

## A Clinico- Radiographic (2D&3D) Analysis of Ameloblastoma: With Impacted and Non-Impacted Teeth

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### Abstract

### Original Research Article

**Background:** Ameloblastoma is a rare odontogenic neoplasm of the mandible and maxilla, with multiple histologic variants, and high recurrence rates if improperly treated. **Objective:** To evaluate the various clinical and radiological behavior (2D & 2D) of histologically diagnosed ameloblastoma with or without impacted teeth. **Materials and Methods:** The present hospital-based retrospective study was conducted by reviewing the clinical and radiographic records of ameloblastoma cases from 2018 to 2021, available in the archives of the department. A total of 21 patients were analyzed were grouped into 1 and 2 on the basis of radiographic findings, ameloblastoma with impacted teeth and without impacted teeth. **Results:** We observed that the patients affected with ameloblastoma were in the age-group of 21–40 yrs. The male: female ratio was 1.5:1 in group 1 and 3:1 in group 2. The posterior mandible (70% in group 1 and 100% in group 2) was more commonly affected than the maxilla. Multilocular appearance was seen in 75% of group 2 and 10% of group 1 cases. Effect on adjacent teeth like displacement (70%), knife edge root resorption (70%) and loss of lamina dura (90%) were most commonly associated with group 1 compared to group 2. **Conclusion:** Ameloblastoma is usually benign tumors. Thorough history along with clinical examination and interpretation of radiographs are necessary to diagnosis this lesion accurately for early treatment and better prognosis.

**Keywords:** Ameloblastoma, impacted teeth, non-impacted teeth, 2D radiograph, 3D radiograph.

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## INTRODUCTION

Ameloblastoma is a benign but locally aggressive epithelial odontogenic neoplasm. It derived from the English word amel, meaning enamel and the Greek word blastos, meaning germ. It represents 1% of all tumors of the jaw bone and 9% of odontogenic tumors. Global incidence of ameloblastoma is 0.5 cases per million people per year [1]. In 80% of cases, it is localized in the mandibular molar and ascending ramus area. 10%–15% of ameloblastoma are associated with an unerupted tooth. They are slow-growing tumors and are usually asymptomatic until a large size is achieved. Only in some patients with the lump accompanied by pain, reduced sensibility of the nerve distribution area and sometimes ulceration due to tooth compression when the tumor has reached a large size. Teeth in the tumor area may get mobile or displaced. If a secondary infection occurs, ulceration, fistula as well as pain, paresthesia, and signs of inflammation may present.

Occasionally, infiltrating tumors may erode through the bone and extend into the soft tissue [1-4].

It has a characteristic, but not diagnostic, radiographic appearance. 2D radiographs like IOPA, occlusal, OPG were helpful in arriving the diagnosis. In 2D radiograph, the lesions are expansile, with thinning of the cortex in the buccal–lingual plane, well-defined borders causing perforation, extensive root resorption and tooth displacement may or may not associated with impacted teeth. The borders are often curved, and for smaller lesions, an ameloblastoma may be indistinguishable from a cyst. Small unilocular ameloblastoma that are located around the crown of an unerupted tooth often cannot be differentiated from a dentigerous cyst. Occlusal imaging may demonstrate the often cyst-like expansion of the bone, and thinning of an adjacent cortical plate leaving a thin “eggshell” of remnant bone. The presence of a septum within a larger cyst-like cavity or when a septum produces partial

loculation within a cavity add greatly to the possibility of ameloblastoma [5, 6].

Panoramic radiographs are inadequate for localization of such lesions because of the nature of panoramic radiography, with its inherently less-sharp image and ghost image. CT is usually helpful for determining the contours of the lesion, its contents, and its extension into soft tissues. Ameloblastoma typically shows expansive growth with an osseous shell. On CT there are cystic areas of low attenuation along with isoattenuation solid regions. Contrast-enhanced CT shows an enhancement effect in the solid components [5].

Six histopathologic subtypes of ameloblastoma are recognized: follicular, acanthomatous, granular cell, basal cell, desmoplastic, and plexiform. Histopathologically, epithelial component proliferates in disconnected islands, strands, and cords within the collagenized fibrous connective tissue stroma. The darkly staining periphery is composed of tall columnar cells with hyperchromatic nuclei. This peripheral layer of tall columnar cells with hyperchromasia, reverse polarity of the nuclei, and subnuclear vacuole formation mimic the normal embryologic development of the tooth bud at the stage of enamel matrix production.

The purpose of this study is to evaluate the various clinical and radiological behavior (2D & 2D) of histologically diagnosed ameloblastoma with or without impacted teeth.

**MATERIAL AND METHODS**

The present hospital-based retrospective study was conducted by reviewing the clinical and radiographic records of 18 ameloblastoma cases for the years 2018–2021. Permission to undertake this study was obtained from the institutional ethics committee. A total of 18 cases that were diagnosed histopathologically as ameloblastoma were included in the study. All the radiographs and images were taken by

standard techniques, were processed under standardized conditions, and viewed on a standard illuminated screen by two oral radiologists to prevent inter-observer bias. Written informed consent obtained from all the patients before enrolling them in the study. After taking consent of patients, clinical data, including patients’ age, sex, lesion locations, radiological diagnosis and histological findings was recorded in structured proforma designated for study.

On the basis of radiographic findings, ameloblastoma with impacted teeth and without impacted teeth were grouped into 1 and 2 and analysis was done in detail.

**RESULTS**

In the present study, out of 18 lesions, 10 were in group 1 and 8 were in group 2. The maximum number (9 (50%)) of patients was in the age-groups of 21–40 yrs (5 in group 1 and 4 in group 2) and least number was seen in 41-60 years (2 patients) in group 1 and 1 patient in 70 years in group 2. The male: Female ratio was 1.5:1 in group 1 and 3:1 in group 2.

In group 1, posterior mandible alone was involved in 7 cases (70%), the anterior maxilla was in 2 cases (20%) and anterior mandible was in 1 case (10%). All 8 cases (100%) had involvement of posterior mandible in group 2. In group 1, maximum of 4 (50%) had duration of less than 3 months followed by 2 (25%) with 3-6 months duration and least of 1 (12.5%) with more than 1 yr and 6 month- 1 year duration each. In group 2, maximum of 3 (37.5%) had duration of less than 3 months and more than 1 yr duration each followed by 2 (25%) with 3-6 months duration.

Out of 10 group 1 cases, 2 patients (20%) were asymptomatic. Clinical differentiating features of symptomatic cases of group 1 and 2 were discussed in table 5. Radiographic differentiating features including 2D and 3D difference between group 1 and 2 were discussed in table 6. Statistical analysis was done

**Table-1: Age wise distribution of patients**

Age	10-20 yrs	21–40 yrs	41–60 yrs	>60 yrs
<b>Ameloblastoma with impacted teeth (n=10)</b>	3 (30%)	5 (50%)	2 (20%)	-
<b>Ameloblastoma without impacted teeth (n=8)</b>	1 (12.5%)	4 (50%)	2 (25%)	1(12.5%)

**Table 2: Sex wise distribution of patients**

Sex	Male	Female
<b>Ameloblastoma with impacted teeth (n=10)</b>	6 (60%)	4 (40%)
<b>Ameloblastoma without impacted teeth (n=8)</b>	6 (75%)	2 (25%)

**Table 3: Duration wise distribution of patients**

Duration	< 3 months	3-6 month	6 month- 1 yr.	>1 yr.	P value
<b>Ameloblastoma with impacted teeth (n=8)</b>	4 (50%)	2 (25%)	1 (12.5%)	1 (12.5%)	<b>0.927 (N.S)</b>
<b>Ameloblastoma without impacted teeth (n=8)</b>	3 (37.5%)	2 (25%)	-	3 (37.5%)	

**Table 4: Site wise distribution of patients**

Site	Ant. maxilla	Post. maxilla	Ant. mandible	Post. mandible	P value
Ameloblastoma with impacted teeth (n=10)	2 (20%)	-	1 (10%)	7 (70%)	<b>0.1 (N.S)</b>
Ameloblastoma without impacted teeth (n=8)	-	-	-	8 (100%)	

**Table 5: Clinical features wise distribution of patients**

Features		Ameloblastoma with impacted teeth (n=8)	Ameloblastoma without impacted teeth (n=8)	P value
Chief complaint	Painful swelling	2 (20%)	1 (12.5%)	<b>0.652 (N.S)</b>
	Painless swelling	6 (60%)	7 (87.5%)	
No	Single	8 (100%)	8 (100%)	
Size	0-2 cm <sup>2</sup>	4 (50%)	7 (87.5%)	<b>0.040 (S)</b>
	>2 cm <sup>2</sup>	4 (50%)	1 (12.5%)	
Periphery	Ill defined	8 (100%)	8 (100%)	
Surface	Smooth	8 (100%)	8 (100%)	
Tenderness		4 (50%)	1 (12.5%)	<b>0.805 (N.S)</b>
Consistency	Soft	1 (12.5%)	-	<b>0.329 (N.S)</b>
	Firm	7 (87.5%)	7 (87.5%)	
	Hard	-	1 (12.5%)	
Egg shell crackling		-	3 (37.5%)	<b>0.039 (S)</b>
Missing teeth		8 (100%)	-	
Over retained deciduous tooth		1 (12.5%)	-	
Mobility of adjacent teeth		3 (37.5%)	5 (62.5%)	<b>0.180 (N.S)</b>
Displacement of adjacent teeth		4 (50%)	4 (50%)	<b>0.180 (N.S)</b>
Non-vital of adjacent teeth		3 (37.5%)	5 (62.5%)	<b>0.180 (N.S)</b>

**Table 6: Comparison of 2D & 3D radiographic features of histologically diagnosed ameloblastoma**

FEATURES		2D		3D		P value
		Impacted teeth(n=10)	Nonimpacted teeth (n=8)	Impacted teeth(n=10)	Nonimpacted teeth (n=8)	
Size	<2 cm <sup>2</sup>	2 (20%)	1 (12.5%)	3 (30%)	2 (25%)	<b>0.414 (N.S)</b>
	2-4 cm <sup>2</sup>	3 (30%)	1 (12.5%)	1 (10%)	2 (25%)	
	>4 cm <sup>2</sup>	5 (50%)	6 (75%)	6 (60%)	4 (50%)	
	<b>P value</b>	<b>0.332 (N.S)</b>		<b>0.843 (N.S)</b>		
Border	Well defined	4 (40%)	6 (75%)	10 (100%)	8 (100%)	<b>0.005 (S)</b>
	Ill defined	6 (60%)	2 (25%)	-	-	
	<b>P value</b>	<b>0.149 (N.S)</b>		<b>1.0 (N.S)</b>		
	Corticated	3 (30%)	5 (62.5%)	10 (100%)	8 (100%)	
Non-corticated	7 (70%)	3 (37.5%)	-	-	<b>0.002 (S)</b>	
	<b>P value</b>	<b>0.606 (N.S)</b>		<b>1.0 (N.S)</b>		
	Scalloping	Present	5 (50%)	6 (75%)		6 (60%)
Expansion	<b>P value</b>	<b>0.293 (N.S)</b>		<b>0.208 (N.S)</b>		<b>0.157 (N.S)</b>
	Lower border	4 (40%)	2 (25%)	6 (60%)	3 (37.5%)	
	<b>P value</b>	<b>0.514 (N.S)</b>		<b>0.354 (N.S)</b>		<b>0.083 (N.S)</b>
	Only Buccal plate	3 (30%)	1 (12.5%)	1 (10%)	-	
	Only Lingual plate	-	-	1 (10%)	-	<b>0.705 (N.S)</b>
	Both plate	3 (30%)	5 (62.5%)	6 (60%)	7 (87.5%)	
	<b>P value</b>	<b>1.0 (N.S)</b>		<b>0.652 (N.S)</b>		
	Ant border of ramus	3 (30%)	3 (37.5%)	4 (40%)	3 (37.5%)	<b>0.317 (N.S)</b>
<b>P value</b>	<b>0.744 (N.S)</b>		<b>0.916 (N.S)</b>			
Post border of ramus	1 (10%)	1 (12.5%)	2 (20%)	1 (12.5%)	<b>0.317 (N.S)</b>	
<b>P value</b>	<b>0.871 (N.S)</b>		<b>0.680 (N.S)</b>			
Thinning of cortex		3 (30%)	4 (50%)	9 (90%)	8(100%)	<b>0.002 (S)</b>
<b>P value</b>	<b>0.401 (N.S)</b>		<b>0.371 (N.S)</b>			
Perforation of cortex		1 (10%)	5 (62.5%)	8 (80%)	8 (100%)	<b>0.002 (S)</b>
<b>P value</b>	<b>0.023 (S)</b>		<b>0.192</b>			
Internal structure	Radiolucent	9 (90%)	6 (75%)	9 (90%)	8 (100%)	<b>0.157 (N.S)</b>
	Mixed	1 (10%)	2 (25%)	1 (10%)	-	
	<b>P value</b>	<b>0.410 (N.S)</b>		<b>0.371 (N.S)</b>		
	Unilocular	7(70%)	2 (25%)	9 (90%)	2 (25%)	<b>0.157 (N.S)</b>
	Multilocular	3 (30%)	6 (75%)	1 (10%)	6 (75%)	
<b>P value</b>	<b>0.065 (N.S)</b>		<b>0.006 (S)</b>			
Soap bubble		3 (30%)	4 (50%)	1 (10%)	5 (62.5%)	<b>0.564</b>

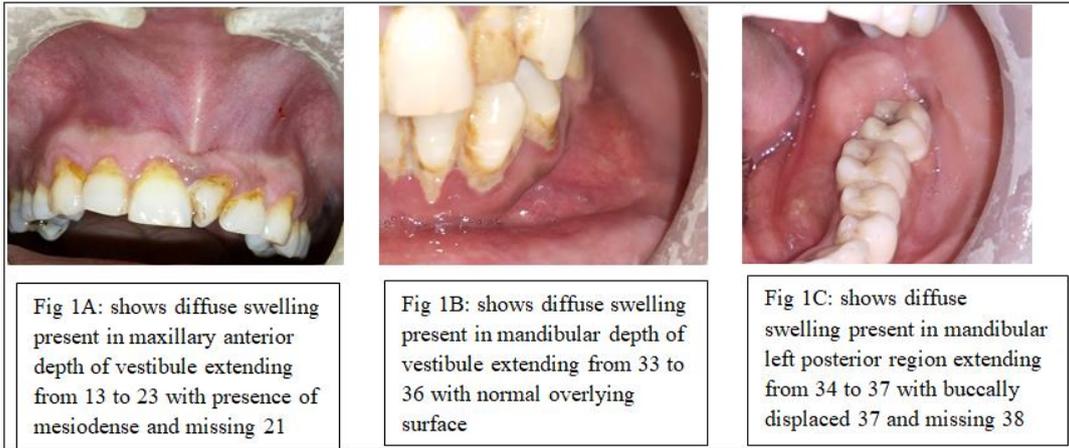
Multilocular	Honey comb	-	2 (25%)	-	1 (12.5%)	<b>(N.S)</b>
	<b>P value</b>	<b>0.140 (N.S)</b>		<b>0.008 (S)</b>		
Septa	Thick	1 (10%)	1 (12.5%)	1 (10%)	1 (12.5%)	<b>0.157 (N.S)</b>
	Thin	2 (20%)	5 (62.5%)	-	5 (62.5%)	
	<b>P value</b>	<b>0.105 (N.S)</b>		<b>0.016 (S)</b>		
Angulation	Mesio angular	1 (10%)	-	1 (10%)	-	
	Horizontal	5 (50%)	-	5 (50%)	-	
	Disto angular	2 (20%)	-	2 (20%)	-	
	Vertical	2 (20%)	-	2 (20%)	-	
Displacement of impacted teeth	Superior	3 (30%)	-	3 (30%)	-	
	Inferior	3 (30%)	-	3 (30%)	-	
	Absent	4 (40%)	-	4 (40%)	-	
Root completion	Completed	9 (90%)	-	9 (90%)	-	
	Not completed	1 (10%)	-	1 (10%)	-	
Associated Teeth	48	3 (30%)	-	3 (30%)	-	
	38	2 (20%)	-	2 (20%)	-	
	33	1 (10%)	-	1 (10%)	-	
	12	1 (10%)	-	1 (10%)	-	
	21	1 (10%)	-	1 (10%)	-	
	32	1 (10%)	-	1 (10%)	-	
	45	1 (10%)	-	1 (10%)	-	
Adjacent teeth	Displacement	7 (70%)	3 (37.5%)	7 (70%)	3 (37.5%)	
	<b>P value</b>	<b>0.180 (N.S)</b>		<b>0.180 (N.S)</b>		
	Loss of lamina dura	9 (90%)	7 (87.5%)	9 (90%)	7 (87.5%)	
	<b>P value</b>	<b>0.871 (N.S)</b>		<b>0.871 (N.S)</b>		
	Smooth root resorption	-	-	-	-	
	Knife edge resorption	7 (70%)	5 (62.5%)	7 (70%)	5 (62.5%)	
	<b>P value</b>	<b>0.744 (N.S)</b>		<b>0.744 (N.S)</b>		
Provisional diagnosis	Dentigerous cyst	4 (40%)	-	2 (20%)	-	
	Unilocular ameloblastoma	3 (30%)	2 (25%)	6 (60%)	2 (25%)	
	Multilocular ameloblastoma	3 (30%)	6 (75%)	2 (20%)	6 (75%)	

**Table 7: Analysis of histology of ameloblastoma**

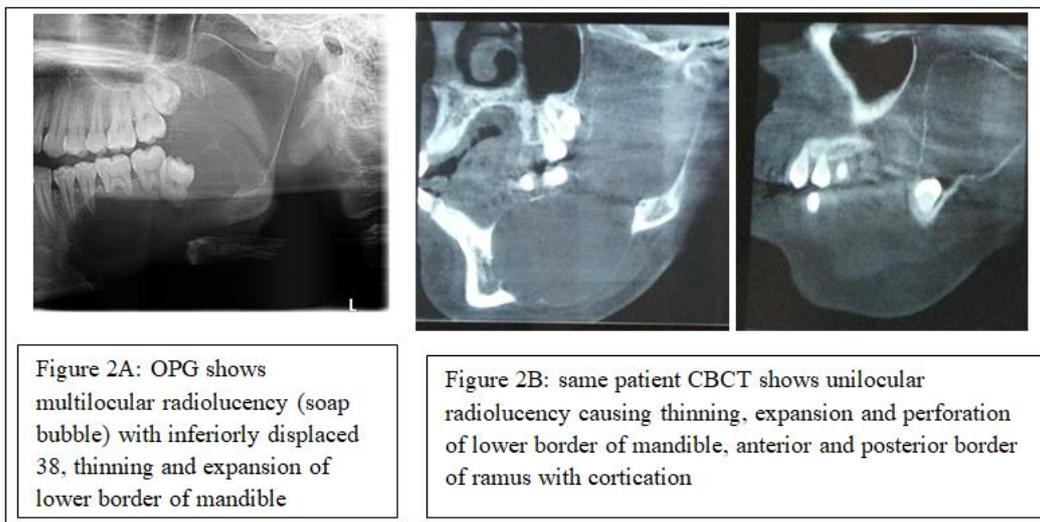
Diagnosis	Ameloblastoma with impacted teeth (n=10)	Ameloblastoma without impacted teeth (n=8)	P value
Unicystic ameloblastoma	9 (90%)	-	<b>0.000 (H.S)</b>
Follicular ameloblastoma	1 (10%)	6 (75%)	
Plexiform ameloblastoma	-	2 (25%)	

**Table 8: Analysis of histologically diagnosed ameloblastoma**

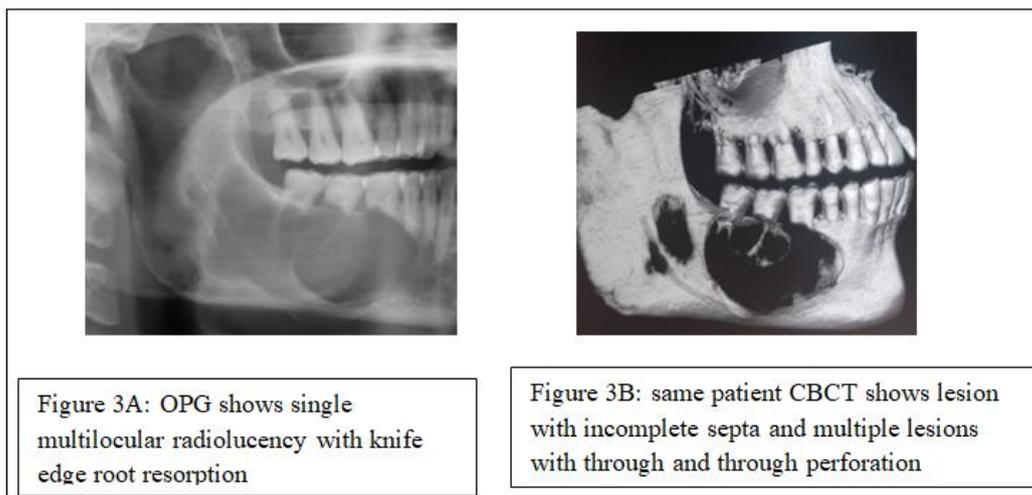
Ameloblastoma N=18	Clinical diagnosis N=18	Radiological diagnosis N=18
<b>With impacted teeth (n=10)</b>	DC=7 (70%) PAA=1 (10%) Asymptomatic=2 (60%)	AM= 8 (80%) DC=2 (20%)
<b>Without impacted teeth (n=8)</b>	AM=6 (75%) DC=1 (25%) RC=1 (25%)	AM=8 (100%)



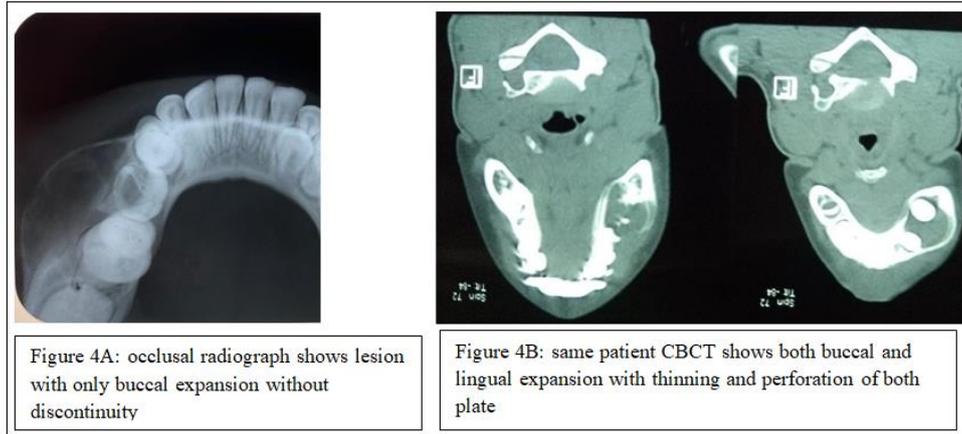
**Figure 1: Ameloblastoma in different sites**



**Figure 2: 2D & 3D radiograph of ameloblastoma with impacted tooth**



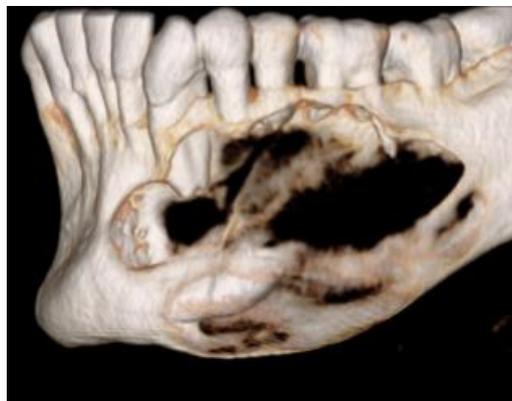
**Figure 3: 2D & 3D radiograph of ameloblastoma without impacted**



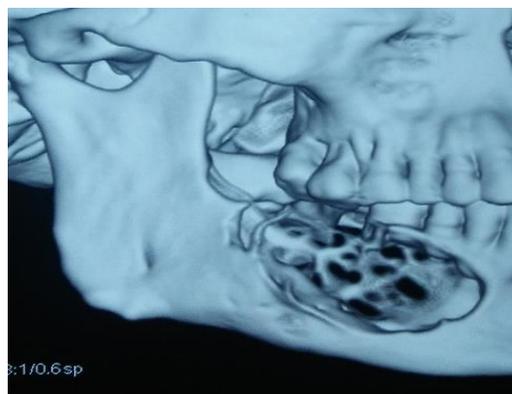
**Figure 4: 2D & 3D radiograph of ameloblastoma with impacted tooth**



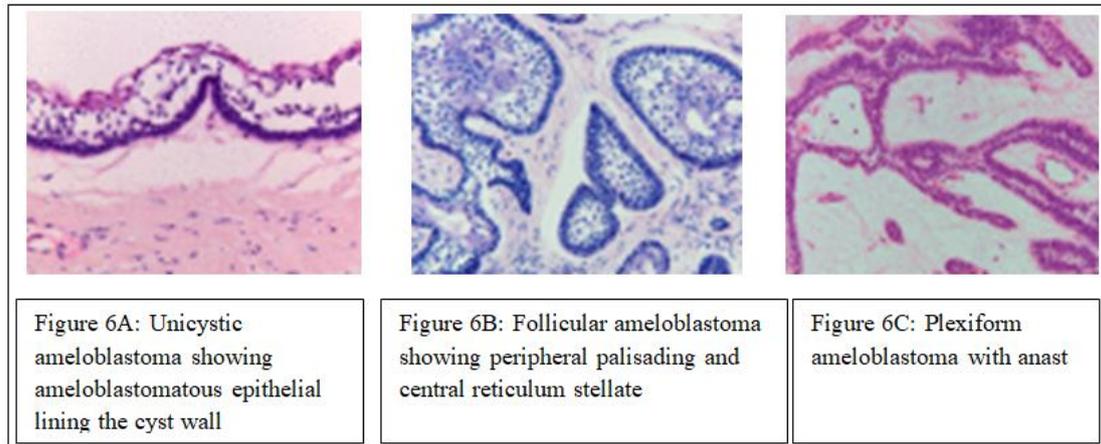
**Figure 5: 2D & 3D radiograph of ameloblastoma with and without impacted tooth**



**Figure 5A: Shows lesion associated with impacted tooth with multilocular soap bubble appearance and scalloping**



**Figure 5B: shows lesion without impacted tooth with multilocular honey comb appearance and without scalloping**



**Figure 6: Histopathology of various ameloblastoma**

## DISCUSSION

Ameloblastoma is an enigmatic group of oral tumors. They are usually benign in growth pattern but frequently invade locally and occasionally metastasize. Ameloblastoma is usually included in the differential diagnosis according to the presentation of the patient history and clinical characteristics. The diagnosis of ameloblastoma is suggested by nonspecific radiographic findings and a thorough locoregional physical examination. Nevertheless, a definitive diagnosis is only obtained through a histopathological exam. The persistent growth pattern (localized and infiltrative to the maxillofacial region) and the ability to produce pronounced deformities are clinical characteristics that contribute to the possible identification of ameloblastomas [4].

The present study, 10 (55%) out of 18 of histologically diagnosed ameloblastoma was associated with impacted teeth and remaining 8 (45%) was ameloblastoma without impacted teeth. This finding was contrary to other studies [6-8]. Till today not a single study was carried out on ameloblastoma to differentiate the association between with and without impacted teeth.

In this study, ameloblastoma associated with impacted teeth (group 1) was observed to occur between the ages of 11-45 years, with the mean age of 26.8 years and for ameloblastoma without impacted teeth (group 2) was 20-70 years with the mean age of 43 years. This is because the lower third molar and maxillary permanent canines are the teeth most frequently involved in ameloblastoma. According to other studies carried out on ameloblastoma, the most common age group was 2<sup>nd</sup> – 3<sup>rd</sup> decade [6, 7].

The present study showed a slight male predilection for group 1, with a male: female ratio of 1.5:1 and strong male predilection for group 2, with the male: Female ratio of 3:1. This due to high incidence of impacted teeth in male. This is similar to other studies [6, 7].

In this study, all lesions in group 2 (100%) and 70% of group 1 were found in posterior mandible as associated with impacted tooth and remnants of odontogenic epithelium present more commonly in that region. The anterior maxilla was involved in only 20% of lesion as the highest impacted teeth after third molar was maxillary canine and anterior mandible was involved in 10% of group 1 as it was associated with impacted lateral incisor.

As ameloblastoma was locally aggressive, the most common reported duration was less than 3 months in both group 1 (50%) and group 2 (37.5%) which is similar to other studies.<sup>8</sup> This suggested that, there is no difference of clinical behavior between the two groups.

All group 2 patients (100%) and 80% of group 1 patients were symptomatic. Clinically, tenderness on palpation was seen more in group 1 (50%) compared to group 2 (12.5%). But egg shell crackling was felt only in group 2 patients which was statistically significant. Mobility and non-vitality of adjacent teeth (62.5%) were more commonly seen in group 2 compared to group 1. The most common chief complaint associated with both group was painless swelling which is similar to other studies.<sup>6</sup> This suggest, the clinical behavior of group 1 is more likely to be a cyst and group 2 more likely to be a tumor.

According to clinical findings, 1 case was diagnosed as acute exacerbation of chronic periapical abscess in group 1 considering the findings of swelling associated with grossly carious teeth, previous history of swelling, short duration, without any changes in adjacent teeth. 7 cases were diagnosed as dentigerous cyst considering the findings of clinically missing tooth, single plate expansion, firm and gradually increasing swelling since longer duration. In group 2, all the cases were diagnosed as ameloblastoma clinically.

Compared to 2D, 3D radiograph gave statistically significant result in accordance with the border, thinning and perforation of cortex. It also gave

accurate idea about the internal structure of the lesion. In contrary to that, both 2D and 3D were giving similar result in accordance with the status of impacted teeth and changes in associated teeth.

In this study, scalloping and both plate expansion was seen more commonly (87.5%) in group 2 compared to group 1 (60%). Single plate expansion was seen only in group 1 cases. Multilocular appearance was seen in 75% of group 2 and 10% of group 1 cases. Effect on adjacent teeth like displacement (70%), knife edge root resorption (70%) and loss of lamina dura (90%) were most commonly associated with group 1 compared to group 2. According to the radiographic findings, symptomatic Group 1 cases were behaving like locally aggressive cyst and group 2 was behaving like tumor.

In group 1, most common impacted tooth associated with lesion was 48 (30%) and most common direction of angulation was horizontal (50%) with displacement of impacted teeth either superior or inferior direction in 60% of lesions.

2 asymptomatic patients were diagnosed in routine radiologic examination and given radiographic diagnosis of dentigerous cyst considering the findings of well corticated, unilocular lesion associated with impacted teeth causing only single plate expansion without thinning, perforation or scalloping of cortex and without any change in adjacent teeth. Thus, asymptomatic ameloblastoma was behaving more like cyst and symptomatic cases were behaving more aggressively.

According to radiographic findings, 2 cases were diagnosed as dentigerous cyst and 8 cases were diagnosed as ameloblastoma in group 1. All 8 cases were diagnosed as ameloblastoma in group 2 considering the findings described in introduction. The probability of diagnosis of ameloblastoma was 80% in group 1 and 100% in group 2 according to our study. Out of 10 cases of group 1, 90% were diagnosed as unicystic ameloblastoma as all cases were originated from dentigerous cyst and 1 case was diagnosed as follicular ameloblastoma. Out of 8 group 2 cases, 75% were diagnosed as follicular ameloblastoma and 25% were diagnosed as plexiform ameloblastoma. This suggested that unicystic ameloblastoma is the most common histopathological type associated with impacted teeth and follicular ameloblastoma is most commonly associated without impacted teeth which was statistically highly significant.

## CONCLUSION

Ameloblastoma is usually benign tumors. Because of its locally aggressive nature of growth characteristics, ameloblastoma can quickly become a massive and expansive tumor which causes tooth mobility, tooth movement and strange facial appearance if the patient suspends treatment. Thorough history along with clinical examination and interpretation of radiographs are necessary to diagnosis this lesion accurately for early treatment and better prognosis.

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