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Correlation Between Clinical Symptoms and Cone Beam Computed Tomography Findings in TMD Patients

Reema Alshawaf

Department of Oral Medicine and Diagnostic Sciences College of Dentistry, King Saud University, Saudi Arabia

Correspondence: Reema AlShawaf, BDS, MSC. Lecturer Maxillofacial Radiology College of dentistry King Saud University, Saudi Arabia, Tel 00966-55 453 9333; 009661 18056104; Fax 00966-11 46 77423, Email ralshawaf@ksu.edu.sa

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Abstract

Objective: The aim of the study was to correlate between the clinical symptoms reported by Oral medicine specialist and the presence of osteroarthic changes in the condyles of patients with TMD using Cone Beam Computed Tomography (CBCT)

Material and Methods: This is a retrospective study in which clinical and radiographic data were obtained from the records of the 50 TMD patients seen at King Saud University (KSU), College of Dentistry, who had CBCT examination undertaken for the TMJ area in the time between years 2008-2017. Data was collected in a special form and analyzed. The prevalence as well as correlations between the clinical symptoms (pain, clicking and limitation on mouth opening) and radiographic CBCT findings of the condyles (flattening, sclerosis, osteophytes, erosions and subchondral cysts) diagnosis were determined for all cases. Correlation between clinical and radiographic findings was performed using the Chi-square test. P values less than 0.05 were considered statistically significant.

Results: Female 40 (80%) and 10 males (20%) with an average age of 29 years. The highest age range was in the age range from 21-30 years and comprised 48% of all age groups. At the time of radiographic examination, pain, clicking, and Limited Mouth opening was present in 64 %, 70%, and 43.2 % of the sample respectively. CBCT findings showed Flattening, Erosion, Osteophyte, Sclerosis present in 90%, 60%, 30%, and 14%, respectively. Correlation between clinical and radiographic findings was performed using the qi square and when the fisher extract was used. It revealed no significant correlations between the clinical symptoms and radiographic CBCT findings of the condyles. A significant correlation was only found between the presence of osteophytes and limited mouth opening.

Conclusion: The study's findings demonstrated no significant correlations between the clinical symptoms and radiographic CBCT findings of the condyles. A significant correlation was only found between the presence of osteophytes and limited mouth opening.

Keywords: TMD, CBCT, pain, clicking, limitation of mouth opening flattening, sclerosis, osteophytes, erosions and subchondral cysts, condyle, osteoarthritic changes

Introduction

Temporomandibular disorders (TMD) are a class of degenerative musculoskeletal conditions associated with morphologic and functional deformities. They present a heterogeneous group of complex disorders of varied and often multifactorial etiologies and are considered the most common cause of non-dental pain in the orofacial region.[1–3] The diagnosis is initially based on presenting symptoms and the clinical examination. The clinical examination assesses the mandibular range of motion and associated pain, joint noises, and muscle and joint tenderness on palpation.[4] Diagnostic imaging may be beneficial when malocclusion or intra-articular abnormalities are suspected.[3] (TMD) can also affect the osseous components of the temporomandibular joint (TMJ) and the soft tissue components of the TMJ.[5,6] However, clinical examination alone is insufficient to assess the osseous and soft tissue components of TMJ fully. CBCT is used to augment the diagnostic process.[2] CBCT is rapidly growing as the imaging modality of choice to evaluate the osseous components of the TMJ. This modality provides high-resolution multiplanar images of the TMJ, and significantly, at a lower radiation dose compared with CT.[5] CBCT offers essential information to aid in the diagnosis of a variety of TMD, including osteoarthritis, inflammatory arthritis, and trauma and development disorders.[5,7] Imaging is necessary when additional information is needed to underline the clinical examination results and clinical examination results and facilitate the clinical diagnosis process or undergo a surgical n. Radiography is of primary importance in the evaluation of chronic lesions in arthritic conditions. However clinical examination alone is insufficient to assess the osseous and soft tissue components of TMJ fully and thus imaging is used to augment the diagnostic process. Over the last three decades, advances in imaging have made significant contributions to improving the diagnosis of TMD. Importantly, in addition to this diagnostic benefit, imaging findings also play a valuable role in influencing the clinician's treatment of TMD patients. Several clinical investigations have related TMD disorders with radiographic findings. It has been observed that many TMD patients with clinical signs and symptoms when referred to CBCT imaging show boney changes in the condyles. There was a need to know if a correlation was there between the clinical signs and symptoms and CBCT radiographic findings of the boney components of the TMJ. Data from existing studies do not point unequivocally to an association between clinical signs and symptoms and structural changes in the TMJ. [8–13] Thus, indications for radiographic examination of the TMJ are not well defined. For the clinicians, it is essential to know how to proceed in the examination of such patients and which symptoms or signs are indicated for radiological examination. Such information can help improve the

quality of health care provided to the patient and reduce the exposure of the patient to unnecessary radiation. Therefore, the aim of the study was to correlate between the clinical symptoms and the presence of osteroarthic changes found in the (CBCT) images of the condyles of patients with TMD.

Materials and methods

The study protocol was approved by the Committee of Ethics in Research from the College of Dentistry, Research Center. The study was conducted in compliance with the "Ethical principles for medical research involving human subjects" of Helsinki Declaration. All data were obtained from the records of the Radiology Department of King Saud University (KSU), College of Dentistry with a total of 50 samples those reported on CBCT findings between the years 2008-2017.

The inclusion criteria of cases were the CBCT reports of all TMD patients referred by Oral Medicine Clinical for CBCT radiographic examination with no history of Rheumatoid arthritis. All of the cases were first examined by an Oral Medicine specialist for history and clinical information then were referred to Radiology department to perform CBCT examination. The radiographic findings were then reported by a Maxillofacial Radiologist at King Saud University, College of Dentistry. The data collection forms were filled-up by examiner while extracting the data that included the number of patient files (if mentioned), patient age and gender, patient medical history, Dental history, previous orthodontic treatment, patient habits (history of trauma, bruxism). The presence of any clinical signs and symptoms (pain, clicking, and limitation of mouth opening) at the time of the radiographic examination was recorded as well. CBCT radiographic findings within the condyles boney changes (flattening, sclerosis, osteophytes, erosions, and subchondral cysts) were recorded. Both clinical and CBCT radiographic findings were recorded. Statistical Package for Social Science (SPSS, Chicago, IL), Version 22 was used to analyze the data. The prevalence as well as correlations between the clinical symptoms (pain, clicking and limitation of mouth opening) and radiographic CBCT findings of the condyles (flattening, sclerosis, osteophytes, erosions and subchondral cysts) diagnosis were determined for all cases), Correlation between clinical and radiographic findings was performed using the chi-square test. P values less than 0.05 were considered statistically significant.

Results

In this study, there were 40 (80%) females and 10 males (20%) (Table 1). The ages included were from 14-55 years old with an average age of 29 years. The highest age range was in the age range from 21-30 years and comprised 48% of all age groups (Table 2). At the time of radiographic examination, pain clicking and limited Mouth opening were present in 64 %, 70%, and 43.2 % of the sample respectively (Table 3). CBCT findings show the presence of Flattening, Erosion, Osteophyte, Sclerosis present in 90%, 60%, 30%, and 14% respectively (Table 4). The results of the Correlation statistical analysis revealed no significant correlations between the clinical symptoms and radiographic CBCT findings of the condyles. However, a significant correlation was only found between the presence of osteophytes and limited mouth opening (Table 5).

Table 1 Gender among the TMD patients

Gender	(n)	%
Female	40	(80%)
Male	10	(20%)
Total	50	(100%)

Table 2 Age range among the TMD patients

Age range	(n)	%
10-20	10	(20%)
21-30	24	(48%)
31-40	9	(18%)
41-50	5	(10%)
more than 50	2	(4%)
Total	20	(100%)

Table 3 Clinical signs and symptoms present

Clinical symptoms	n	%
Pain present	32	(64%)
clicking present	35	(70%)
Limited Mouth opening	19	(43.20%)

Table 4 CBCT findings of TMJ boney changes present among the TMD patients

Radiographic examination CBCT findings	(n)	%
Radiographic Examination condyle Flattening presents	45	(90%)
Radiographic Examination condyle Erosion presents	30	(60%)
Radiographic Examination condyle Osteophyte presents	15	(30%)
Radiographic Examination condyle Sclerosis presents	7	(14%)

Table 5 Correlation between clinical findings and radiographic CBCT findings in TMD patients

Correlation								
	Condyle flattening present		Condyle erosion present		Osteophyte present		Condyle sclerosis present	
	n (%)	P-value	n (%)	P-value	n (%)	P-value	n (%)	P-value
Pain present	27(84.4%)	0.77	20(62.5%)	0.63	11(34.4%)	0.368	3(9.4%0	0.234
Clicking present	32(91.4%)	0.629	20(57.1%)	0.529	11(31.4%)	1	6(17.1%)	0.659
Limited Mouth opening present	17(89.5%)	1	11(57.9%)	0.9	10(52.6%)	0.003*	2(10.5%)	1

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Discussion

Temporomandibular disorders (TMD) are a class of degenerative musculoskeletal conditions associated with morphologic and functional deformities. They present a heterogeneous group of complex disorders of varied and often multifactorial etiologies and are considered the most common cause of non-dental pain in the orofacial region.[1–3] The diagnosis is initially based on presenting symptoms and the clinical examination. The clinical examination assesses the mandibular range of motion and associated pain, joint noises, muscle and joint tenderness on palpation.[4] Diagnostic imaging may be beneficial when malocclusion or intra-articular abnormalities are suspected.[3] However, (TMD) can also affect the osseous components of the temporomandibular joint (TMJ) and the soft tissue components of the TMJ.[5,6] Therefore, clinical examination alone is insufficient to assess the osseous and soft tissue components of TMJ fully. Therefore, imaging is used to augment the diagnostic process.[2] CBCT is rapidly growing as the imaging modality of choice to evaluate the osseous components of the TMJ. This modality provides high-resolution multiplanar images of the TMJ, and significantly, at a lower radiation dose compared with CT.[5] CBCT provides essential information to aid in the diagnosis of a variety of TMD conditions, including osteoarthritis, trauma and developmental disorders.[5,7] Imaging is necessary when additional information is needed to underline the clinical examination results and facilitate the clinical diagnosis process or take surgical intervention. Radiography is of primary importance in the evaluation of chronic lesions in arthritic conditions. However clinical examination alone is insufficient to assess the osseous and soft tissue components of TMJ fully and thus imaging is used to augment the diagnostic process.

In this study, there were 40 (80%) females and 10 males (20%). This finding is in agreement with those of previous studies. [8–10,13] The high frequency of TMD among females has been linked to hormonal differences between women and men.[14] A recent study reported that women experience a higher incidence of oral diseases including periodontal diseases and temporomandibular joint disease (TMD) implicating the role of estrogen signaling in disease pathology.[15]

Temporomandibular joint disease (TMD) may affect patients from a wide age group. The ages included in this study ranged from 14-55 years old with an average age of 29 years old. In our study, the most common age range was (21-30) years old. This is in agreement with what has been reported in the which the peak incidence at 20 to 40 years of age. Although previous studies associated osteroarthic changes of bone with older ages. Others indicate that osteoarthritis is more common in adolescents and young adults.[3]

At the time of radiographic examination, pain clicking and limited, mouth opening were reported in a high percent 64%, 70% and 43.2 % of the sample respectively. The clinical symptoms are commonly reported in TMD patients. Information collected in this research was based on history and clinical examination performed by Oral Medicine Consultant. However, no objective measurements or criteria were applied, producing more measurable and precise information.

CBCT findings showed the presence of Flattening, Erosion, Osteophyte, Sclerosis present in 90%, 60%, 30%, and 14% respectively. These rates are relatively consistent with those reported from the TMJ-OA studies performed by Bae S et al.[8] Comert Kilic et al.,[9] dos Anjos Pontual et al.[13]

However the present study's findings are inconsistent with those from other studies. Nah[12] found the most frequent condylar bony changes to be sclerosis (30.2%) and erosion (29.3%).[12,18] The different signs of osteroarthic changes may be due to different stages of the disease; erosive lesions may indicate acute early changes, whereas flattening and osteophyte formation may indicate late changes in the TMJ. Sclerosis and flattening reflect a stage of bone repair. [16,21]

Degenerative joint disease is diagnosed radiographically, as the clinical signs and symptoms have poor validity. Ahmad et al,[6] reported that the three cardinal radiographic features that lead to a diagnosis of DJD are osteophyte, surface erosion, and subcortical pseudocyst. They defined osteophyte as a marginal hypertrophy with sclerotic borders and exophytic angular formation of osseous tissue arising from the surface. Surface erosion is loss of continuity of articular cortex of the condyle or the fossa. A subcortical pseudocyst is defined as a cavity below the articular surface that deviates from normal marrow pattern. It is not a true cyst but rather the loss of trabeculation.[6]

However, other radiographic findings related to possible osseous remodeling are articular surface flattening and subcortical sclerosis. Flattening and subcortical sclerosis may be indeterminate for degenerative joint disease as they may represent aging, functional remodeling of the joints or a precursor to DJD. However, the reported that longitudinally, flattening and sclerosis might progress to DJD; as such it would represent regressive remodeling, whereas if it does not progress would represent an adaptive remodeling (Figure 1).

In this study, the most common bone change in our study was Flattening (90%) which agrees with those reported 92.3% Comert[9] and similar to that reported by Bea 77.4%.[8] However it was not in accordance with percentages reported by 25.5% Nah[12] dos 59%[13] reported a lower percentage. Erosion was reported in 60% of the sample (Figure 3 A,B). This is in agreement with Bea who reported 59.7%[8] but much lower than that reported by Comert who found it in 94% of their sample. [9] Nah reported a much lower percentage of only 29.3%[12] Osteophytes were radiographically found in only (30%) of our sample which similar to that reported by 45.2% Bea[8] which is lower than that reported Comert 79.5%[9] and much higher than that reported by Nah who found it in only 8 %.[12] (Figure 2)

Sclerosis was found (14%). This is in agreement with Comert who reported a similar finding of 12%.[9] Our result is lower than those reported by Bea et.al. who found it in 49.1%[8] and Nah who reported it in 30.2%.[12] Subchondral cyst was not reported in our study. It was reported in only 3.4% by Comert[9] and 5.5 % by Nah[12] which is the lowest osteroarthic findings to be reported in those studies. However, a higher precent was reported by Bae, et al.[8] Their relatively large sample size of 283 TMJs with degenerative bony changes, may have contributed to the higher percentage.

In this study the most frequent condylar bony change was Flattening flowed by Erosion which in agreement with the findings of Bae, et al.[8]

The conflicting findings reported in the previous studies may have resulted from differences in the sample size, method of collecting the data , the diagnostic criteria used, age groups, or ethnic diversity. The different signs of TMJ-OA may represent different disease stages. Erosive lesions may indicate acute early changes, whereas flattening and osteophyte formation may indicate late TMJ changes. Sclerosis and flattening reflect a stage of bone repair (Figure 2).[16]

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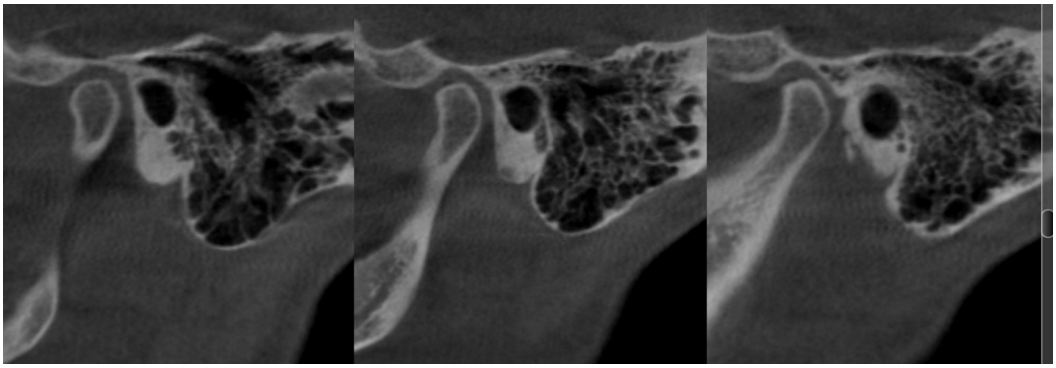

Figure 1 CBCT Corrected Sagittal views of the left TMJ shows Flattening and Sclerosis.

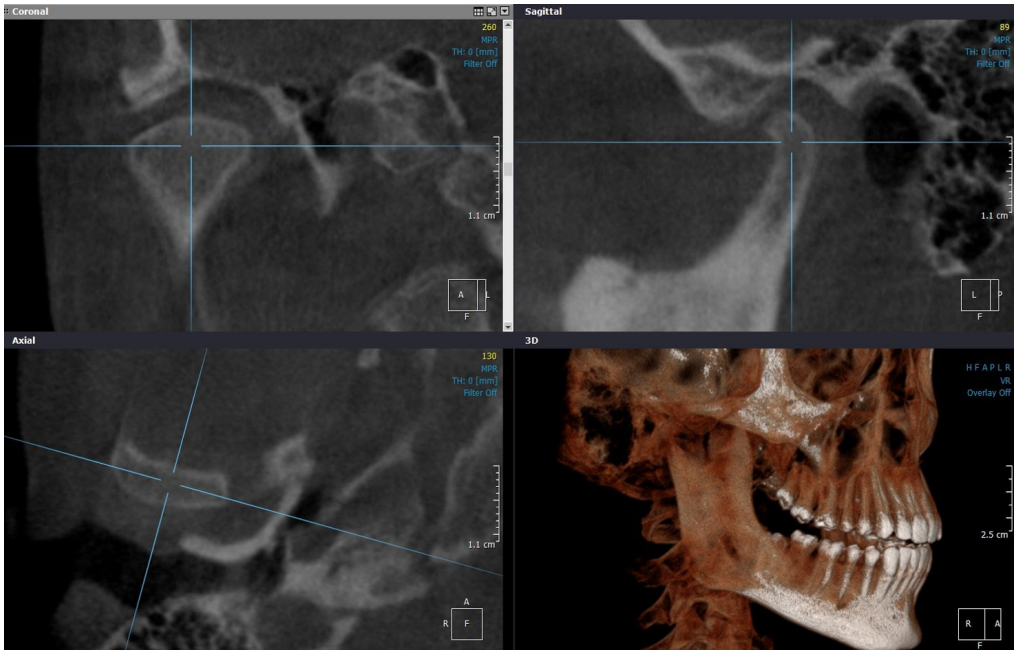

Figure 2 CBCT Corrected Sagittal view of the right TMJ shows the osteophyte formation in the superior anterior aspect.

Whether there is a correlation between clinical symptoms and radiological findings in TMD patients is still controversial. Some researchers have found correlations between specific clinical and radiological parameters.[8,10] However, others have reported poor correlations.[9,11,13] Our study revealed poor significant correlations between specific clinical symptoms and radiographic CBCT findings of the condyles.

Only one significant correlation was only found between the presence of osteophytes and limited mouth opening. Limited or reduced mouth opening could be attributed to different etiological factors some muscle-related, disc-related, or boney interferences. The mouth opening in this study was evaluated only by clinical examination in which an opening less than 3 mm (two fingers width) was considered limited. On the other hand, osteophyte formation may indicate late changes in the TMJ.[16] However, it is not clear whether there is a direct relationship or an indirect correlation between osteophyte formation and limited mouth opening. Further research using more objective methods may give a better understating.

Although it has been observed that many TMD patients with clinical signs and symptoms when referred to CBCT imaging show boney changes. Other studies conducted on non-TMD patients have shown the presence of similar degenerative changes in the condyles.[17,18] And although the clinician's certainty about the primary diagnosis increased after the cone-beam CT had been assessed, 73% of the TMJD patients had no management changes after the radiographic examination. In cases with changes, only adjustments within management categories was performed.[19] It was concluded by Shahidi, Salehi et al. 2018 that the frequency of various temporomandibular joint alterations on CBCT images was comparable in patients with and without TMD complaints, suggesting that some people with TMJ structural damage may not display clinical manifestations.[18] Moreover, they concluded that CBCT imaging might not be necessary for TMD patients and

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more attention should be given to clinical examination.[18] Furthermore, additional studies found no significant difference in the prevalence of boney changes in the TMJs of TMD and non-TMD patients. They reported a lack of a significant difference in the prevalence of TMJ osteoarthritic changes in TMD and non-TMD patients which highlights the equivocal relationship between osseous TMJ morphology and degenerative bone disease. However, other studies showed a significant difference.[20–22]

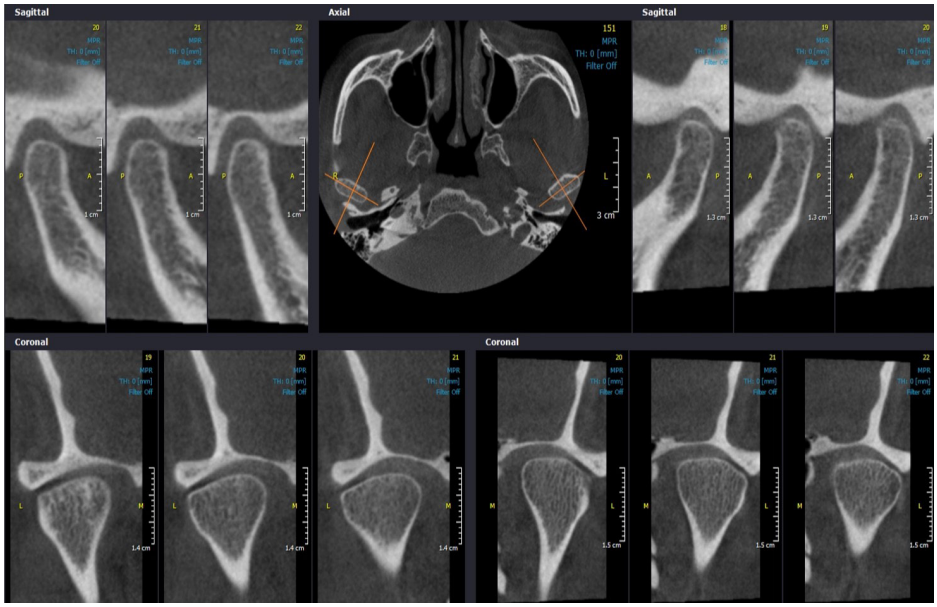

Figure 3A CBCT Corrected Sagittal and Coronal views of the right and left TMJs shows Flattening, Sclerosis and Surface erosion on the left condyle.

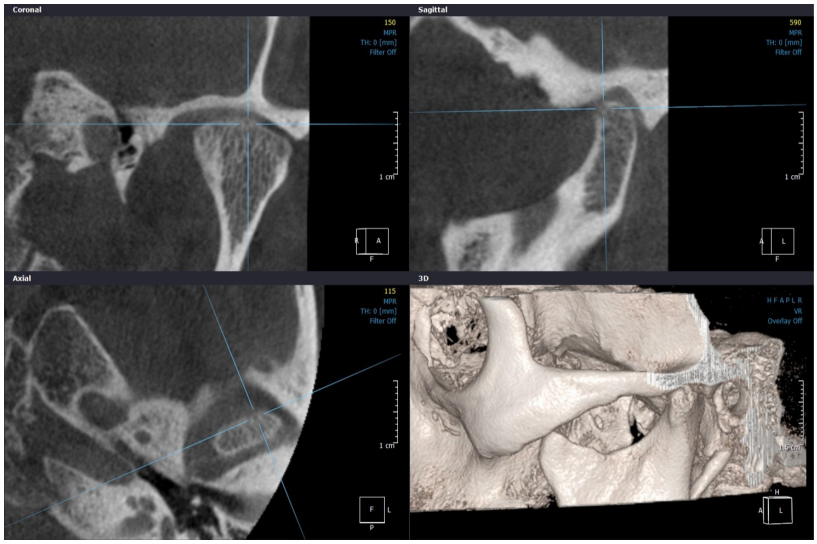

Figure 3B CBCT Corrected Sagittal and Coronal views of the Left TMJ from the same patients shows the area of Erosion.

Such Conflicting studies raises the question of whether or not CBCT examination is indicated for each patient who shows clinical signs and symptoms of TMD. CBCT examination as reported would be excellent in evaluating the boney components as well as detecting any osteroarthic changes. However, it is still not clear whether such findings would alter the management and therefore the prognosis of the case. Further studies may be needed regarding the impact of such information on patient's management and overall prognosis. There is a need for more clear guidelines to guide the clinicians in terms of making the decision to perform CBCT examination for patients with TMD. This will help in improving the quality of dental care provided and prevent patients from unnecessary radiation exposure and financial expenses.

This study had some limitations, which included the nature of observational design and subjective evaluations. The sample size is within relatively acceptable limits concerning the generalizability of the findings. However, increasing the sample size in future studies with more objective measurement tools may improve the results' outcome and give a more precise evaluation. In conclusion, this

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study's findings demonstrated no significant correlations between the clinical symptoms and radiographic CBCT findings of the condyles. A significant correlation was only found between the presence of osteophytes and limited mouth opening. Further studies are needed to develop clear guidelines to perform CBCT examination for patients with TMD.

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Conflicts of interest

The author states that there are not any conflicts of interest.

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