The imaging characteristics of odontogenic myxoma and a comparison of three different imaging modalities

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Objective. To report the imaging characteristics of odontogenic myxoma (OM) and compare the different imaging modalities used.
Study design. The radiological images of 33 OM cases were retrospectively analyzed. The radiographs were severally examined to describe the features of OM as seen on conventional radiographs (CRs), computed tomography (CT) scans, and magnetic resonance images (MRIs).
Results. MRI was effective in displaying the true extension and contents of OMs. CT scans demonstrated the extensions of OMs, expansion, growth pattern, and rendered it possible to compare density of OM with that of surrounding muscles. Assessment of CRs revealed great limitations about the diagnostic values and failed to display important features.
Conclusions. All 3 radiographic techniques, conventional radiography, CT, and magnetic resonance imaging (MRI), have inherent advantages and disadvantages; however, all 3 should be routinely used in the diagnosis of OM. The results of CT and MRI can accurately reveal margins of tumors and greatly aid in diagnosis. (Oral Surg Oral Med Oral Pathol Oral Radiol 2013;116:492-502)

Odontogenic myxoma (OM) is a rare, nonencapsulated benign but locally invasive odontogenic tumor first described by Thoma and Goldman in 1947.[1-4] It represents 3%-6% of all odontogenic tumors and has been reported to be the second most common odontogenic tumor after ameloblastoma in some countries.[5,6]

In the facial region, OM occurs mostly within the bone and radiologic examination is therefore important.[7] Generally, diagnosis of OM is made by the examination of conventional radiographs (CRs) and confirmed by histopathology. Advanced technologies such as computed tomography (CT) and magnetic resonance imaging (MRI) may offer diagnostic options, which could overcome some of the limitations of CR. Hence, recognizing the paucity of relevant research, the aim of this study was to report the imaging characteristics of OM and compare the different imaging modalities used.

MATERIALS AND METHODS

The radiological records of 33 OM cases presenting over a period of 42 years (1967-2009) were included in the study. The study was exempt from obtaining ethical approval because of its retrospective nature. In all cases, the diagnosis was histopathologically confirmed before enrolment in the study. All images, which had been determined to be of a good standard, were examined independently by 2 oral and maxillofacial radiologists. A third examiner was invoked when there was a dispute between the 2 observers and the decision of the majority was accepted.

All 3 imaging techniques were viewed under the same conditions using a viewing box of sufficient size that was bright and evenly illuminated. Adjunctive tools such as magnifying glasses and opaque masks were used to allow proper examination of the images.

This retrospective study undertook, in the first place, the description of the radiologic features of OM as seen on CR. Then the radiologic information provided by CT scans and magnetic resonance images (MRIs), respectively, was studied and analyzed. Finally the 3 modalities were compared in terms of how comprehensive were the descriptive diagnostic data which could be obtained from each to determine which was superior.

The patients were grouped according to the type of imaging available in their records. A comparison of all 3 imaging modalities was done for patients with

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Statement of Clinical Relevance

Conventional radiography, computed tomography (CT), and magnetic resonance imaging (MRI) with their inherent advantages and disadvantages should be routinely used in the diagnosis of odontogenic myxoma. CT and MRI are highly accurate and greatly aid in diagnosis.

complete sets of all 3 imaging modalities. Conventional radiography had been performed in 30 cases; MRIs were available in 10 cases, whereas CT images had been recorded in 8 cases. Demographic data were recorded and analyzed for age, gender, and ethnic origin.

Conventional radiography included panoramic radiographs, occlusals, lateral obliques, and posteroanteriors (PAs). The radiological features examined included location, appearance of the internal structures, locularity, expansion, and borders/margins of the tumor, and the association with unerupted or impacted teeth. In addition, the study included the effects that the tumors exerted on surrounding tissues, such as displacement of teeth, root resorption, encroachment upon the mandibular canal, and maxillary sinus as well as the influence that some maxillary tumors had on the nasal cavity and floor of the orbit.

The tumors, located in either the maxilla or the mandible, were divided into 5 categories based on their internal structure: (i) unilocular radiolucency with no internal trabeculation; (ii) radiolucent area with a few strands of delicate or coarse intratumoral trabeculae; (iii) radiolucency with straight and angular trabeculation (tennis-racket appearance); (iv) radiolucency with round or oval compartments formed by curved trabeculation (honeycomb appearance); and (v) tumors that showed a combination of any 2 or more of the above.

Locularity of tumors was described as either unilocular or multilocular. Expansion of the tumor was recorded as (i) no cortical expansion; (ii) expansion with visible margin; (iii) cortical destruction (perforation); and (iv) cortical destruction with extension outside the bone. The margins of tumors were classified as (i) uncorticated; (ii) poorly corticated; (iii) moderately corticated; and (iv) well corticated.

For CT images, the features examined, in addition to those assessed on the CR films, included locularity in 3 dimensions. The content of the tumor was compared with the surrounding muscles using CT attenuation values (Hounsfield number) and accordingly the tumor was categorized as hypodense or isodense. The pattern of growth of the tumor was investigated to show whether lobulation, budding, nodulation, and/or crevice formation or a mixed pattern were present.

MRIs of OMs were examined for signal intensities in the tumor and these were compared with those of the surrounding structures. The degree of homogeneity was recorded for all images. The internal composition of the tumor and pattern of enhancement were also assessed. The pattern of growth was investigated to show whether lobulation, budding, nodulation, and/or crevice formation or mixed pattern were present. As before, the border of the tumor, status of the cortex (thinning and/or perforation), and/or soft tissue extension were also evaluated.

Table I. Distribution of OM by age, gender, and ethnic groups

Age group (years)	*Male*	*Female*	*Ethnicity*		*Total*
0-10	2	0	Negroid	2	2 (6.1%)
			Caucasian	1	
11-20	5	5	Mixed	6	10 (30.3%)
			Negroid	3	
			Caucasian	3	
21-30	3	10	Mixed	7	13 (39.4%)
			Negroid	3	
31-40	0	6	Caucasian	1	6 (18.1%)
			Mixed	5	
41-50	0	2	Mixed	2	2 (6.1%)
Total	10 (30.3%)	23 (69.7%)			33 (100%)

RESULTS

Patient demographics

Of the 33 records from this sample, which were reviewed, 23 (69.7%) cases were reported in females and 10 (30.3%) cases occurred in males. For females, the ages ranged from 12 to 44 years (average of 23.7), whereas in males the ages ranged from 8 to 28 years (average of 24.6 years) (Table I).

Location

Seventeen cases occurred in the mandible, whereas 16 cases were observed in the maxilla. The majority of the tumors appeared in the posterior regions of the jaws within the body and ramus for the mandible, whereas for the maxilla, the premolar, molar, and tuberosity areas were most affected.

Radiological features of OM on CR

Thirty cases had been examined radiographically using panoramic radiographs and/or PA mandible, occipitomental, and/or occlusal views. In the majority of cases teeth were missing in the area of the tumor. A summary of the radiological features disclosed by CR examination is recorded in Table II.

The internal structures of the tumors (Table III) were found to show varying radiological appearances and appeared as clear unilocular in 2 (6.7%) cases (Figure 1*A*), multilocular in 13 (43.3%) cases (Figure 1*B*), whereas radiolucent tumors with fine delicate or sometimes coarse trabeculae (Figure 1*C* and *D*) appeared to be the most common form in this regard and was reported in 50% of cases.

OM is an expansile tumor that demonstrated in this sample a tendency to displace teeth in 24 (80%) cases, 3 cases showing migration and severe displacement of the teeth. Root resorption appeared to be uncommon in the present study and was reported in only 3 (10%) cases.

Involvement of impacted teeth within the tumors occurred in 3 (10%) instances, whereas 5 (16.7%) cases