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Assessment of Temporomandibular Joint Region Using Cone Beam Computed Tomography: A Retrospective Study

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Abstract: ***Background: Cone Beam Computed Tomography (CBCT) has become an indispensable imaging modality in dental and maxillofacial diagnostics due to its three-dimensional visualization and high diagnostic accuracy. The increasing use of CBCT has led to the detection of incidental findings (IFs), particularly in regions not directly related to the primary diagnostic purpose. The temporomandibular joint (TMJ) region, owing to its complex anatomy, is frequently included in large field-of-view CBCT scans, making it susceptible to incidental detection of osseous and soft tissue alterations. Aim: To assess the prevalence and pattern of incidental findings in the temporomandibular joint region using cone beam computed tomography. Materials and Methods: A retrospective study was conducted on 350 CBCT scans obtained for diagnostic purposes unrelated to TMJ evaluation. Scans with a full field of view including both maxilla and mandible were included. The images were evaluated in corrected sagittal, coronal, and axial planes for TMJ incidental findings. Findings were categorized into flattening and erosion of the condyle, osteophyte formation, condylar hyperplasia, condylar hypoplasia, bifid condyle, and soft tissue calcifications. Statistical analysis was performed using SPSS version 21.0. Results: Incidental findings were observed in a significant number of CBCT scans. Flattening and erosion of the condyle were the most frequently encountered findings, followed by osteophyte formation and soft tissue calcifications. A statistically significant association was observed between incidental findings and increasing age ($p < 0.05$). No significant gender predilection was noted. Conclusion: CBCT is a valuable imaging modality for the detection of incidental findings in the TMJ region. Proper evaluation of the TMJ area in routine CBCT scans is essential, as these findings may influence treatment planning and necessitate referral or modification of dental procedures.***

Keywords: Cone beam computed tomography, Incidental findings, Temporomandibular joint, Condylar changes, Retrospective study

1. Introduction

Cone Beam Computed Tomography (CBCT) has revolutionized maxillofacial imaging since its introduction in 1998, offering three-dimensional visualization with reduced radiation dose compared to conventional computed tomography. CBCT is widely utilized in orthodontics, implant dentistry, evaluation of impacted teeth, presurgical planning, and dentoalveolar assessment. The enhanced spatial resolution and three-dimensional capability of CBCT increase the likelihood of detecting incidental findings that are often missed on conventional two-dimensional radiographs.

Incidental findings are defined as abnormalities detected on imaging that are unrelated to the patient's chief complaint or the initial diagnostic purpose. Large field-of-view CBCT scans frequently encompass adjacent anatomical structures, including the temporomandibular joint, paranasal sinuses, cervical vertebrae, and airway spaces, thereby increasing the probability of identifying clinically significant incidental findings.

The temporomandibular joint is a unique synovial joint responsible for complex mandibular movements such as mastication, speech, and swallowing. Structural harmony between the condyle, articular disc, glenoid fossa, and associated musculature is essential for normal joint function. Alterations in condylar morphology may lead to temporomandibular disorders (TMDs), which have a varied prevalence across populations.

Identification of incidental TMJ findings is clinically relevant as they may alter dental treatment planning, delay procedures, or require specialist referral. Early detection through CBCT may aid in preventing progression of joint pathology. Hence, the present study aimed to evaluate incidental findings in the TMJ region using cone beam computed tomography.

2. Materials and Methods

Study Design
A retrospective observational study.

Study Setting
Department of Oral Medicine and Radiology.

Study Population
CBCT scans of patients who underwent imaging for diagnostic purposes unrelated to the temporomandibular joint but included the TMJ region within the field of view.

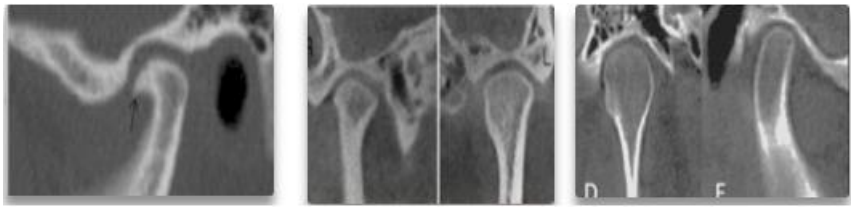
Sample Size
A total of 350 CBCT scans were included in the study.

Sampling Technique
Purposive sampling technique.

Inclusion Criteria
- CBCT scans with a full field of view including both maxilla and mandible
- Scans that clearly included the TMJ region
- Patients aged between 20 and 70 years
- Both male and female patients
- Dentate and partially dentate individuals

Exclusion Criteria
- Patients below 20 years of age
- CBCT scans with limited field of view involving only maxilla or mandible
- Scans with poor image quality or artifacts obscuring the TMJ region

Image Evaluation
CBCT scans obtained between November 2024 and February 2025 were evaluated. Images were assessed in corrected sagittal, corrected coronal, and axial planes. TMJ incidental findings were categorized into:
- Flattening and erosion of the condyle
- Osteophyte formation
- Condylar hyperplasia
- Condylar hypoplasia
- Bifid condyle
- Soft tissue calcifications



Statistical Analysis
Data were analyzed using Statistical Product and Service Solution (SPSS) version 21.0. Shapiro–Wilk test was used to assess normality. Chi-square test was applied to determine associations between incidental findings and variables such as age, gender, and TMJ side. Pearson's correlation was used where applicable. A p-value < 0.05 was considered statistically significant.

3. Results

Out of the 350CBCT scans evaluated, incidental findings in the TMJ region were identified in a considerable proportion of cases. The most common finding was flattening and erosion of the condylar head, followed by osteophyte formation. Soft tissue calcifications were observed less frequently. Condylar hyperplasia, hypoplasia, and bifid condyle were rare findings. A statistically significant increase in incidental findings was observed with advancing age ($p < 0.05$). No statistically significant difference was observed between males and females. Both right and left TMJs showed comparable prevalence of findings.

4. Discussion

The present study highlights the importance of systematic evaluation of the TMJ region in CBCT scans obtained for routine dental purposes. The high prevalence of incidental condylar changes observed aligns with previous studies, emphasizing age-related degenerative alterations of the temporomandibular joint.

Flattening and erosion of the condyle are commonly associated with adaptive remodeling or early degenerative joint disease. Osteophyte formation represents advanced degenerative changes and may remain asymptomatic for long periods. Detection of such findings is crucial, as they may influence prosthodontic, orthodontic, or surgical treatment planning.

CBCT offers superior visualization of osseous structures compared to panoramic radiography and allows early identification of TMJ abnormalities. However, clinicians must be adequately trained to recognize and interpret incidental findings to avoid medico-legal implications.

5. Conclusion

Cone beam computed tomography is an effective imaging modality for detecting incidental findings in the temporomandibular joint region. Routine and thorough evaluation of the TMJ area in CBCT scans is essential, even when imaging is performed for unrelated diagnostic purposes. Early identification of TMJ abnormalities may facilitate timely intervention, appropriate referrals, and improved patient care.

References

[1] Mozzo P, Procacci C, Tacconi A, et al. A new volumetric CT machine for dental imaging based on the cone-beam technique: preliminary results. Eur Radiol 1998;8(9):1558–1564. DOI: 10.1007/s003300050586
[2] Dreiseidler T, Mischkowski RA, Neugebauer J, et al. Comparison of cone-beam imaging with orthopantomography and computerized tomography for assessment in presurgical implant dentistry. Int J Oral Maxillofac Implants 2009;24(2):216–225. PMID: 19492636.
[3] Hans MG, Palomo JM, Valiathan M. History of imaging in orthodontics from Broadbent to cone-beam computed tomography. Am J Orthod Dentofacial Orthop 2015;148(6):914–921. DOI: 10.1016/j.ajodo.2015.09.007.
[4] Caglayan F, Tozoğlu U. Incidental findings in the maxillofacial region detected by cone beam CT. Diagn Interv Radiol 2012;18(2):159–163. DOI: 10.4261/1305-3825.DIR.4341-11.2

[5] Al-koshab M, Nambiar P, John J. Assessment of condyle and glenoid fossa morphology using CBCT in South-East Asians. PLoS One 2015;10(3):e0121682. DOI: 10.1371/journal.pone.0121682.
[6] Alhammadi MS, Shafey AS, Fayed MS, et al. Temporomandibular joint measurements in normal occlusion: a three-dimensional cone beam computed tomography analysis. J World Fed Orthod 2014;3(4):155–162. DOI: 10.1016/j.ejwf.2014.08.005.
[7] Alomar X, Medrano J, Cabratosa J, et al. Anatomy of the temporomandibular joint. Semin Ultrasound CT MR 2007;28(3):170 183. DOI: 10.1053/j.sult.2007.02.002.
[8] Borahan MO, Mayil M, Pekiner FN. Using cone beam computed tomography to examine the prevalence of condylar bony changes in a Turkish subpopulation. Niger J Clin Pract 2016;19(2):259–266. DOI: 10.4103/1119-3077.164336.
[9] Zain-Alabdeen EH, El Khateeb SM. Incidental cone beam computed tomographic findings among Taibah University patients, KSA: a retrospective study. J Taibah Univ Med Sci 2017;12(2):131–138. DOI: 10.1016/j.jtumed.2016.10.014.
[10] Price JB, Thaw KL, Tyndall DA, et al. Incidental findings from cone beam computed tomography of the maxillofacial region: a descriptive retrospective study. Clin Oral Implants Res 2012;23(11):1261–1268. DOI: 10.1111/j.1600-0501.2011.02299.x.
[11] Rheem S, Nielsen IL, Oberoi S. Incidental findings in the region identified on cone-beam computed tomography scans. J Orthod Res 2013;1(1):33–39. DOI: 10.4103/2321-3825.112254.
[12] Altındag A, Avsever H, Borahan O, et al. Incidental findings in cone beam computed tomographic images: calcifications in head and neck region. Balk J Dent Med 2017;21(2):100–107. DOI: 10.1515/bjdm-2017 0015.
[13] Crusoe Rebello IM, Campos PS, Rubira IR, et al. Evaluation of the relation between the horizontal condylar angle and the internal derangement of the TMJ – a magnetic resonance imaging study. Pesqui Odontol Bras 2003;17(2):176–182. DOI: 10.1590/s1517 74912003000200015. The Journal of Contemporary Dental Practice,
[14] Mehdizadeh M, Rezaei Z, Moghadam FG. Incidental findings in temporomandibular joint region detected by conebeam computed tomography: a retrospective study. Open Dent J 2020;14(1):337–342. DOI: 10.2174/1874210602014010337.
[15] Arnheiter C, Scarfe WC, Farman AG. Trends in maxillofacial cone-beam computed tomography usage. Oral Radiol 2006;22(2):80–85. DOI: 10.1007/s11282-006-0055-6.
[16] Cha JY, Mah J, Sinclair P. Incidental findings in the maxillofacial area with 3-dimensional cone-beam imaging. Am J Orthod Dentofac Orthop 2007;132(1):7e14. DOI: 10.1016/j.ajodo.2005.08.041.
[17] Pazera P, Bornstein MM, Pazera A, et al. Incidental maxillary sinus findings in orthodontic patients: a radiographic analysis using cone-beam computed tomography (CBCT). Orthod Craniofac Res 2011;14(1):17–24. DOI: 10.1111/j.1601-6343.2010.01502.x
[18] Hans MG, Martin Palomo J, Valiathan M. History of imaging in orthodontics from Broadbent to cone-beam computed tomogra phy. Am J Orthod Dentofac Orthop. 2015; 148: 914–21. https:// doi.org/10.1016/j.ajodo.2015.09.007.
[19] Ludlow JB, Timothy R, Walker C, Hunter R, Benavides E, Samuelson DB, et al. Efective dose of dental CBCT—a meta analysis of published data and additional data for nine CBCT units. Dentomaxillofac Radiol. 2015. https:// doi. org/ 10. 1259/ dmfr.20140197.
[20] Çağlayan F, Tozoğlu Ü. Incidental findings in the maxillofa cial region detected by cone beam CT. Diagn Interv Radiol. 2012; 18: 159–63. https:// doi. org/ 10. 4261/ 1305- 3825. DIR. 4341-11.2.
[21] Kachlan MO, Yang J, Balshi TJ, Wolfinger GJ, Balshi SF. Inci dental findings in cone beam computed tomography for dental implants in 1002 patients. J Prosthodont. 2021. https://doi.org/ 10.1111/jopr.13329.
[22] Edwards R, Altalibi M, Flores-Mir C. The frequency and nature of incidental findings in cone-beam computed tomographic scans of the head and neck region: a systematic review. J Am Dental Assoc. 2013; 144: 161–70. https:// doi. org/ 10. 14219/ jada. archive.2013.0095.

RESULTS -

Table 1: Descriptive statistics of incidental findings seen on 100 CBCT screened

	Frequency (n)	Percentage (%)
Flattening and erosion of condyle	45/100	45%
Osteophytes	14/100	14%
Condyle Hyperplasia	2/100	2%
Condyle Hypoplasia	5/100	5%
Bifid condyle	4/100	4%
Soft tissue calcifications	30/100	30%
Total	100	100%
Average Prevalence (Incidental findings/Total Scan)	100/350	28.5%

- The most IF seen was flattening and erosion of condyle and soft tissue calcification. The prevalence of flattening and erosion of condyle and articular eminence was remarkably high.

Table 2: Descriptive statistics of incidental findings -gender wise seen on 100 CBCT screened

	Males	Females	Frequency (n)	Percentage (%)
Flattening and erosion of condyle	22	23	45/100	45%
Osteophytes	8	6	14/100	14%
Condyle Hyperplasia	2	0	2/100	2%
Condyle Hypoplasia	4	1	5/100	5%
Bifid condyle	1	3	4/100	4%
Soft tissue calcifications	16	14	30/100	30%
Total	53 (53%)	47 (47%)	100/100	100%

A total of 350 CBCT scans were assessed in this study; 230 of the subjects (47%) were female and 120 (53%) were male .