior maxilla, three cases in the anterior mandible, and three cases in the posterior mandible
Radiopaque	Halo-radiolucent	Irregular	N/A	Impacted mandibular second and third molar	Lower molar region
Radiopaque	Radiolucent	Irregular	N/A	Average of impacted teeth: maxillary molar Dental malposition Delayed eruption of permanent teeth Dilaceration of surrounding teeth Tooth root resorption	12,5% anterosuperior region and 50% posteroinferior region
Radiopaque	Radiolucent	Irregular	8 cm	Impacted tooth 38 Extension of the lesion to the coronoid process Displacement of the mandibular canal	Left posterior mandible
Radiopaque	Radiolucent	Oval	1,5 x 1 cm	Tooth 47 partially erupted due to pressure	Right posterior mandible
Radiopaque	Radiolucent with corticated border	Irregular	N/A	Impacted teeth 34 dan 44 Distal root apex resorption teeth 74 dan 84	Ramus mandible
Radiopaque	Radiolucent	Irregular	1 x 0,7 cm	Tooth 38 is prevented to eruption	Left posterior mandible
Radiopaque	Radiolucent	Irregular	30 x 25 x 20 mm	Tooth 38 displacement Expansion and thinning of buccal cortical bone	Right posterior mandible
Radiopaque	Radiolucent	Irregular	4,5 x 4,5 cm	Displaced teeth 27 and 28 into orbit	Left posterior mandible
Radiopaque	Radiolucent	Oval	N/A	Impacted teeth 37 and 38 due to being restrained by radiopaque lesions	Left posterior mandible
Radiopaque	Radiolucent	Multilocular	2 cm	Impacted teeth 21	Left anterior mandible

complex odontomas. Osteomas often occurs in people over 30 years of age and often involve the roots of the teeth.^{29,43} The appearance of Periapical Cemental Dysplasia resembles that of a Complex Odontoma lesion, but it is multiple and located in the periapical area of the tooth.¹⁴ Ameloblastic Fibro-Odontomas consist of radiopaque lesions with well-defined radiolucent borders and frequently occur at a young age.²⁹

Cementoblastoma are radiolucent and radiopaque lesions with well-defined borders surrounded by a halo-radiolucent zone in a wheel-spoke pattern and usually occur in the roots of premolars and molars mandible.³¹

Based on the articles used in this study, there are limitations to the study design used, namely only retrospective cohort studies and case reports. There are still difficulties finding better quality

articles based on the Level of Evidence and Scimago Journal Rank assessment. This study did not find articles on Complex Odontoma involving impacted teeth accompanied by other abnormal conditions. They could not see variations in the panoramic radiographic appearance of the lesion. Other abnormalities engaged with the growth of Complex Odontoma were found in previous studies, namely Dentigerous Cyst^{41,42}, Supernumerary Teeth³⁵, Ossifying Fibroma⁴⁰, Calcifying Cystic Odontogenic Tumour⁴⁴, and Orthokeratinizing Odontogenic Cyst⁴⁵. The study was not included in the inclusion criteria of this study because it did not involve impacted teeth in their growth and was not found in any search engine that has been set.

CONCLUSION

Panoramic radiographs of Complex Odontoma involving impacted tooth in the form of a homogeneous radiopaque lesion with an oval or irregular shape with a lesion density more significant than bone and surrounding tissue. A well-defined radiolucent lesion surrounds this radiopaque lesion in the form of a connective tissue capsule.

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FOOTNOTES

All authors have no potential conflict of interest to declare for this article.

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