

## Evaluation Of Temporomandibular Joint CBCT Findings Of Osteoarthritis İn Different Patient Groups

Nida Geçkil<sup>1\*</sup>

1. Department of Oral and Maxillofacial Surgery, Karakopru Oral and Dental Health Hospital, Şanlıurfa-Turkey.

\*Corresponding author: Geçkil N, Ass. Prof. Department of Oral and Maxillofacial Surgery, Karakopru Oral and Dental Health Hospital, Şanlıurfa-Turkey.  
E-mail: [nidavesil@hotmail.com](mailto:nidayesil@hotmail.com)

### Abstract

**Aim:** The aim of this study is to evaluate the presence and findings of osteoarthritis based on cone beam computed tomography (CBCT) images according to different age and gender groups.

**Material and methods:** CBCT images of 764 temporomandibular joints (TMJ) were analyzed retrospectively. Osteoarthritis (OA) findings were grouped as normal or flattened, erosion, sclerosis, subchondral cyst, and osteophyte. These groups were evaluated separately for both sexes and for five separate decades.

**Results:** While pseudocyst and flattening among osteoarthritis findings were more common in men, sclerosis was significantly more common in women ( $p<0.05$ ). Osteoarthritis findings were rarely observed in the 20-29 age group. While erosion and flattening were significantly higher in the 60-69 age group, sclerosis was observed at a higher rate in the 50-59 age group ( $p<0.05$ ).

**Conclusions:** In women, sclerosis as a sign of OA, and in men, flattening is in the foreground. While the frequency of normal articular eminence decreased regularly with age, flattening, erosion and sclerosis were observed as signs of OA with an increasing rate in advanced age.

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**Keywords:** Osteoarthritis, computed Beam CT, temporomandibular joint.

### Introduction

Osteoarthritis, a form of arthritis, is a chronic condition caused by the degeneration of hard tissues (1,2). Osteoarthritis (OA) occurs in the most load-bearing joints in the body (3). The temporomandibular joint (TMJ) is always under stress with functional and parafunctional activities and is often affected by OA (4,5). OA findings in TMJ may also be a harbinger of degeneration in other joints in the body (6).

Impairment of the functioning of the temporomandibular joint leads to temporomandibular disorders (TMD). TMD is a general term describing a musculoskeletal disorder (7). In studies conducted, 11% of individuals with TMD had osteoarthritis findings (8). These findings are condylar erosion, sclerosis, osteophyte, flattening, subcondylar cyst and can be diagnosed by hard tissue examinations (9).

TMJ is a complex structure consisting of soft

and hard tissues and different imaging techniques can be used for its examination. Orthopantomography, lateral projections, frontal projections, ultrasonography, magnetic resonance imaging (MRI), computed tomography, cone-beam computed tomography (CBCT) are among the frequently used techniques (10,11). CBCT is currently the most commonly used method to examine the hard tissue components of the joint (12). CBCT is frequently preferred today because it can provide ideal images with low radiation dose and low cost (13).

The aim of this study is to reveal the presence and different findings of osteoarthritis (OA) findings according to different age and gender groups through CBCT images. Knowing the presence, appearance and frequency of OA will shed light on its diagnosis and treatment.

## Materials and methods

The presented retrospective study was conducted at Cukurova University Faculty of Dentistry Department of Oral and Maxillofacial Radiology. Ethical approval for the study was obtained from University Ethics Committee (decision no: 18, date: 10.09.2021).

The images with the Planmeca ProMax 3D Mid device and analyzed with the Romexis software program (Planmeca Oy, Helsinki, Finland). Cone-beam computed tomography (CBCT) images of 764 patients who were referred for various reasons between 2019 and 2021 were analyzed. Patients who had undergone surgery or trauma in the joint area, patients with rheumatological disorders, and patients with the syndrome were not included in the study. However, CBCT images with artifacts and low quality were also excluded. Whether the joint examined was right or left was randomized.

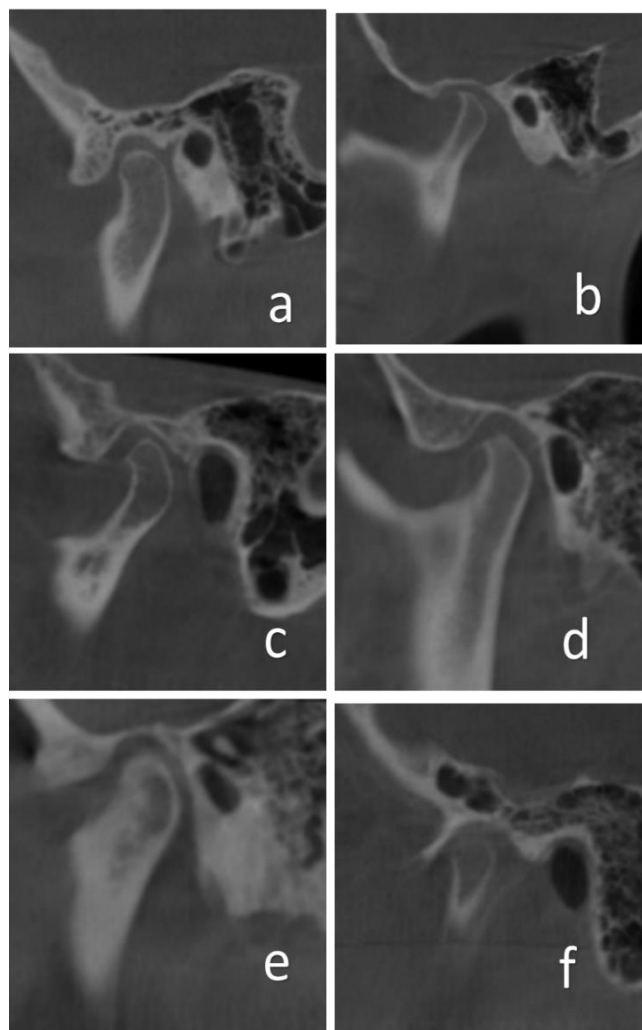
The present study included 256 male and 508 female patients. The mean age of the cases was  $42.28 \pm 13.08$  (min: 22 max: 68). The patients were divided into five groups according to age: 20-29, 30-39, 40-49, 50-59 and 60-69 years.

## Image analysis

If the mandibular condyle did not exhibit any pathology, it was considered as normal (Figure 1a). Five main findings of osteosclerosis that can be observed in CBCT examinations were examined separately (14). The bony prominence at the posterior edge of the condyle is osteophyte (Fig. 1b), the eroded appearance of cortical bone erosion (Fig. 1c), complete degeneration of the bone contour flattening (Fig. 1d), the thickened appearance of the contour subchondral sclerosis (Fig. 1e), radiolucent degeneration of subchondral trabecular bone pseudocyst (Fig. 1f) were classified as.

## Statistical analysis

Statistical analysis was performed using SPSS software package 25.0 (Chicago, IL, USA). The age and gender of the patients were determined. The significance level was set at  $p < 0.05$ . The Chi-square test and Fisher's exact test was used to evaluate the distribution of categorical variables. The chi-square test was sensitive to the number of samples and the number of samples was found sufficient.



**Figure 1.** Sagittal cone beam computed tomography images of osteoarthritis findings. a. Normal b. Osteophyte c. Erosion d. Flattening e. Subchondral Sclerosis f. Pseudocyst

## Results

A total number of 764 joints were evaluated on CBCT images. The distribution of osteosclerosis findings by gender is shown in Table 1.

As seen in Table 1, pseudocyst and flattening were significantly more common in males and sclerosis in females ( $p < 0.05$ ). Normal bone appearance, osteophyte and erosion findings did not make a significant difference between men and women.

Another parameter examined is the distribution of osteosclerosis findings according to age. Statistical results are shown in Table 2.

Table 1. The distribution of osteosclerosis findings by gender

OA	Female	Male	Total	p value
Normal	292 57,50%	165 64,50%	457 59,80%	0.064 <sup>a</sup>
Osteofit	69 13,60%	32 12,50%	101 13,20%	0.677 <sup>a</sup>
Pseudocyst	-	3 <u>1,20%</u>	3 0,40%	<b>0.037*<sup>b</sup></b>
Erosion	45 8,90%	24 9,40%	69 9,00%	0.814 <sup>a</sup>
Flattening	30 5,90%	32 <u>12,50%</u>	62 8,10%	<b>0.002*<sup>a</sup></b>
Sclerosis	72 <u>14,20%</u>	-	72 9,40%	<b>0.000*<sup>a</sup></b>
Total	508 100,00%	256 100,00%	764 100,00%	

<sup>a</sup> Chi-square test (\* $p < 0.05$ ). <sup>b</sup> Fisher's Exact test (\* $p < 0.05$ ).

Table 2. Distribution of osteosclerosis findings by age

OA	20-29	30-39	40-49	50-59	60-69	Total	p value
Normal	177 86,80%	141 78,30%	106 57,00%	30 21,90%	3 5,30%	457 59,80%	<b>0.000*<sup>a</sup></b>
Osteofit	21 10,30%	24 13,30%	26 14,00%	24 17,50%	6 10,50%	101 13,20%	0.382 <sup>a</sup>
Pseudocyst	3 1,50%	-	-	-	-	3 0,40%	0.074 <sup>b</sup>
Erosion	-	6 3,30%	21 11,30%	18 13,10%	24 42,10%	69 9,00%	<b>0.000*<sup>a</sup></b>
Flattening	-	3 1,70%	6 3,20%	35 25,50%	18 31,60%	62 8,10%	<b>0.000*<sup>a</sup></b>
Sclerosis	3 1,50%	6 3,30%	27 14,50%	30 21,90%	6 10,50%	72 9,40%	<b>0.000*<sup>a</sup></b>
Total	204 100,00%	180 100,00%	186 100,00%	137 100,00%	57 100,00%	764 100,00%	

<sup>a</sup> Chi-square test (\* $p < 0.05$ ). <sup>b</sup> Fisher's Exact test (\* $p < 0.05$ ).

When the mandibular condyle and OA findings were examined according to age, the bone contours were highly normal in the 20-29 age group. When the table is examined in detail, it can be seen that the normal bone contour image decreases regularly with age. There was no significant relationship between age and osteophyte finding. There was no significant finding in age classification for pseudocyst sign. This may be attributed to the small number of randomized results of the finding being observed. While erosion and flattening were significantly higher in the 60-69 age group, while sclerosis was observed at a higher rate in the 50-59 age group ( $p < 0.05$ ).

### Discussion

While TMD occurs with a high prevalence in all age groups in epidemiological studies (15), this issue is controversial in the literature. While some studies claim that the prevalence decreases with age (16,17), there is also research that finds similar results in all age groups<sup>14</sup>. OA is a chronic disease under the umbrella of TMD (18). Although there are researchers who suggest that clinical symptoms are decisive (19), it can develop asymptotically (20). Therefore, imaging methods have an important place in the diagnosis of OA (21). CBCT is currently the most reliable method for hard tissue examinations, providing high quality cross-sectional images (22).

OA can be observed as osteophyte, flattening, erosion, subchondral sclerosis and pseudocyst in radiographic examinations (14). When findings such as narrowing of the joint space and disc displacement accompany the disease, clinical symptoms may develop (23). This study will help to determine the etiology of temporomandibular diseases and will shed light on the diagnosis of clinical disorders.

Schmitter et al. (14), reported in their study that the incidence of osteoarthritis increased with increasing age. However, the frequency of OA was not found to be associated with gender. In our study, it was found that different findings of OA varied according to decades. While erosion and flattening were more common in the sixth decade, sclerosis was more common in the fifth decade. Although osteoarthritis (OA) is an important problem, radiological studies on this subject are very limited. Schmitter et al. (14) evaluated 30 patients aged between 73 and 75 years in their study and found the incidence of osteoarthritis to be high. However,

osteoarthritis findings were not classified. In our study, it was determined that different findings of OA also differed according to decades. Erosion and flattening were more common in the sixth decade, while sclerosis was more common in the fifth decade. In the above-mentioned study, no significant difference was observed in osteoarthritis findings between men and women. In our study, the different groups of findings were significantly different between men and women. Symptoms of OA tend to appear as sclerosis in women and flattening and subchondral cysts in men.

Widmalm and Ishibashi (24,25), in their study to examine the distribution of OA by age, found OA more frequently in elderly patients. The distribution of different findings was not examined, and in our study, flattening erosion and subchondral sclerosis were encountered as findings increasing with age. This result is highly significant as it suggests that OA may be a part of bone remodelling.

Kilic et al. (21), in their study conducted on CBCT examinations of 117 TMJs, they found that OA findings were more common in women. In our study, subchondral sclerosis was common in women, flattening and erosion were common in men. There are studies in the literature reporting that hormonal changes have a role in OA in women (26). The difference in the appearance of OA between men and women can be explained by these hormonal changes.

Alzahrani et al. (27), in their study to show the distribution of OA according to age and gender,

observed OA findings in 65.5% of the patients who applied to the clinic. Flattening constituted the majority of these findings, while subchondral cysts were seen in the least number. OA was significantly higher in female patients and in advanced age. Likewise, Koç (28) stated in his retrospective study that OA findings were observed more frequently in later decades.

Soydan et al. (29), investigated the relationship between osteoarthritis findings and the thickness of the glenoid fossa roof in their retrospective study. Erosion was not associated, while the other four findings were related to the thickness of the roof of the glenoid fossa. This result revealed that OA cannot be considered as an isolated disorder that only concerns the mandibular condyle. The influence of other bone components of the TMJ may lead to different clinical outcomes.

To review the results again, flattening and erosion are the sixth-decade findings in men. Subchondral sclerosis is the fifth decade finding in

women. In the second and third decades, the finding of OA is observed with a low frequency in both genders. The difference in OA findings in men and women may explain the difference in clinical symptoms. The increase in OA findings with advancing age may be the response of the bone to increasing loads.

In the results of our study, we did not find any finding that contradicts the literature. However, since it is a more detailed study, it will help to reveal the etiology of OA.

### Conflict of interest

Author declare that there is no conflict of interest.

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