CASE REPORT

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Exploring the radiographic distinctions between ewing's sarcoma and malignant and fibrous ameloblastoma: a clinical case report and review

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ABSTRACT

Objectives: Ewing's sarcoma and fibrous ameloblastoma are distinct entities that can present similarly in imaging studies, posing challenges in accurate diagnosis. This report aims to elucidate the radiographic features that differentiate these two lesions.

Case Report: The first case was a 7-year-old boy who came to the radiology installation accompanied by his mother for a panoramic radiography examination. The patient complained of swelling on both sides of the lower jaw for 1.8 years. The second case was an 8-year-old boy who came with a referral for a panoramic radiography examination due to swelling on the left side of the lower jaw for 6 months. The first case was radiographically determined as Differential Radiodiagnosis Ewing sarcoma and malignant ameloblastoma, and the second case was radiographically determined as fibrous ameloblastoma with differential Radiodiagnosis malignant ameloblastoma. The differential diagnosis between Ewing's sarcoma and fibrous ameloblastoma is critical due to their distinct treatment protocols and prognoses. This case underscores the importance of comprehensive imaging evaluation and correlating clinical findings to achieve an accurate diagnosis.

Conclusion: This case report contributes to the understanding of radiographic distinctions among Ewing's sarcoma, fibrous ameloblastoma, and malignant ameloblastoma. Enhanced awareness of these differences may improve diagnostic accuracy and inform treatment strategies. This abstract provides a succinct overview of the case report, highlighting essential elements such as background information, case details, discussion points, and conclusions relevant to radiographic distinctions between the two conditions.

Keywords: *Ewing's sarcoma, malignant ameloblastoma, fibrous ameloblastoma, panoramic radiograph*
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INTRODUCTION

Ewing's sarcoma is a rare and aggressive malignant tumor primarily affecting bone, but it can also develop in the surrounding soft tissues, particularly in children and young adults. While it most commonly occurs in long bones and the pelvis, its presence in the jaw, specifically the mandible, is uncommon but clinically significant. Ewing's sarcoma is the second most common bone tumor of the jaw, frequently occurring in patients aged between 5 and 25 years.[1] Ewing sarcoma is the second most common primary bone malignancy in adolescents and young adults, with a median age of 15 years, and accounts for less than 5% of all soft tissue sarcomas. There are more than 200 cases per year in the United States. The incidence of Ewing sarcoma in the United States was 2.93 per million between 1973 and 2004. The peak incidence is between ages 10 and 15, with approximately 30% of cases occurring in children under 10 and another 30% in adults over 20. There is a male predominance, with a male-to-female ratio of 3:1. Whites are much more frequently affected than Blacks, Asians, Hispanics, or Africans. This significant racial discordance has yet to be explored. The actual incidence of Ewing sarcoma in older populations is unknown.[2,3]

It is very difficult to differentiate Ewing's sarcoma, ameloblastic malignancy, and fibrous ameloblastoma because they have similar characteristics. Malignant ameloblastoma is a rare and aggressive malignant tumor that primarily affects the jaw, particularly the mandible. According to the World Health Organization malignant ameloblastoma or ameloblastic malignance is "a neoplasm in which the features of an ameloblastoma are shown by the primary growth in the jaws and by any metastatic growth".[3] Differentiating ameloblastic malignance from ameloblastoma and malignant ameloblastoma in a patient presenting with a suspicious jaw tumor is a

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challenge due to overlapping clinical features, inconclusive cytology/biopsy report, and different management approaches.[3,4]

Fibrous ameloblastoma is a benign odontogenic tumor that arises from the epithelial remnants of the dental lamina or tooth germ. It is considered a locally aggressive tumor with a potential for recurrence. This variant is relatively rare compared to other types of ameloblastomas and typically accounts for a smaller percentage of cases. The fibrous ameloblastoma is commonly referred to as desmoplastic ameloblastoma. This variant of ameloblastoma is characterized by its extensive fibrous stroma and unique histopathological features. Originates from a benign odontogenic tumor commonly found in the jawbone, derived from the epithelial remnants of odontogenic cysts and the epithelium of the enamel organ. Clinically, it is seen as an aggressive odontogenic tumor, often asymptomatic and slow-growing, with no swelling. About 80% occur in the mandible, especially the third molar region, and 20% in the maxilla. Radiographically, fibrous ameloblastoma lesions appear radiolucent, either multilocular or unilocular, without calcification in the radiolucent area in another case.[5,6]

In this case study, we will discuss two cases that have almost the same radiographic characteristics but have differences in radiodiagnosis. The first case will examine the findings related to Ewing sarcoma, while the second case involves a suspected instance of fibrous ameloblastoma, with the differential diagnosis for both cases being malignant ameloblastoma.

These two cases will be shown and discussed from the panoramic radiographic view. Panoramic radiography is one of the early diagnostic support examinations that is usually chosen and used by practitioners because it is easy, fast, and non-invasive in detecting pathological abnormalities with a fairly wide field of view. Many early diagnoses can be detected through radiography, although further supporting examinations are needed. Treatment may change due to variations in radiological images, anatomical location, and clinical behavior of the tumor. Other important factors depend on the age and general health condition of the patient.[7]

CASE REPORT

CASE 1

A 7-year-old child and his mother arrived at the RSGM installation with a recommendation for a panoramic examination related to the boy's complaint of swelling on both his left and right faces since he was 1.8 years old. Before reaching its current size, the swelling was steady and progressive (Figure 1). An extraoral examination showed edema, parasthesias, facial asymmetry, and sporadic pain. The left and right mandibular ramus had inferior boundaries, while the left and right TMJ areas had superior borders. An intraoral examination revealed a one-finger mouth opening and the evident enlargement of the cheek and dental mucosa on the left and right sides, beginning with tooth 75 in the direction of the left ramus and tooth 84 in the direction of the right ramus.

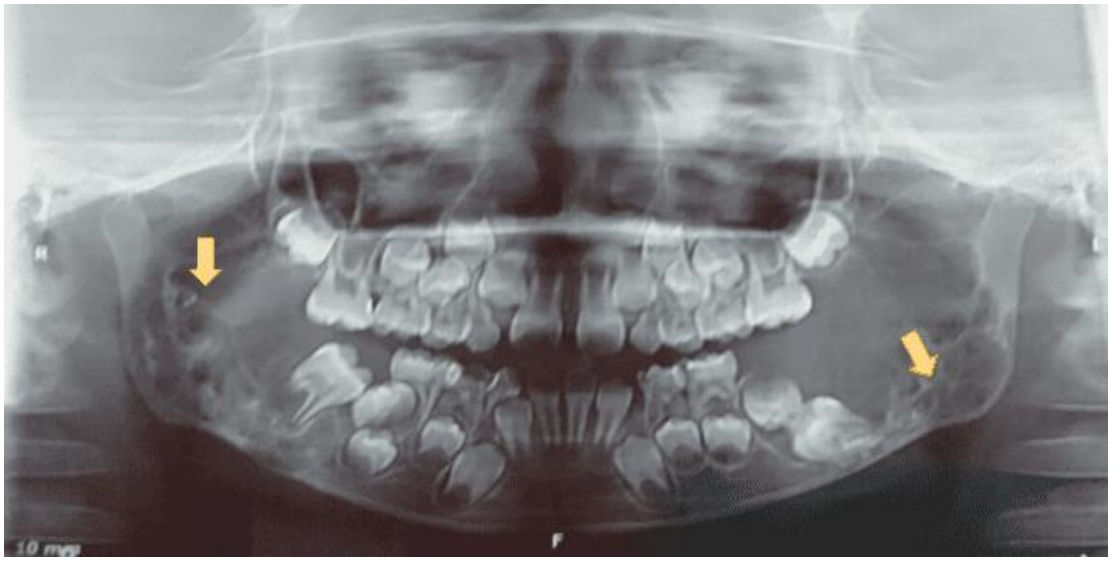

Figure 1. Based on panoramic radiographs, the characteristics appear as ill-defined margins with multiple small radiolucencies. This can manifest as a "moth-eaten" appearance due to the destruction of bone and presence of multiple irregular radiolucent areas within the mandible (Yellow Arrow).

On panoramic radiographs, Ewing's sarcoma usually appears as a radiolucent lesion. This indicates that due to bone deterioration, the tumor-affected area appears darker than the surrounding bone. The diagnosis is Ewing's Sarcoma based on the results of the intraoral, extraoral, and clinical investigations. Ameloblastic malignancy or ameloblastic carcinoma are used as differential Radiodiagnosis for Ewing's sarcoma.

Table 1. Radiograph Interpretation of Figure 1

No	Radiograph Characteristic	Radiograph View
1	Location	Lesions present on both sides: right and left Right: Superior at the neck of the coronoid process, extending to the distal of tooth 85 inferior border at the angulus and mandibular border. Soft tissue lesion enlarging to reach the occlusal of teeth 54 and 55. Left: Superior to the left TMJ area, inferior border on the mandibular border, ramus involving the left mandibular angulus.
2	Size	Approximately 6x5 cm (right lesion) dan 6x6 cm (left lesion)
3	Border and Sharpness	Ill-defined margin, non-corticated
4	Internal Structure	Multiple radiolucent with “moth-eaten” appearance
5	Bone Matrix	No calcification (-), soft tissue (+)
6	Surrounding Effect	Destroy the alveolar bone on left and right lesion, with periosteal reaction on right lesion
7	Periosteal Reaction	Only on right side, showing periosteal reaction on superior border of coronoid process and inferior border of mandible
8	Suspected Radiodiagnosis	Ewing’s sarcoma
9	Differential Radiodiagnosis	Malignant ameloblastoma

CASE 2

Together with his mother, an 8-year-old boy arrived at the RSGM installation with a recommendation for a panoramic examination related to a complaint of swelling in the left lower face that had been present for six months. The swelling increased gradually until it reached its current magnitude (Figure 2). An extraoral examination showed parasthesia, smooth and hard skin, no discomfort, and swelling in the left mandible. An intraoral examination revealed that the left gingiva was enlarged from the mandibular symphysis region, posterior to the left mandibular corpus. It was determined that the affected tooth had luxation.

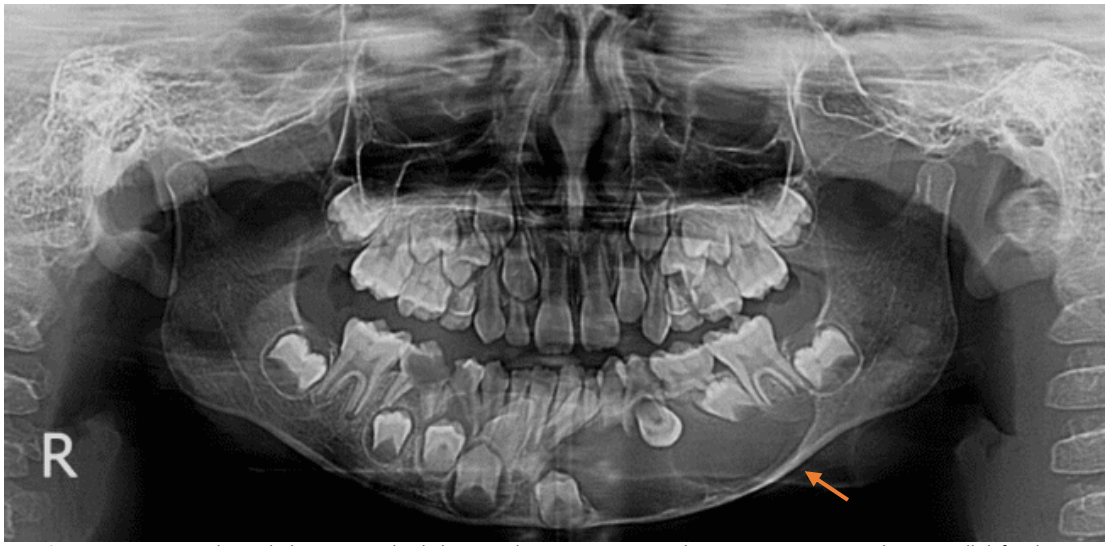

Figure 2. Panoramic radiograph showing mixed radiolucent-radiopaque appearance, lesion area is approximately 8x4 cm, ill-defined borders, expansion of cortical bone (Red Arrow)

Table 2. Radiograph Interpretation of Figure 2

No	Radiograph Characteristic	Radiograph View
1	Location	Corpus of left mandible extending from mandible symphysis to mesial permanent second molar of mandible and inferior border of mandible
2	Size	Approximately 9x3 cm
3	Border and Sharpness	Well-defined with ill-defined border in some sites
4	Internal Structure	Mixed radiolucent-radiopaque with true septa
5	Bone Matrix	-
6	Surrounding Effect	Expansion of inferior cortical border of mandible
7	Periosteal Reaction	No periosteal reaction
8	Suspected Radiodiagnosis	Fibrous ameloblastoma
9	Differential Radiodiagnosis	Malignant ameloblastoma

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Fibrous ameloblastoma, also referred to as desmoplastic ameloblastoma, is a variant of ameloblastoma characterized by its unique histopathological features and clinical behavior. This type of ameloblastoma is notable for its extensive stromal collagenization, which differentiates it from other forms of ameloblastoma. According to the findings of the intraoral, extraoral, panoramic, and clinical examinations, fibrous ameloblastoma is the diagnosis.

DISCUSSION

Ewing's sarcoma is the second most common childhood primary malignant tumor of the bone and constitutes 10% of primary malignant bone tumors. Ewing's sarcoma is frequently observed between the ages of 5 and 20. For Ewing's sarcoma, the most favorable sites are distal extremities and central locations (e.g., skull, clavicle, vertebrae, and ribs). The occurrence of Ewing's sarcoma in the head and neck region is uncommon, accounting for less than 3% of all Ewing's sarcomas. The involvement of the mandible is primarily very rare, but when it occurs in the jaw, the mandible is more frequently affected than the maxilla.[8]

Pathogenesis of Ewing's sarcoma in 85-90% of cases is based on Genetic aetiology. The Development of Ewing's sarcoma, tumor cells have shown a displacement between chromosome 11 and chromosome 22 (q24; q21) (11, 22). In 85% of cases, Ewing sarcoma is characterized by the expression of the EWSR1-FLI1 chimeric protein resulting from the chromosomal translocation t(11;22)(q24;q12), which links the transcription-regulating domain of EWSR1 to the ETS DNA-binding domain of FLI1.[9]

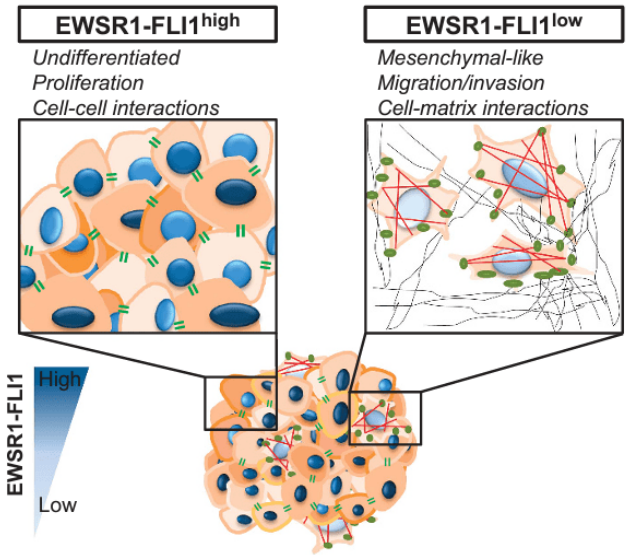

Figure 3. Genetic etiology: Development of Ewing's sarcoma. Model of Ewing cells dissemination based on cell-to-cell heterogeneity of EWSR1-FLI1 expression. In this model, undifferentiated EWSR1-FLI1High cells proliferate with robust cell-cell adhesion, whereas mesenchymal-like EWSR1-FLI1 Low cells migrate and invade the environment through important cell-matrix interactions.[10]

Signs and symptoms associated with Ewing's sarcoma when it occurs in the mandible are: Patients typically present with a swelling in the affected area of the mandible. The swelling may be firm, tender, and can rapidly increase in size, often leading to facial asymmetry. Pain is a common symptom that may range from mild discomfort to severe pain in the affected region. The pain can be persistent and may worsen over time. The tumor's growth can lead to loosening or displacement of adjacent teeth, particularly in the area surrounding the lesion. This is due to bone destruction and pressure from the expanding mass, There may be numbness or tingling sensations (paresthesia) in the lower lip or chin area if the inferior alveolar nerve is affected by tumor growth, Limited mouth opening (trismus) can occur due to muscle involvement or swelling around the temporomandibular joint, and than The mucosa overlying the tumor may appear normal or show erythema but is rarely ulcerated unless there is significant local invasion.[11]

Based on the characteristics of Ewing's Sarcoma on Panoramic Radiographs, in this case, the lesion often exhibits a moth-eaten pattern, which indicates aggressive bone destruction. This pattern is characterized by irregular, ill-defined margins with multiple small radiolucent areas resembling holes or "moth-eaten" fabric, suggesting rapid progression and infiltration into surrounding tissues.[12,13] A permeative pattern of bone destruction is commonly observed in Ewing's sarcoma. This feature indicates that the tumor invades the marrow space and progressively erodes the cortical bone, leading to a poorly defined and irregular outline of the lesion. The tumor may cause significant cortical erosion, which can be visualized as a loss of the normal contour of the cortical bone surrounding the lesion. This erosion is indicative of aggressive behavior and local invasion. In advanced cases, a soft tissue mass may be associated with the radiolucent lesion, indicating that the tumor has infiltrated beyond the bone into adjacent soft tissues. This can sometimes be seen as an expansion of the lesion beyond the bony confines on imaging. Although less common in jaw lesions, some cases may exhibit a sunray or sunburst

appearance, characterized by radiating spicules of new bone formation emanating from the periosteum due to aggressive periosteal reactions. The lesions can vary in shape but are often described as oval or round. They typically measure less than 1 cm in diameter at initial presentation but can grow significantly larger as the disease progresses. Ewing's sarcoma may also lead to displacement or destruction of unerupted teeth and other dental structures due to its aggressive nature and location within the jaw.[12–14]

Ewing's sarcoma is a poorly defined and uncorticated radiolucent lesion. Its border is irregular, as its advancing edge unevenly destroys the surrounding bone. These lesions are typically solitary and may be associated with pathologic fractures and adjacent soft tissue masses that are visible radiographically.[15] The internal structure exhibited multiple irregular, patchy radiolucent areas with a moth-eaten appearance.[3] Although they may be round or ovoid, Ewing's sarcomas generally lack a distinctive shape.[15] In the present case, the lesion appears as multiple radiolucent areas with a “moth-eaten” appearance with an ill-defined, non-corticated margin.

Ewing's sarcoma is a highly destructive process with minimal bone formation. It typically starts within the internal aspect of the bone and later involves the endosteal and periosteal surfaces, resulting in an entirely radiolucent appearance. This aggressive lesion may stimulate the periosteum to produce new bone, often in the form of Codman's triangle, "sunray" patterns, or "hair-on-end" spiculations. While laminar periosteal new bone formation has been reported, it is not a common feature of active Ewing's sarcoma lesions in the jaws. Additionally, these lesions are characterized by erosion, irregular thinning, and discontinuity of both the buccal and lingual cortices.[15] The present lesion demonstrates alveolar bone destruction and periosteal reaction. This pattern corresponds to a lamellated periosteal reaction, which appears as multiple concentric layers parallel to the bone cortex on the right side.

Ameloblastic malignance or ameloblastic carcinoma is classified as an odontogenic tumor, originating from the epithelial cells that form the enamel of teeth. It retains some histological characteristics of ameloblastoma but exhibits cytological features of malignancy. This tumor can arise de novo or develop from a pre-existing benign ameloblastoma or odontogenic cyst. The incidence of malignant ameloblastoma is low, accounting for approximately 0.3% to 3.5% of all odontogenic tumors. It shows a distinct predilection for the mandible, as two-thirds of these tumors arise in the mandible and one-third originate in the maxilla. Clinically, the most common complaint is swelling, although others include associated pain, ulceration, trismus, and parasthesia.[16] Malignant ameloblastoma can arise de novo or develop from preexisting benign lesions such as ameloblastomas or odontogenic cysts. The majority of cases originate from benign ameloblastomas, which are more common in the posterior mandible.[4,16] The malignant transformation may occur through genetic mutations that activate signaling pathways, particularly the MAPK pathway, contributing to tumorigenesis.

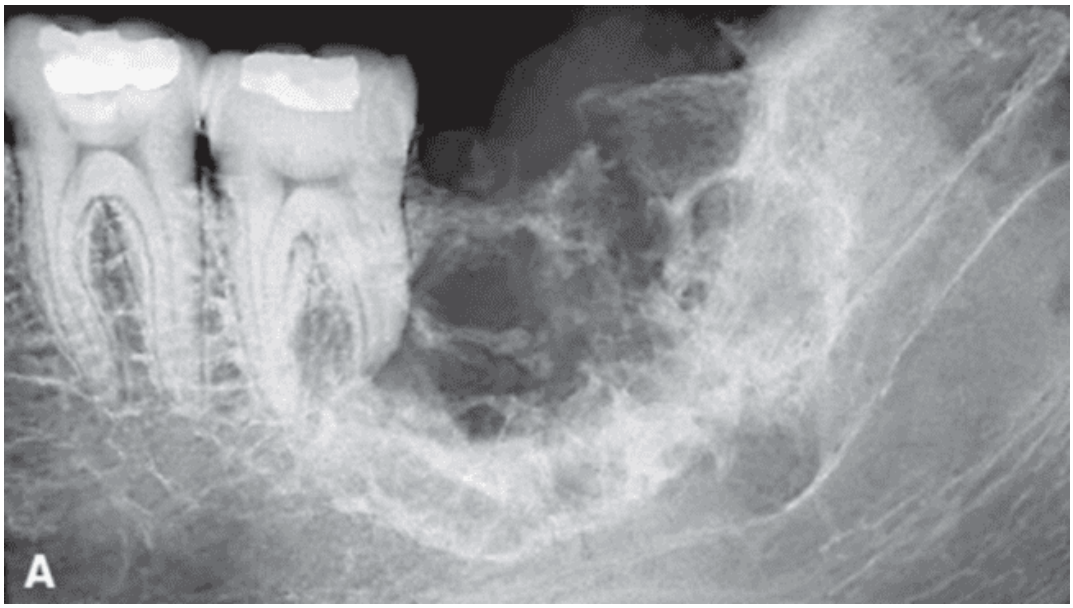

Figure 4. Multilocular radiolucency is characteristic of central mucoepidermoid carcinoma. This lesion has displaced the mandibular canal and destroyed the superior crest of the alveolar process and the distal supporting bone of the second molar.[6,15]

Radiographic features of ameloblastoma in the mandible are usually well defined, corticated, and some display a scalloped appearance. In contrast, in the maxilla, the margins are ill-defined as the lesion tends to grow along the bone rather than widen. Internal structure varies from radiolucent to mixed, with the presence of bone septa creating internal compartments.[6]

Table 3. Differentiating between Ewing's sarcoma and ameloblastic carcinoma in the jaw

Feature	Ewing's Sarcoma	Malignance Ameloblastoma
Age Group Affected	Primarily adolescents and young adults	Can occur at any age; mean age ~30
Imaging Characteristics	Osteolytic lesions with "onion skin" periosteal reaction	Significant bone resorption; aggressive cortical perforation
Treatment Approach	Chemotherapy, surgery, radiation	Wide surgical excision; adjunctive radiation
Prognosis	Better prognosis with early treatment	Poor prognosis; high recurrence risk

Fibrous ameloblastoma in case 2, also known as desmoplastic ameloblastoma, is a rare variant of ameloblastoma characterized by extensive stromal collagenization and unique clinical, radiographic, and histopathological features. Ameloblastomas of 0.9–12.1 % have been reported to be desmoplastic ameloblastomas (DA). Desmoplastic ameloblastoma differs from other variants of ameloblastoma in that it is more frequently seen in the anterior region of the jaw, and its mixed radiolucent and radio-opaque appearance is often more representative of a fibro-osseous lesion. Histologically, desmoplastic ameloblastoma is characterized by extensive stromal desmoplasia, dense collagenization with highly variable odontogenic epithelium islands and cords of various sizes.[16,17]

Radiographic features on panoramics radiographs, fibrous ameloblastomas usually appear as Mixed Radiolucent-Radiopaque Lesions: These lesions may exhibit both radiolucent and radiopaque areas due to calcifications within the fibrous stroma, Well-Defined Margins: The lesions often have well-defined borders but may present ill-defined margins in some cases, Cortical Expansion: There is often evidence of cortical bone expansion without perforation, Tooth Displacement: Adjacent teeth may be displaced due to the expanding lesion.[17–19]

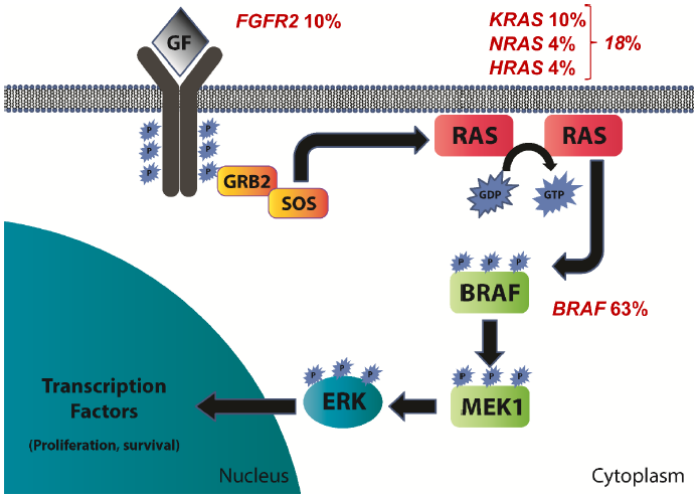

Figure 5. The pathogenesis of fibrous ameloblastoma involves complex interactions between genetic mutations, dysregulated signaling pathways, and histopathological changes that lead to its unique clinical behavior.[20]

Histologically, fibrous ameloblastomas are composed of nests of ameloblast-like cells and fibrous stroma, with no significant nuclear atypia or necrosis observed.[21] The differential diagnosis of fibrous ameloblastoma is malignant ameloblastoma, the same as case 1. Malignant ameloblastoma, while histologically similar to its benign counterpart, exhibits aggressive behavior and can metastasize. Radiographically, it may present similarly to fibrous ameloblastoma but often shows more extensive cortical destruction and invasion into adjacent structures.[22]

Table 4. Features of Fibrous Ameloblastoma and Malignant Ameloblastoma

Feature	Fibrous Ameloblastoma	Malignance Ameloblastoma
Radiographic Appearance	Well-defined multilocular radiolucency	Multilocular with irregular margins
Cortical Involvement	Cortical expansion, minimal destruction	Significant cortical destruction
Soft Tissue Invasion	Rarely invades soft tissues	Often invades surrounding soft tissues
Histological Features	Benign features, no atypia	Malignant potential with atypical cells

CONCLUSION

Ewing's sarcoma and malignant ameloblastoma are distinct entities that require careful consideration during diagnosis. This case illustrates how panoramic radiography can aid in distinguishing between these lesions but emphasizes the necessity of histopathological confirmation for accurate diagnosis.

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FOOTNOTES

Conceptualization, NJ and LE; validation, LE and YL; investigation, NJ and LE; resources, NJ and LE; writing original draft preparation, YL and LE; writing review and editing, YL; supervision, LE; project administration, NJ; funding acquisition, all authors; All authors have read and agreed to the published version of the manuscript

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