



Radiographic Evaluation of TMJ Osseous Alterations in Asymptomatic Elderly Population Using OPG: A Prevalence Study

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Abstract

Background: Temporomandibular joint (TMJ) osseous alterations are commonly associated with symptomatic disorders; however, similar radiographic changes may also be observed in asymptomatic individuals. With the increasing use of orthopantomograms (OPGs) in routine dental practice, incidental findings in the TMJ region have become more frequent, often leading to misinterpretation and unnecessary intervention. Understanding the prevalence of such changes in asymptomatic populations is therefore essential for accurate diagnosis and clinical decision-making.

Aim: The aim of the present study was to evaluate the prevalence and characteristics of osseous alterations in the temporomandibular joint of asymptomatic elderly individuals using OPG and to assess their association with age, gender, and condylar morphology.

Materials and Methods: A retrospective cross-sectional study was conducted on 100 digital orthopantomograms of asymptomatic individuals aged 40–70 years, comprising equal numbers of males and females. Radiographic evaluation included assessment of condylar flattening, articular eminence flattening, erosion, osteophyte formation, subchondral sclerosis, Ely’s cyst, and glenoid fossa morphology. All images were assessed by experienced oral radiologists under standardized conditions. Data were analyzed using descriptive statistics and Chi-square test, with a p-value < 0.05 considered statistically significant.

Results: The majority of participants belonged to the 50–59 year age group. Conical condylar morphology was the most common, followed by round morphology. Condylar flattening (62%) and erosion (57%) were the most frequently observed osseous alterations, while osteophyte formation and Ely’s cyst were less common findings. No

statistically significant association was found between TMJ osseous changes and age or gender. However, a significant association was observed between condylar morphology and condylar flattening.

Conclusion: TMJ osseous alterations are commonly observed in asymptomatic elderly individuals on OPG and are likely to represent physiological remodeling rather than pathological changes. Awareness of these findings is important to prevent over diagnosis and unnecessary treatment.

Keywords: Temporomandibular Joint, Orthopantomograms, Asymptomatic, Osseous, Radiographs

Introduction

The temporomandibular joint (TMJ) is a complex synovial articulation that plays a vital role in mastication, speech, and mandibular movements. It is subjected to continuous functional loading, resulting in adaptive remodeling throughout life. Radiographic evaluation of the TMJ often reveals osseous changes such as condylar flattening, erosion, osteophyte formation, and subchondral sclerosis, which have traditionally been associated with temporomandibular disorders¹. However, several studies have demonstrated that similar radiographic findings may also be present in asymptomatic individuals, particularly in the elderly population².

With the widespread use of orthopantomograms (OPGs) in routine dental practice, incidental detection of TMJ alterations has become increasingly common. This creates a diagnostic challenge for clinicians, as it becomes difficult to distinguish between normal age-related remodeling and pathological changes³. Misinterpretation of such findings may lead to unnecessary investigations and treatment. Therefore, it is essential to establish baseline data regarding the

prevalence and pattern of TMJ osseous changes in asymptomatic individuals, especially within the Indian population where such data remain limited⁴.

Aim

The aim of the present study was to evaluate the prevalence and characteristics of osseous alterations in the temporomandibular joint of asymptomatic elderly individuals using orthopantomograms and to assess their association with age, gender, and condylar morphology.

Objectives

The objectives of the study were to determine the prevalence of osseous changes such as condylar flattening, erosion, osteophyte formation, and subchondral sclerosis; to evaluate the distribution of condylar morphology; to assess the association of these changes with age and gender; and to analyze the relationship between condylar morphology and radiographic findings.

Need for the Study

Radiographic TMJ alterations are often interpreted as pathological findings even in the absence of clinical symptoms, which may result in over diagnosis and unnecessary interventions. With the increasing use of OPG as a routine diagnostic tool, incidental findings in the TMJ region have become more frequent. However, there is limited data on the prevalence and pattern of such changes in asymptomatic elderly individuals, particularly in the Indian context. Hence, this study was undertaken to provide baseline data that may assist clinicians in differentiating normal anatomical variations from early degenerative changes⁵.

Materials and Methods

The present study was designed as a retrospective cross-sectional prevalence study conducted using 100 digital orthopantomograms of asymptomatic individuals aged between 40 and 70 years, with equal representation of

males and females. The radiographs were obtained from archived records of the Department of Oral Medicine and Radiology and were selected based on predefined inclusion and exclusion criteria.

Radiographic evaluation was performed under standardized viewing conditions by two experienced oral radiologists who were blinded to patient details. Each TMJ was assessed for condylar flattening, articular eminence flattening, erosion, osteophyte formation, subchondral sclerosis, Ely's cyst, and glenoid fossa morphology. In cases of disagreement, consensus was achieved through joint evaluation. (Fig 1- 4)

The collected data were entered into Microsoft Excel and analyzed using SPSS software. Descriptive statistics, including frequency and percentage, were calculated, and the Chi-square test was used to assess associations between variables. A p-value of less than 0.05 was considered statistically significant⁶.

Inclusion and Exclusion Criteria

The study included individuals aged between 40 and 70 years who were clinically asymptomatic for temporomandibular joint disorders and had high-quality digital OPGs with clearly visible TMJ regions. Equal numbers of male and female subjects were included to ensure balanced representation.

Individuals with a history of TMJ disorders, trauma, or surgery were excluded from the study. Patients with systemic joint diseases such as rheumatoid arthritis, edentulous individuals, those with significant occlusal alterations, poor-quality radiographs, or those undergoing TMJ treatment or splint therapy were also excluded to avoid confounding factors.

Results

The present study included 100 asymptomatic elderly individuals, with the majority of participants belonging to the 50–59 years age group (73%), followed by 60–69

years (21%), while only 3% each were in the 40–49 years and ≥ 70 years categories. The study population demonstrated an equal gender distribution, comprising 50 males and 50 females, ensuring balanced representation. Evaluation of condylar morphology revealed that the conical type was the most prevalent (46%), followed by the round type (38%). Mixed morphologies were comparatively less frequent, with round/conical observed in 4% of cases, round-hook in 7%, and conical-hook in 5%. The predominance of conical and round forms suggests that these represent common anatomical variations in the elderly population, whereas hook-shaped and mixed variants are relatively uncommon. [(Table 1& Graph 1)].

Analysis of condylar morphology across gender showed a similar distribution pattern, with conical morphology being slightly more common in males (50.0%) and nearly equal proportions of round (40.0%) and conical (42.0%) types observed in females. Mixed morphologies were infrequent in both groups. Statistical analysis demonstrated no significant association between gender and condylar morphology ($p = 0.939$). Similarly, although variations were observed across age groups, with conical morphology predominating in the 40–49 years (66.7%) and 60–69 years (57.1%) groups, and a more balanced distribution in the 50–59 years group, the association between age and condylar morphology was not statistically significant ($p = 0.166$). [(Table 2& Graph 2)]

Radiographic evaluation of TMJ osseous changes revealed that condylar flattening was the most common finding, present in 62% of participants, followed by erosion (57%) and subchondral sclerosis (34%). Articular eminence flattening was observed in 36% of cases, while osteophyte formation was noted in 28%. Ely's cyst was the least frequent finding, detected in only 13% of

individuals. With respect to glenoid fossa morphology, a shallow fossa was more prevalent (66%) compared to a deep fossa (34%). These findings indicate that degenerative changes, particularly condylar flattening and erosion, are relatively common even in asymptomatic individuals.

Comparison of radiographic findings between males and females showed no statistically significant differences for any of the parameters studied ($p > 0.05$). Although condylar flattening was slightly more common in females (66%) than in males (58%), and subchondral sclerosis was observed more frequently in females (38%) compared to males (30%), these differences were not significant. Similarly, articular eminence flattening, erosion, osteophyte formation, and Ely's cyst demonstrated only minor variations between genders. The distribution of glenoid fossa depth was identical in both sexes, with shallow fossae being twice as common as deep fossae (66% vs. 34%). [Table 3,4 & Graph 3,4,5] A statistically significant association was observed between condylar morphology and condylar flattening ($p = 0.044$), with higher prevalence noted in non-round morphologies such as conical (69.6%), round/conical (75%), round-hook (71.4%), and conical-hook (80%) compared to round condyles (47.4%). Although articular eminence flattening showed a trend toward higher prevalence in hook-shaped morphologies, this association did not reach statistical significance ($p = 0.063$). No significant associations were found between condylar morphology and other radiographic findings, including erosion, osteophyte formation, subchondral sclerosis, Ely's cyst, or glenoid fossa depth ($p > 0.05$). However, descriptive analysis suggested that complex morphologies exhibited relatively higher frequencies of degenerative changes. [Table 5]

Age-wise analysis revealed that condylar flattening was most prevalent in the 50–59 years group (67.1%), followed by the ≥ 70 years (66.7%) and 60–69 years (52.4%) groups, while it was absent in the 40–49 years category. Erosive changes and subchondral sclerosis showed slightly higher frequencies in older age groups, whereas osteophyte formation was more common in the 50–59 years group. Ely's cyst remained an infrequent finding across all age groups. Despite these variations, none of the radiographic parameters demonstrated a statistically significant association with age ($p > 0.05$). [Table 6]

Overall, the findings of the present study indicate that TMJ osseous alterations are common in asymptomatic elderly individuals, with no significant influence of age or gender, while condylar morphology appears to play a role in specific changes such as condylar flattening.

Discussion

The findings of the present study demonstrate that osseous alterations of the temporomandibular joint are commonly observed in asymptomatic elderly individuals. Condylar flattening emerged as the most prevalent radiographic finding, followed by erosion and subchondral sclerosis. These findings support the concept that such changes may represent adaptive remodeling of the joint in response to functional stress rather than true pathological degeneration⁷.

The predominance of conical and round condylar morphologies observed in the study suggests that these forms may represent normal anatomical variations within the elderly population. The absence of significant association between condylar morphology and demographic variables such as age and gender further supports the notion that these variations are physiological rather than pathological.

Interestingly, a significant association was found between condylar morphology and condylar flattening, indicating that certain morphological patterns may influence the distribution of mechanical stress within the joint, thereby predisposing to specific remodeling changes. However, other radiographic findings such as erosion, osteophyte formation, and sclerosis did not show significant association with morphology, suggesting that these changes may occur independently.

The lack of statistically significant association between TMJ osseous changes and age or gender is consistent with previous studies, indicating that such alterations are widespread and not limited to specific demographic groups⁸. These findings highlight the importance of correlating radiographic findings with clinical presentation to avoid over diagnosis.

Limitations

The present study has certain limitations, including a relatively small sample size and retrospective design. The use of OPG, which provides a two-dimensional representation of a three-dimensional structure, may limit the detection of subtle changes. Additionally, the absence of clinical correlation and longitudinal follow-up restricts the ability to assess the progression and clinical significance of the observed findings.

Future Perspectives

Future studies with larger sample sizes and prospective designs are recommended to validate these findings. The use of advanced imaging modalities such as cone beam computed tomography (CBCT) and magnetic resonance imaging (MRI) may provide more detailed evaluation of TMJ structures. Longitudinal studies correlating radiographic findings with clinical symptoms would further enhance understanding of the significance of these changes.

Conclusion

Within the limitations of the present study, it can be concluded that TMJ osseous alterations are frequently observed in asymptomatic elderly individuals when evaluated using orthopantomograms. These changes, particularly condylar flattening and erosion, are likely to represent physiological remodeling rather than pathological conditions. Therefore, careful interpretation of such findings is essential to prevent unnecessary diagnostic and therapeutic interventions.

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Legend Figures, Tables and Graphs



Figure 1: Orthopantomogram showing flattening of right condylar head, osteophyte formation and subchondral sclerosis on left condyle and flattening of both articular eminences.



Figure 2: Orthopantomogram showing erosion of right condylar head and Ely's cyst formation in the right condyle, osteophyte formation on left condyle and flattening of left articular eminence.



Figure 3: Orthopantomogram showing subchondral sclerosis on both condylar heads.



Figure 4: Orthopantomogram showing round condylar heads and deep right glenoid fossa and shallow left glenoid fossa.

Table 1: Distribution of Condylar Morphology among Study Participants (n = 100)

Condylar Morphology	n	%
Round	38	38.0
Conical	46	46.0
Round/Conical	4	4.0
Round-Hook	7	7.0
Conical-Hook	5	5.0
Total	100	100.0

Table 2: Association of Condylar Morphology with Gender and Age Group among Study Participants (n = 100)

Variable	Category	Round n (%)	Conical n (%)	Round/Conical n (%)	Round-Hook n (%)	Conical-Hook n (%)	Total n (%)	χ^2 value	p-value
Gender	Male	18 (36.0)	25 (50.0)	2 (4.0)	3 (6.0)	2 (4.0)	50 (50.0)	0.796	0.939
	Female	20 (40.0)	21 (42.0)	2 (4.0)	4 (8.0)	3 (6.0)	50 (50.0)		
Age Group	40-49 yrs	1 (33.3)	2 (66.7)	0 (0.0)	0 (0.0)	0 (0.0)	3 (3.0)	16.591	0.166
	50-59 yrs	29 (39.7)	32 (43.8)	3 (4.1)	5 (6.8)	4 (5.5)	73 (73.0)		
	60-69 yrs	7 (33.3)	12 (57.1)	0 (0.0)	2 (9.5)	0 (0.0)	21 (21.0)		
	≥70 yrs	1 (33.3)	0 (0.0)	1 (33.3)	0 (0.0)	1 (33.3)	3 (3.0)		

Table 3: Distribution of Radiographic Features among Study Participants (n = 100)

Radiographic Feature	Category	n	%
Condylar Flattening	Absent	38	38.0
	Present	62	62.0
Articular Eminence Flattening	Absent	64	64.0
	Present	36	36.0
Erosion	Absent	43	43.0
	Present	57	57.0
Osteophyte Formation	Absent	72	72.0
	Present	28	28.0
Subchondral Sclerosis	Absent	66	66.0
	Present	34	34.0
Ely's Cyst	Absent	87	87.0
	Present	13	13.0
Glenoid Fossa	Deep	34	34.0
	Shallow	66	66.0

Table 4: Association between Gender and TMJ Morphology / Radiographic Findings (n = 100)

Variable	Category	Male n (%)	Female n (%)	χ^2 Value	df	p-value
Condylar Flattening	Absent	21 (42.0)	17 (34.0)	0.679	1	0.410
	Present	29 (58.0)	33 (66.0)			
Articular Eminence Flattening	Absent	34 (68.0)	30 (60.0)	0.694	1	0.405
	Present	16 (32.0)	20 (40.0)			
Erosion	Absent	21 (42.0)	22 (44.0)	0.041	1	0.840
	Present	29 (58.0)	28 (56.0)			
Osteophyte Formation	Absent	35 (70.0)	37 (74.0)	0.198	1	0.656
	Present	15 (30.0)	13 (26.0)			
Subchondral Sclerosis	Absent	35 (70.0)	31 (62.0)	0.713	1	0.398
	Present	15 (30.0)	19 (38.0)			
Ely's Cyst	Absent	44 (88.0)	43 (86.0)	0.088	1	0.766
	Present	6 (12.0)	7 (14.0)			
Glenoid Fossa Depth	Deep	17 (34.0)	17 (34.0)	0.000	1	1.000
	Shallow	33 (66.0)	33 (66.0)			

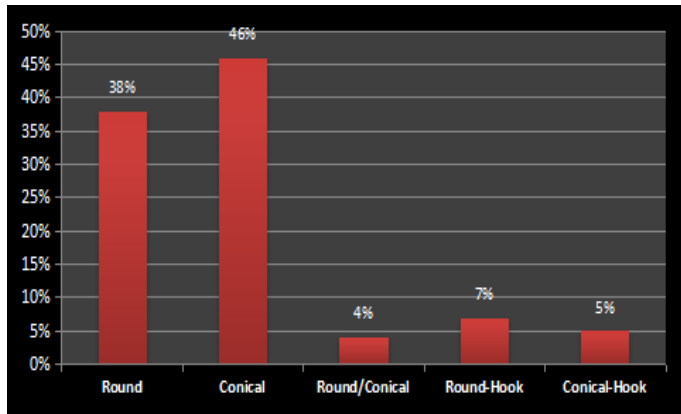
Table 5: Association between Condylar Morphology and Radiographic Findings (n = 100)

Variable	Category	Round n (%)	Conical n (%)	Round/Conical n (%)	Round-Hook n (%)	Conical-Hook n (%)	χ^2 Value	df	p-value
Condylar Flattening	Absent	20 (52.6)	14 (30.4)	1 (25.0)	2 (28.6)	1 (20.0)	9.81	4	0.044*
	Present	18 (47.4)	32 (69.6)	3 (75.0)	5 (71.4)	4 (80.0)			
Articular Eminence Flattening	Absent	29 (76.3)	28 (60.9)	3 (75.0)	2 (28.6)	2 (40.0)	8.91	4	0.063
	Present	9 (23.7)	18 (39.1)	1 (25.0)	5 (71.4)	3 (60.0)			
Erosion	Absent	19 (50.0)	20 (43.5)	1 (25.0)	2 (28.6)	1 (20.0)	4.19	4	0.381
	Present	19 (50.0)	26 (56.5)	3 (75.0)	5 (71.4)	4 (80.0)			
Osteophyte Formation	Absent	30 (78.9)	34 (73.9)	3 (75.0)	3 (42.9)	2 (40.0)	6.64	4	0.156
	Present	8 (21.1)	12 (26.1)	1 (25.0)	4 (57.4)	3 (60.0)			
Subchondral Sclerosis	Absent	28 (73.7)	30 (65.2)	4 (100.0)	3 (42.9)	1 (20.0)	6.52	4	0.164
	Present	10 (26.3)	16 (34.8)	0 (0.0)	4 (57.1)	4 (80.0)			
Ely's Cyst	Absent	33 (86.8)	39 (84.8)	3 (75.0)	7 (100.0)	5 (100.0)	2.04	4	0.728
	Present	5 (13.2)	7 (15.2)	1 (25.0)	0 (0.0)	0 (0.0)			
Glenoid Fossa Depth	Deep	13 (34.2)	16 (34.8)	1 (25.0)	2 (28.6)	2 (40.0)	0.35	4	0.986
	Shallow	25 (65.8)	30 (65.2)	3 (75.0)	5 (71.4)	3 (60.0)			

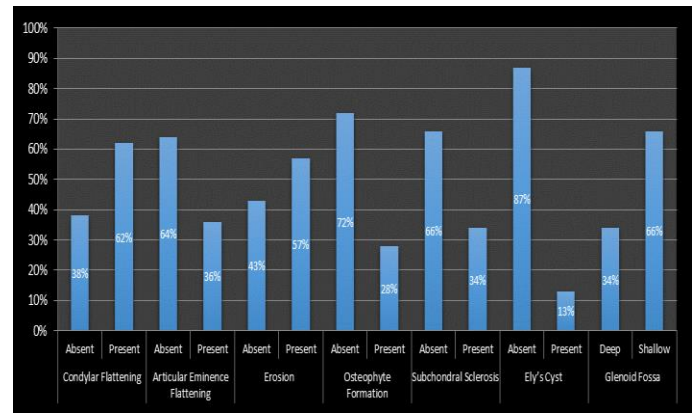
Table 6: Age-wise distribution of TMJ osseous alterations and association (n = 100)

Osseous Alteration	Age Group	Absent n (%)	Present n (%)	Total n (%)	χ^2 value	p-value
Condylar Flattening	40-49 yrs	3 (100.0)	0 (0.0)	3 (3.0)	6.560	0.087
	50-59 yrs	24 (32.9)	49 (67.1)	73 (73.0)		
	60-69 yrs	10 (47.6)	11 (52.4)	21 (21.0)		
	≥70 yrs	1 (33.3)	2 (66.7)	3 (3.0)		
Articular Eminence Flattening	40-49 yrs	2 (66.7)	1 (33.3)	3 (3.0)	0.063	0.996
	50-59 yrs	47 (64.4)	26 (35.6)	73 (73.0)		
	60-69 yrs	13 (61.9)	8 (38.1)	21 (21.0)		
	≥70 yrs	2 (66.7)	1 (33.3)	3 (3.0)		
Erosion	40-49 yrs	1 (33.3)	2 (66.7)	3 (3.0)	0.580	0.901
	50-59 yrs	33 (45.2)	40 (54.8)	73 (73.0)		
	60-69 yrs	8 (38.1)	13 (61.9)	21 (21.0)		
	≥70 yrs	1 (33.3)	2 (66.7)	3 (3.0)		
Osteophyte Formation	40-49 yrs	2 (66.7)	1 (33.3)	3 (3.0)	1.557	0.669
	50-59 yrs	51 (69.9)	22 (30.1)	73 (73.0)		
	60-69 yrs	16 (76.2)	5 (23.8)	21 (21.0)		
	≥70 yrs	3 (100.0)	0 (0.0)	3 (3.0)		
Subchondral Sclerosis	40-49 yrs	1 (33.3)	2 (66.7)	3 (3.0)	2.647	0.449
	50-59 yrs	51 (69.9)	22 (30.1)	73 (73.0)		
	60-69 yrs	12 (57.1)	9 (42.9)	21 (21.0)		
	≥70 yrs	2 (66.7)	1 (33.3)	3 (3.0)		
Ely's Cyst	40-49 yrs	3 (100.0)	0 (0.0)	3 (3.0)	1.397	0.706
	50-59 yrs	62 (84.9)	11 (15.1)	73 (73.0)		
	60-69 yrs	19 (90.5)	2 (9.5)	21 (21.0)		
	≥70 yrs	3 (100.0)	0 (0.0)	3 (3.0)		
Glenoid Fossa Morphology	40-49 yrs	0 (0.0)	3 (100.0)	3 (3.0)	1.635	0.651
	50-59 yrs	26 (35.6)	47 (64.4)	73 (73.0)		
	60-69 yrs	7 (33.3)	14 (66.7)	21 (21.0)		
	≥70 yrs	1 (33.3)	2 (66.7)	3 (3.0)		

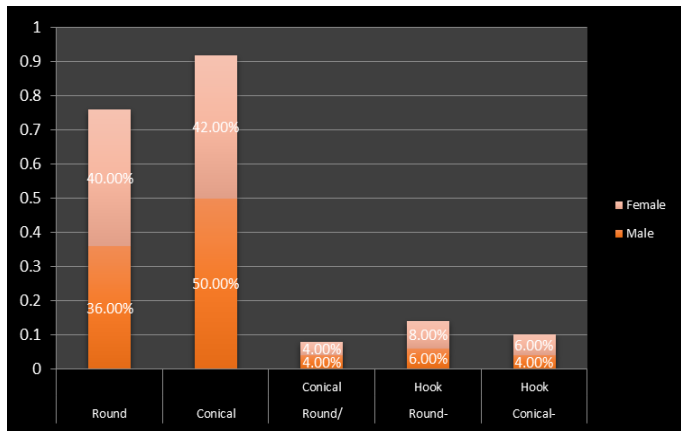
Graph 1: Distribution of Condylar Morphology among Study Participants (n = 100)



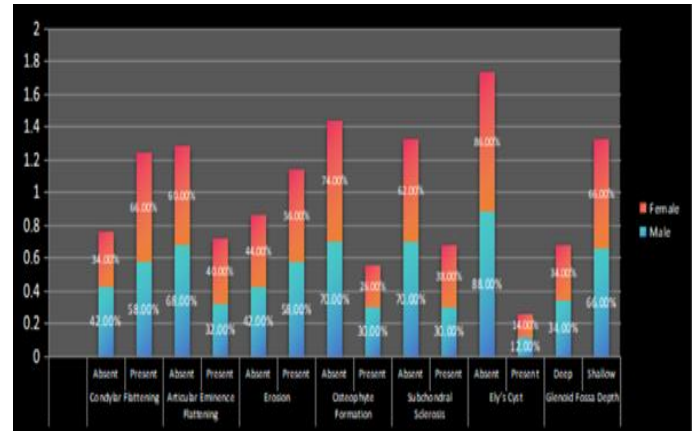
Graph 4: Distribution of Radiographic Features among Study Participants (n = 100)



Graph 2: Distribution of condylar Morphology according to gender



Graph 5: Distribution of Radiographic Features among Study Participants according to gender (n = 100)



Graph 3: Distribution of condylar Morphology according to age groups

