# The Effect of Advancing Age on the Temporomandibular Joint Osteoarthritis Findings

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Abstract

**Aim:** The aim of this study is to evaluate temporomandibular joint osteoarthritis (TMJ OA) findings in elder patients with cone beam computed tomography.

**Materials and methods:** One hundred and sixty-seven patients (136 women, 31 men) participated in the study. Three hundred and thirty-four joints were evaluated in the study. According to the presence of OA, TMJs were divided into two groups as "with osteoarthritis" and "without osteoarthritis". When any of the osteoarthritis findings were present, the joint was included in the "with osteoarthritis" group. OA findings were listed as osteophyte, erosion, flattening, sclerosis and pseudocyst. Also, TMJs were divided into two age groups: Group 1 (50-64 years old) and group 2(65-81 years old) For statistical analysis, SPSS v20 were used.

**Results:** There was no significant difference between genders for the presence of OA ($p$>0.005). There were significant differences between group 1 and group 2 for erosion, flattening and sclerosis ($p$<0.005). There was no significant difference between group 1 and group 2 for osteophyte and pseudocyst ($p$>0.005).

**Conclusion:** Radiological findings like erosion, flattening and sclerosis can be seen more common with advancing age.

***Keywords:*** *Osteoarthritis, cone beam computed tomography, geriatrics*

## 1. Introduction

Temporomandibular joint osteoarthritis ( TMJ OA) is a subgroup of diseases which was under the umbrella term of temporomandibular disorders[1]. It is characterized by erosion, osteophyte formation, subchondral sclerosis, pseudocyst, flattening. It is known that osteoarthritis is an age-related disorder and more common in female patients compared to men[2,3]. Cone beam computed tomography (CBCT) is the method of choice to evaluate degenerative bone changes in TMJ due to osteoarthritis. It provides excellent diagnostic quality images with low-radiation dose compared to computed tomography[4]. Prevalence of TMJ OA in elder patients is not well documented in the literature. With the widespread use of CBCT, objective incidental findings began to be observed more frequently by clinicians. It was reported that available database on clinical examination for degenerative joint diseases is insufficient[5]. TMJ is one of the most commonly used joints in the human body and in close relationship with other vital functions such as chewing and speaking. Since TMJ OA may affect the quality of life of elder patients, the diagnosis and management should be performed carefully and objectively. The purpose of the present study is to evaluate TMJ OA findings in older patients with cone beam computed tomography.

## 2. Materials and methods

The presented retrospective study was carried out at Çukurova University Faculty of Dentistry Department of Dentomaxillofacial Radiology. It was approved by Çukurova University Clinical Researches Ethics Committee. A written consent form was obtained from all participants. Patients who had a CBCT scanning due to various reasons (scannings which include TMJ region) were included in the present study. Previous surgical procedures in temporomandibular joint, trauma, patients with rheumatic diseases (which can affect OA severity) and low-quality images with artefacts were listed as exclusion criteria.

One hundred and sixty-seven patients (136 women, 31 men) were included in the study. A total of 334 TMJs were evaluated in the study. The maxillofacial imaging of the patients was performed with CBCT device (Planmeca ProMax® 3D Mid, Helsinki, Finland; exposure parameters: 90 kV, 10 mA, 27 s scan time, voxel size: 0.4 mm3).

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Figure 1
The view of a normal condyle in sagittal CBCT sections.

Image analysis were performed using the Planmeca, Romexis viewer software in a dark and quiet room. All categorical evaluations were performed by two maxillofacial radiologists with 20 days interval. The differences were discussed and reconsidered, and a consensus was reached.TMJs were classified into two groups as the osteoarthritis group and without osteoarthritis group. If any of the osteoarthritis findings were present, TMJ was included in the "with osteoarthritis" group. Osteoarthritic bone changes were examined according to the following definitions. Normal condyle was defined as mandibular condyle without any osteoarthritic findings (Figure 1).

Erosion was defined as the visible breaks of continuity in cortical bone. Osteophyte was defined as a bony exostosis developed on the margin of the condyle. Sclerosis was defined as increased thickness of cortical bone. Flattening was defined as the flat bony contour of mandibular condyle due to degenerative changes. Pseudocyst was defined as a radiolucent degeneration area in the subchondral trabecular bone.

According to patients' age groups, TMJs were divided into two groups: Group 1 consisted of patients younger than 65 years old. Group 2 consisted of patients aged 65 and older.

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2008.

### 2.5. Statistical Analysis

IBM SPSS 20.0 (IBM Corp., Armonk, NY) statistical program was used for statistical analysis. Significance level was determined as $p<0.05$. Categorical data were summarized as n (%), age data as mean±standard deviation. Possible associations between osteoarthritis findings and gender/age groups were analyzed by chi-square or Fisher's exact test. Inter-observer agreement was assessed by Kappa (κ) analysis.

## 3. Results

There was a high level of agreement for all categorical assessments [minimum κ value 0.92 ($p<0.001$)]. Demographic information is shown in Table 1.

Table 1
Demografic Data

| Age groups | n | Number of joints (male/female) | Age |
|---|---|---|---|
| 65 years< | 234 | (36/198) | 57.41±4.37 |
| 65 years≥ | 110 | (26/84) | 69.97±4.69 |

Table 2
Osteoarthritis findings according to genders

| | | Genders | | | |
|---|---|---|---|---|---|
| | | Female | Male | Total | p |
| Osteophyte | Absent | 145(51.4) | 33(53.2) | 178(51.7) | 0.797Ω |
| | Present | 137(48.6) | 29(46.8) | 166(48.3) | |
| Flattening | Absent | 205(72.7) | 46(74.2) | 251(73) | 0.810Ω |
| | Present | 77(27.3) | 16(25.8) | 93(27) | |
| Sclerosis | Absent | 216(76.6) | 42(67.7) | 258(75) | 0.145Ω |
| | Present | 66(23.4) | 20(32.3) | 86(25) | |
| Erosion | Absent | 174(61.7) | 36(58.1) | 210(61) | 0.595Ω |
| | Present | 108(38.3) | 26(41.9) | 134(39) | |
| Pseudocyst | Absent | 266(94.3) | 58(93.5) | 324(94.2) | 0.767§ |
| | Present | 16(5.7) | 4(6.5) | 20(5.8) | |
| Total | | 282(100) | 62(100) | 344(100) | |

Data are shown as n (%). Ω Chi-square test. § Fisher's exact test.

Table 3
Osteoarthritis findings according to age groups.

| | | Age groups | | | |
|---|---|---|---|---|---|
| | | 65 years< | 65 years≥ | Total | p |
| Osteophyte | Absent | 123(52.6) | 55(50) | 178(51.7) | 0.657 |
| | Present | 111(47.4) | 55(50) | 166(48.3) | |
| Flattening | Absent | 192(82.1) | 59(53.6) | 251(73) | <0.001* |
| | Present | 42(17.9) | 51(46.4) | 93(27) | |
| Sclerosis | Absent | 195(83.3) | 63(57.3) | 258(75) | <0.001* |
| | Present | 39(16.7) | 47(42.7) | 86(25) | |
| Erosion | Absent | 153(65.4) | 57(51.8) | 210(61) | 0.016* |
| | Present | 81(34.6) | 53(48.2) | 134(39) | |
| Pseudocyst | Absent | 222(94.9) | 102(92.7) | 324(94.2) | 0.428 |
| | Present | 12(5.1) | 8(7.3) | 20(5.8) | |
| Total | | 234(100) | 110(100) | 344(100) | |

Data are shown as n (%). Chi-square test (*p<0.05).

Three hundred and thirty-four joints were evaluated. Table 1 shows the distribution of age and gender of the patients. While the mean age of group 1 was 57.41±4.37, the mean age of group 2 was 69.97±4.69.

Table 2 shows the distribution of osteoarthritis findings according to genders. There was no statistically significant relationship between gender and osteoarthritis findings.

The prevalences of flattening, sclerosis, and erosion were significantly higher in group 2 (46.4%, 42.7%, and 48.2%, respectively) compared to group 1(17.9%, 16.7%, and 34.6%, respectively) ($p$<0.001, respectively). $p$<0.001 and $p$=0.016). There was no statistically significant relationship between age groups and osteophytes and pseudocysts (Table 3).

## 4. Discussion

Epidemiological studies exhibited a high prevalence of temporomandibular disorder (TMD) for all age groups[6]. The prevalence of TMD is a matter of controversy in the literature. While some studies suggested that the frequency of TMD symptoms were similar among all age groups[7], other authors had found it lower in older people[8]. TMJ OA is one of the diseases under the umbrella term of TMD. It led clinicians to seek for a more objective assessment area. A clinical examination based diagnosis of OA is reported to be uncertain and unreliable[9].

Many imaging methods can be used to evaluate TMJ OA such as panoramic radiography, computed tomography and magnetic resonance imaging. CBCT, which has become increasingly popular in recent years, has been used as a reliable imaging method for the evaluation of TMJ OA[10]. CBCT provides high-quality images for the diagnosis of degenerative changes in TMJ with relatively lower radiation dose[11]. It was reported that CBCT is better to exhibit bony changes like bone destruction, cortical integrity changes, erosion, osteophyte and flattening[4,11]. In the presented study, CBCT is used due to above-mentioned features.

OA is the most common disease that can be observed in any joint including temporomandibular joint. It is an age-related disease in the articular cartilage and subchondral bone in synovial joints[12]. TMJ OA is known to have certain bone features like erosion, osteophyte, flattening, subchondral sclerosis and pseudocyst. Also, joint space narrowing, articular disc displacements may accompany this process[13].

Widmalm[14] and Ishibashi[15] reported that TMJ OA was more common in older patients compared to young patients. While only older patients were included in the present study, Kiliç et al.[10] included patients who were aged between 14-73 years old. Since osteoarthritis is an age-related disease, further studies should be conducted in the characterized osteoarthritis findings of older patients for different age groups.

In this study, no statistical difference was found between genders for the OA findings. A previous study reported that TMJ OA is more common in women due to the potential role of sex hormones[16]. Kiliç et al[10]. investigated 117 TMJs in their CBCT study. In controversy with our findings, they reported that OA was more common in female patients. This difference may be attributed to the study population and different methodology used.

The radiological findings of osteoarthritis were investigated in CBCT records in the present study. Significant differences were found between group 1 and group 2 for erosion, flattening and sclerosis. There was no significant difference between group 1 and group 2 for osteophyte, and pseudocyst. OA findings may display different stages of the degenerative disease. While erosion may indicate the acute phase of degenerative disease, sclerosis and flattening may indicate a bone repair stage[3]. According to the present study findings, erosion, flattening and sclerosis were found significantly higher in group 2.

There were some limitations to this study. First, male patients were lower in the study population. Also, the overall study population can be enlarged to a higher number. To identify different osteoarthritis stages (acute phase, chronic phase, reparative bone phase), an elder patient population with larger numbers should be evaluated. Another limitation is that the study was conducted in a

single center. Multicenter studies with more patients should be carried.

## 5. Conclusions

CBCT is a useful imaging modality to evaluate radiological findings of TMJ OA. In elder patients, erosion, flattening and sclerosis can be seen more common with advancing age.

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## Statement of ethics

This study was conducted in accordance with the ethical principles of the Declaration of Helsinki and was approved was approved by Çukurova University Clinical Researches Ethics Committee. (Date: June 11, 2021; No:112).

## Conflict of interest statement

The authors declare that they have no financial conflict of interest with regard to the content of this report.

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None.

## Author contributions

All authors contributed to the study conception and design.

All authors read and approved the final manuscript.

## References

1.Wang X, Zhang J, Gan Y, et al. Current understanding of pathogenesis and treatment of TMJ osteoarthritis. J Dent Res. 2015; 94(5): 666-73. https://doi.org/10.1177/0022034515574770

2.Alexiou K, Stamatakis H, Tsiklakis K. Evaluation of the severity of temporomandibular joint osteoarthritic changes related to age using cone beam computed tomography. Dentomaxillofac Radiol. 2009; 38(3): 141-7. https://doi.org/10.1259/dmfr/59263880

3.Wiberg B, Wänman A. Signs of osteoarthrosis of the temporomandibular joints in young patients: a clinical and radiographic study. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1998; 86(2): 158-64. https://doi.org/10.1016/S1079-2104(98)90118-4

4.Tsiklakis K, Syriopoulos K, Stamatakis H. Radiographic examination of the temporomandibular joint using cone beam computed tomography. Dentomaxillofac Radiol. 2004; 33(3): 196-201. https://doi.org/10.1259/dmfr/27403192

5.Brandlmaier I, Grüner S, Rudisch A, et al. Validation of the clinical diagnostic criteria for temporomandibular disorders for the diagnostic subgroup of degenerative joint disease. J Oral Rehabil. 2003; 30(4): 401-6. https://doi.org/10.1046/j.1365-2842.2002.00980.x

6.Carlsson GE. Epidemiology and treatment need for temporomandibular disorders. J Orofac Pain. 1999; 13(4): 232-7.

7.Norheim Pw, Dahl Bl. Some self-reported symptoms of temporomandibular joint dysfunction in a population in Northern Norway. J Oral Rehabil. 1978; 5(1): 63-68. https://doi.org/10.1111/j.1365-2842.1978.tb00392.x

8.Öterberg T, Carlsson GE, Wedel A et al. A cross-sectional and longitudinal study of craniomandibular dysfunction in an elderly population. J Craniomandib Disord. 1992;6(4).

9.John MT, Dworkin SF, Mancl LA. Reliability of clinical temporomandibular disorder diagnoses. Pain. 2005; 118(1-2): 61-9. https://doi.org/10.1016/j.pain.2005.07.018

10.Kiliç SC, Kiliç N, Sümbüllü M. Temporomandibular joint osteoarthritis: cone beam computed tomography findings, clinical features, and correlations. Int J Oral Maxillofac Surg. 2015; 44(10): 1268-74. https://doi.org/10.1016/j.ijom.2015.06.023

11.Ludlow JB, Davies-Ludlow L, Brooks S et al. Dosimetry of 3 CBCT devices for oral and maxillofacial radiology: CB Mercuray, NewTom 3G and i-CAT. Dentomaxillofac Radiol. 2006;35(4):219-26. https://doi.org/10.1259/dmfr/14340323

12.Ogura I, Kaneda T, Mori S et al. Magnetic resonance characteristics of temporomandibular joint disc displacement in elderly patients. Dentomaxillofac Radiol. 2012; 41(2): 122-5. https://doi.org/10.1259/dmfr/1286942

13.Larheim T, Abrahamsson A, Kristensen M et al. Temporomandibular joint diagnostics using CBCT. Dentomaxillofac Radiol. 2014; 44(1): 20140235. https://doi.org/10.1259/dmfr.20140235

14.Widmalm SE, Westesson P-L, Kim I-K, et al. Temporomandibular joint pathosis related to sex, age, and dentition in autopsy material. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 1994; 78(4): 416-25. https://doi.org/10.1016/0030-4220(94)90031-0

15.Ishibashi H, Takenoshita Y, Ishibashi K, et al. Age-related changes in the human mandibular condyle: a morphologic, radiologic, and histologic study. J Oral Maxillofac Surg. 1995; 53(9): 1016-23. https://doi.org/10.1016/0278-2391(95)90117-5

16.Yasuoka T, Nakashima M, Okuda T, et al. Effect of estrogen replacement on temporomandibular joint remodeling in ovariectomized rats. J Oral Maxillofac Surg. 2000; 58(2): 189-96. https://doi.org/10.1016/S0278-2391(00)90337-9