

Juvenile Trabecular Ossifying Fibroma

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Abstract Benign fibro-osseous lesions within the maxillofacial region represent a heterogeneous group of benign entities with overlapping histologic features. Ossifying fibroma, the rarest of these entities, represents a true neoplasm. Juvenile ossifying fibroma (JOF) is considered an aggressive rapidly growing sub-type. It tends to occur in the first or second decades of life. Based on histological and clinical features it can further be classified into two variants, namely juvenile trabecular ossifying fibroma (JTOF) and juvenile psammomatoid ossifying fibroma (JPOF). JTOF features a proliferation of cellular fibroblastic tissue admixed with woven bone trabeculae with varying histologic presentations. Correlation with clinical and radiographic features is essential to differentiate it from other fibro-osseous lesions. A case of JTOF of the mandible is exemplified in this *Sine Qua Non Radiology-Pathology* article.

Keywords Benign fibro-osseous lesions · Ossifying fibroma · Juvenile trabecular ossifying fibroma · Mandible · Oral cavity

Radiographic Features

An 8 year-old boy presented with a 1-year history of a rapidly expanding lesion of the right mandibular ramus. Panoramic and cone-beam computed tomography (CBCT) imaging demonstrated a large well-demarcated, uniformly corticated, unilocular lytic lesion of the right mandibular ramus. Marked outward expansion was evident in all directions (Fig. 1a–c). The outer cortical plate was significantly thinned but remained intact. The internal structure was almost completely radiolucent with the presence of faint irregular radio-opacities at the most inferior aspect of the lesion. Although the right inferior alveolar nerve remained intact, there was displacement of the right mandibular second molar, however, the tooth follicle was intact. Resorption of the distal root of the mandibular right first molar was also noted.

Diagnosis and Treatment

An incisional biopsy was planned and attempted, however, the majority of the lesion was delivered at the time of the biopsy procedure. Gross appearance of the submitted specimen revealed multiple soft to hard tan-white fragments. Histologic examination revealed an un-encapsulated loose tissue mass (Fig. 2a). The tissue was spindle cell rich with varying degrees of immature and mature inter-connecting osseous trabeculae (Fig. 2b, c). In some areas, the osteoid was difficult to distinguish from the stroma, while other

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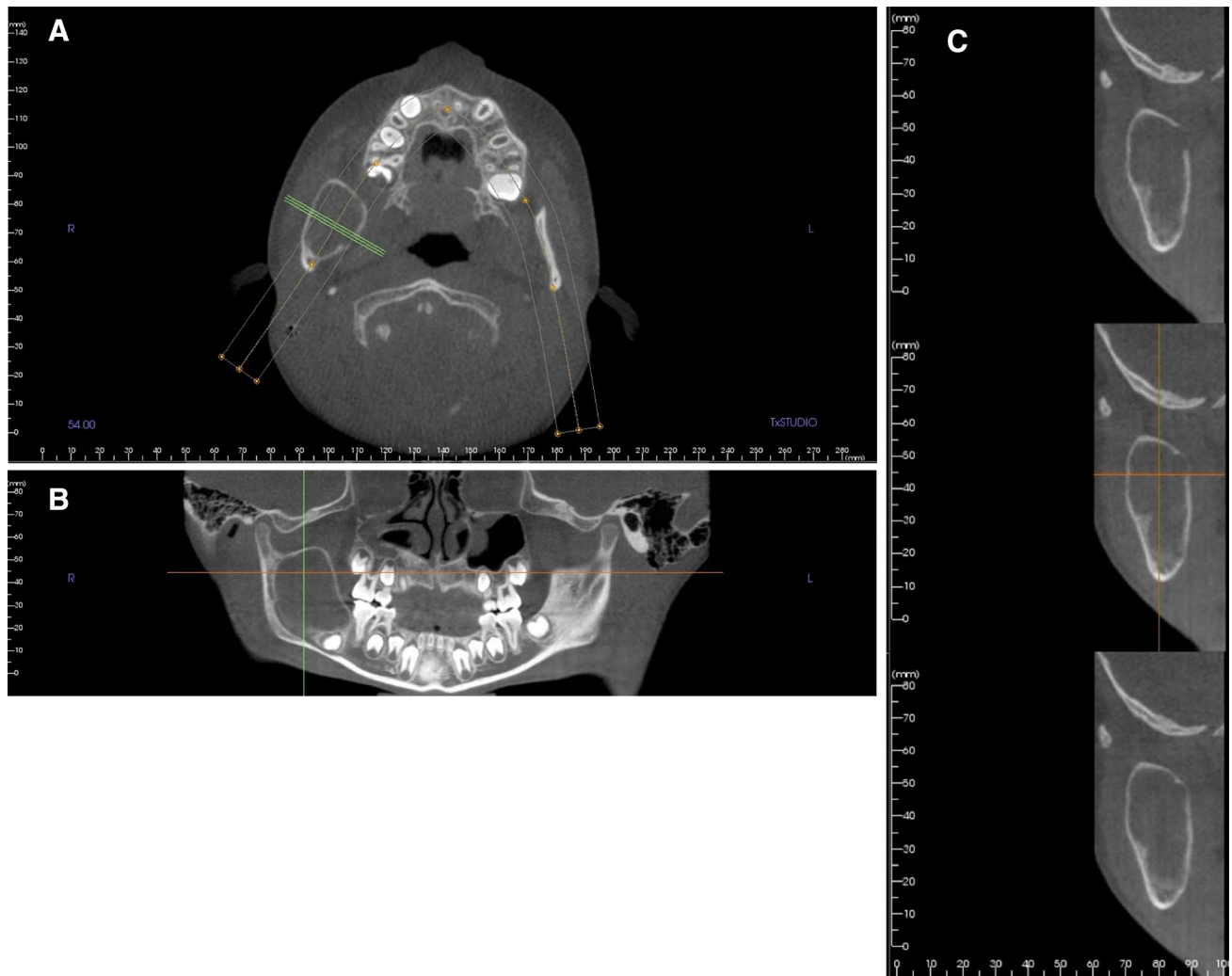


Fig. 1 **a** Axial CBCT scan (bone window) shows an expansile lesion of the right mandibular ramus with marked bucco-lingual expansion. **b** Coronal CBCT scan (bone window) demonstrates a well-demarcated unilocular radiolucency with marked anterior-posterior expansion. Displacement of the right mandibular second molar and resorp-

tion of the distal root of the mandibular right first molar is seen. **c** Sagittal CBCT scan (bone window) demonstrates irregular internal radio-opacities at the most inferior aspect of the lesion. Significant thinning of the outer cortical plate is observed

areas featured varying degrees of mineralization. The osseous trabeculae were highly cellular and adjacent fibroblasts were incorporated into the trabeculae. Some trabeculae were rimmed by plump osteoblasts. Clusters of multi-nucleated giant cells and aggregates of hemorrhage were seen (Fig. 2d). A few foci of pseudocystic degeneration (Fig. 2e) and scattered mitotic figures were observed.

The patient was followed for 6 months, and despite the early appearance of bony in-fill, progress slowed radiographically. In addition, the patient began to complain of discomfort and at this time, a panoramic radiograph (Fig. 3) and a CT scan were obtained which showed persistence of the lesion, slightly smaller compared to its original radiographic dimensions but presenting with two lytic foci. The patient was taken to the operating room for definitive excision. The

tumor was enucleated, an ostectomy was performed, and the bone cavity heat-treated with electrosurgical coagulation. The patient unevenly recovered from the surgery and is currently undergoing routine follow-up.

Discussion

Ossifying fibroma (OF) can be classified into two main types, namely cemento-ossifying fibroma (COF) and juvenile ossifying fibroma (JOF) [1]. The World Health Organization (WHO) classifies juvenile ossifying fibroma into two histologic variants; juvenile trabecular ossifying fibroma (JTOF) and juvenile psammomatoid ossifying fibroma (JPOF) [1]. The former is usually seen in children

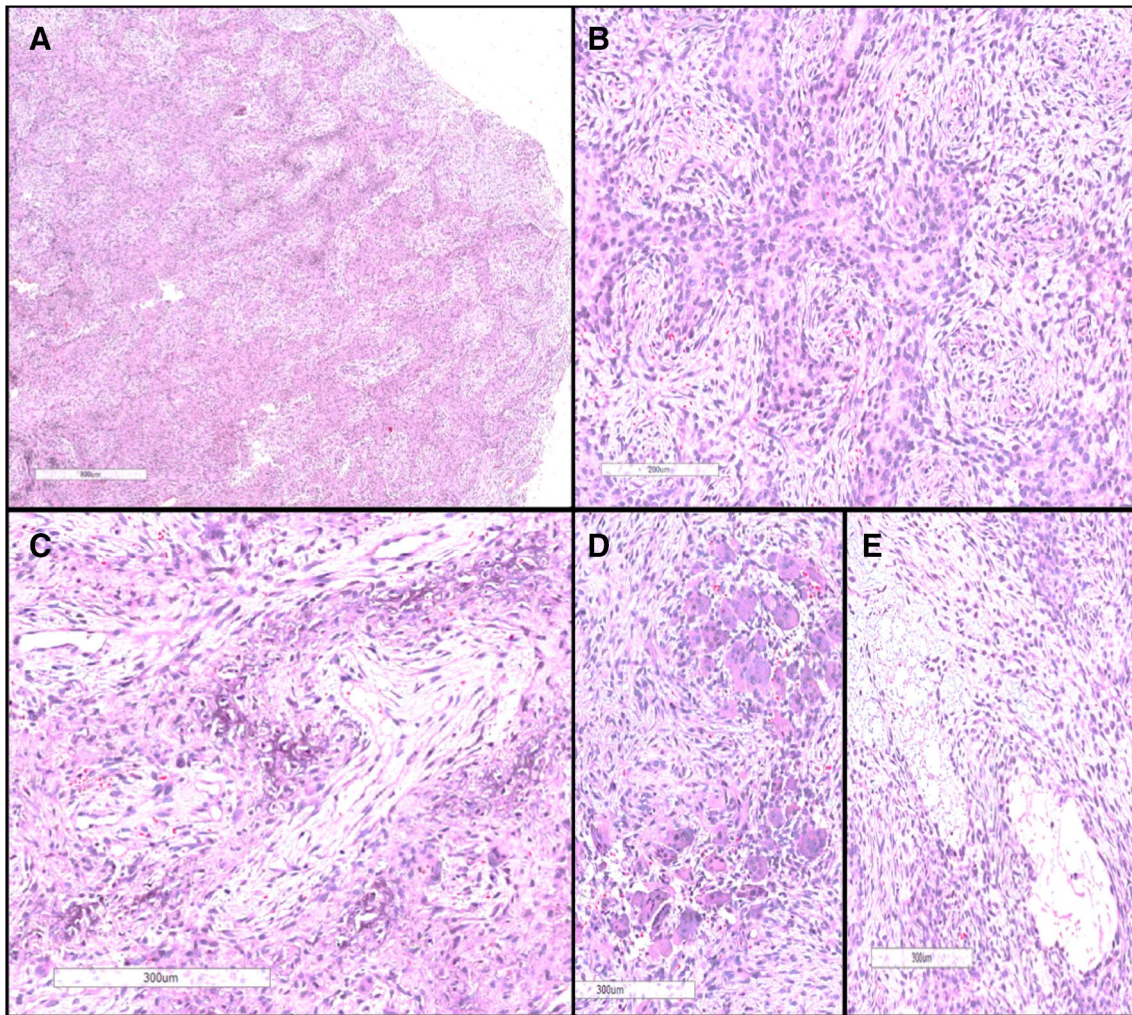


Fig. 2 **a** Section shows spindle cell rich stroma admixed with immature inter-connecting osteoid trabeculae (20 \times , 800 μ m scale bar). **b** Hypercellular immature osteoid trabeculae with numerous plump osteoblasts. Adjacent fibroblasts incorporated into trabeculae (80 \times , 200 μ m scale bar). **c** Marked spindle cell proliferation with more mature inter-connecting osteoid trabeculae. Osteoid deposits were

highly cellular (40 \times , 300 μ m scale bar). **d** Clusters of multi-nucleated giant cells (40 \times , 300 μ m scale bar). **e** Few foci of pseudocystic degeneration (40 \times , 300 μ m scale bar). Tissue was scanned using Leica ScanScope and all photomicrographs were captured using Aperio ImageScope

and adolescents (mean age of presentation: 8.5–12 years) whereas the latter usually affects a wider patient age range (16–33 years) [1]. There is no gender predilection for either entity [1]. Both entities are relatively rare however; JPOF is more commonly encountered than JTOF [2, 3]. Localization differs for each subtype, with the maxilla being more common for JTOF and the paranasal sinuses more common for JPOF [1]. The etiopathogenesis of JTOF is not well understood [2]. *GNAS* or *HRPT2* mutations have not been consistently found in JTOF which suggests that the etiopathogenesis of JTOF differs from that of fibrous dysplasia (FD) and COF [2, 4].

Clinically, patients with JTOF are often asymptomatic and early lesions are usually discovered as incidental radiographic findings [2, 5]. Displacement of teeth may be an

early sign of this tumor process [5]. JTOF may be aggressive in its growth potential and as it matures, rapid growth may result in facial asymmetry and jaw deformity [2–5].

Radiographically, JTOF are usually unilateral, unilocular mixed radiolucent/radiopaque lesions but may present as completely radiolucent lesions with faint internal radiopacities [3, 5]. CT imaging is required for larger lesions to determine the full extent of the lesion. JTOF tend to expand concentrically from a central point or epicenter, outward in all directions, and this expansion may result in displacement of teeth and the inferior alveolar nerve canal [5]. Importantly the outer cortical plate remains intact despite significant expansion and thinning [4, 5]. Resorption of teeth is common [2, 3]. Unlike the ground-glass, ill-defined blending borders in FD, JTOF maintains a well-defined

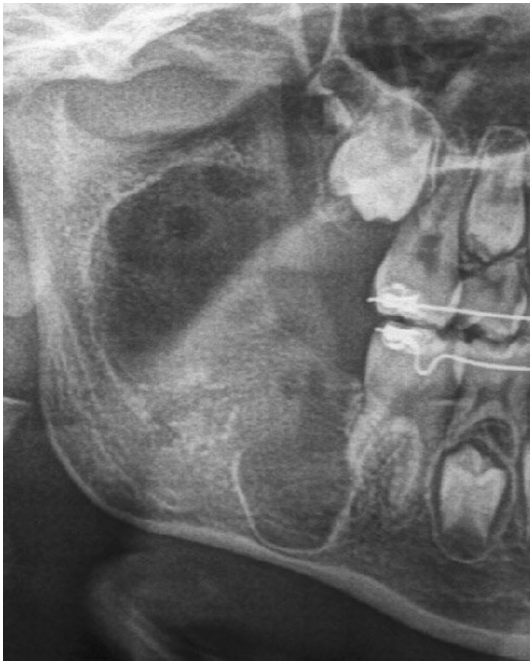


Fig. 3 Panoramic radiograph demonstrates persistence of the lesion with two lytic foci. Resorption of the distal root of the mandibular right first molar is featured

corticated border. The rapid progression of this neoplasm can mimic malignancy and osteosarcoma is suspected in younger patients, however; osteosarcomas radiographically display destructive irregular cortical margins invading the periodontal ligament and soft tissues, and do not have a thin radiolucent corticated boundary as seen in JTOF [5].

The primary histologic criterion for JTOF consists of a neoplasm predominantly composed of cellular fibroblastic tissue with thin trabeculae of immature bone. This immature bone may anastomose to form a lattice [2]. JTOF is usually well demarcated but unencapsulated [1, 2]. Of note, there may be considerable variation in stromal cellularity [6, 7]. Plump osteoblastic rimming of bone is a common feature [2]. Clusters of osteoclastic multi-nucleated giant cells, areas of hemorrhage and foci of pseudocystic stromal degeneration may be observed [1, 4, 6, 8]. Occasionally mitoses are seen in cell-rich areas [1, 4, 6, 8]. It has been suggested that rapid growth may be correlated with the secondary development of an aneurysmal bone cyst component [2].

The histologic differential of JTOF includes JPOF, COF, FD, cemento-osseous dysplasia (COD) and osteblastoma. JPOF differs from JTOF in that it does not feature the thin trabeculae of immature bone as seen in JTOF but is characterized by a proliferation of cellular fibroblastic tissue with a predominance of small basophilic ovoid concentric cementum-like spherules that feature peripheral brush borders that tend to blend into the connective tissue [1, 2, 9]. Although COF is a histologic mimic of JTOF, it notably

occurs in older individuals. FD is characterized by irregular bony trabeculae with curvilinear shapes embedded in a fibrous background [2, 10]. FD typically encompasses the osseous cortex. COD displays a variable histologic picture of cellular fibroblastic tissue with deposits of woven bone, lamellar bone and cementum-like spherules depending on the stage of maturation [2]. In contrast to JTOF, the bony trabeculae in COD are thicker and less delicate and show less osteoblastic rimming [2]. Furthermore, the cementum-like spherules in COD are unevenly shaped and display retraction from the stroma [2]. Peripheral aggregates of hemorrhage are common in JTOF whereas in COD, hemorrhage is seen throughout [2]. Osteblastoma features a proliferation of plump osteoblasts within a vascular stroma and multiple layers of over-lapping osteoblasts and osteoclasts on more basophilic appearing bone [10]. Clinical and radiographic correlation is important in the diagnosis of JTOF due to the histologic similarities and over-lapping histologic features with other fibro-osseous lesions. Immunohistochemistry has limited utility in differentiating benign fibro-osseous lesions.

JTOF will persist and continue to enlarge if left untreated and therefore excision of early lesions is mandated to prevent further expansion. The prognosis for JTOF is variable and recurrence following removal is not uncommon (~30–67% recurrence rate), especially if residual tumor persists following incomplete excision [2–4, 11]. There is no potential for malignant transformation of JTOF [2, 3, 11].

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Compliance with Ethical Standards

Conflict of interest No conflicts of interest to disclose.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. For this type of retrospective case report, formal consent is not required. The tumor tissue included in the manuscript was obtained as part of the standard of care for the patient and retrospectively collected for the case report.

Informed Consent No identifier information is included in the case report, and the study meets the waiver criteria for the institutional review board of University of Maryland Baltimore.

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