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Correlation Between Temporomandibular Joint Pain, Sounds And Degenerative Bony Changes On Cone-Beam Computed Tomography.

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INTRODUCTION

Temporomandibular disorder (TMD) refers to clinical disorders involving the masticatory muscles and the temporomandibular joint (TMJ) and its associated tissues. TMD is commonly associated with disc displacement and degenerative abnormalities in the TMJ. [1] Degenerative joint disease (DJD) affects both soft and hard tissues, including cartilage, subchondral bone, and the synovial membrane. [2]TMD is characterized by a various sign and symptoms directly related to the joint, which are pain or tenderness in the region of the temporomandibular joint (TMJ) and pre-auricular areas, limitation in the mouth opening, or TMJ sounds during jaw movement. [3]TMDs are frequently associated with degenerative bone changes involving the bone structures of the TMJ such as flattening, erosion, osteophytes, subchondral bone sclerosis, and pseudocysts. Digital Panoramic radiographs, also have a limited role in diagnosing bony changes of mandibular condyle in patients with chronic TMJ disorders.[4]With the advent of CBCT, better diagnostic information on TMJ pathology can be obtained as it provides multiplanar images without superimposition of the mandibular condyle, with minimal radiation exposure to the patient.[5]This aids in better diagnosis, and treatment planning and thus improves the prognosis.[1]The study aimed to check the correlation between temporomandibular joint pain, sounds, and degenerative bony changes on CBCT.

MATERIALS AND METHODS

Subject

This was the Prospective Cross-sectional study done in the Department of Oral Medicine and Radiology. Patients in the age range of 18-60 years were included in this study. Patients with a history of maxillofacial trauma, maxillofacial surgery, oral and maxillofacial pathologies, and congenital abnormalities affecting the temporomandibular joint were excluded from this study.

50 patients who visited the Department of Oral Medicine and Radiology complained of TMJ pain or TMJ sounds included in this study. Sample size calculation was done by using G power. Pain intensity and pain duration were examined. Pain intensity was evaluated with the visual analog scale (VAS).[6] We asked patients average pain intensity of the past 3 days. Patients marked to point their pain on the visual analog scale (0 to 10cm scale) where “0” was no pain and “10” was the worst pain. In addition, we asked patients about the

onset time of their pain.[7] Sounds during opening, closing, or lateral jaw movements were recorded by interview and auscultation. Each patient was asked the question: 'When you open your mouth, do you have any noises in your ears?' The examiner used a stethoscope to listen for TMJ sounds during jaw movements.[8] Later on, CBCT examinations were performed. 50 patients (32 women and 18 men) with degenerative bony changes on their CBCT images were selected. We excluded normal condyles of DJD patients and finally evaluated 50 condyles.

Radiographic examination and evaluation

The primary reconstruction of the raw data was restricted to the TMJ region(approximately 3.5cm superior to the mandibular fossa and 4 cm inferior, 4cm anterior, and 3 cm posterior to the condylar neck) using the Planmeca Promax 3D imaging CBCT unit. The long axial view of the examined condyle was traced with the TMJ tool, and the software generated lateral and frontal cross-sectional reconstructions perpendicular and parallel to the long axis of the condyle, respectively. The thickness of the image slices was 1mm, and the distance between slices was 1mm for both lateral and frontal reconstructions. The reconstructed images were analyzed by three well-trained dentists. Right and left TMJs were examined separately, resulting in a total of 100 TMJs. Comparing the sagittal, coronal, axial and 3D images, we classified degenerative bony changes into five types: osteophytes, erosion, flattening, and subchondral sclerosis. For accurate assessment, only the bony changes on the articular surfaces were evaluated.

In figure 1 **a**. Coronal view

b. Axial view

c. Sagittal view

The criteria for the types of condylar bony changes were as follows:

In figure 2, figure 3, figure 4

A. shows **Osteophytes**: marginal bony outgrowths on the condyle

B. shows **Subchondral Sclerosis**: an area of increased density of cortical bone extending into the bone marrow

C. shows **Flattening**: a flat bony contour deviating from the convex form

D. shows **Erosion**: an area of decreased density or discontinuity or irregularity of the cortical bone

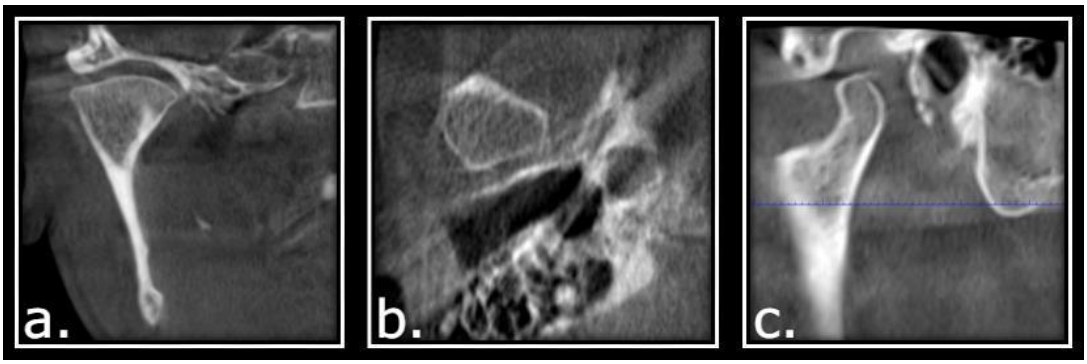


Figure 1

In **Figure 1** **a**. Coronal view

b. Axial view

c. Sagittal view

Figure 2

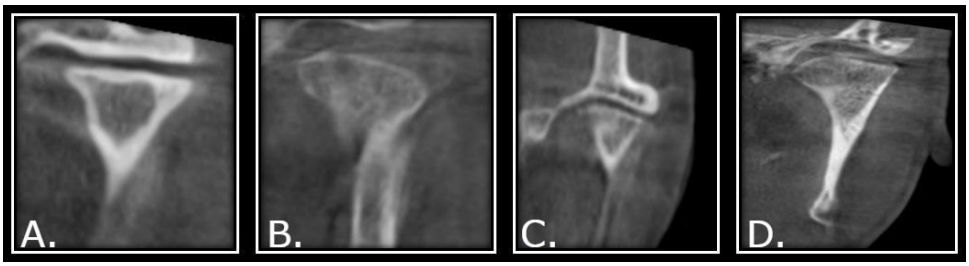
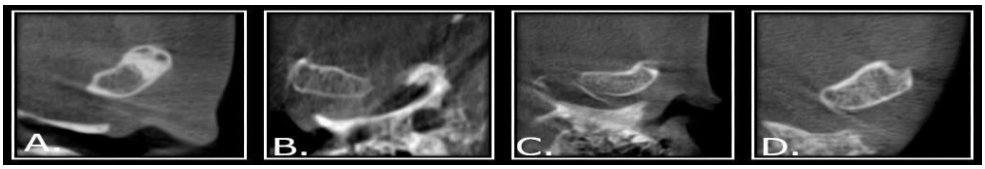


Figure 3



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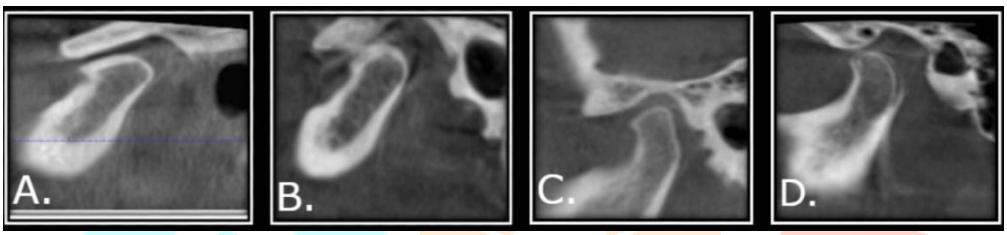


In **Figure 2, Figure 3, Figure 4**

Fig **A.** shows **Osteophytes**: marginal bony outgrowths on the condyle

Fig **B.** shows **Subchondral Sclerosis**: an area of increased density of cortical bone extending into the bone marrow

Fig **C.** shows **Flattening**: a flat bony contour deviating from the convex form

Fig **D.** shows **Erosion**: an area of decreased density or discontinuity or irregularity of the cortical bone

STATISTICAL ANALYSIS

The chi-square test was used to assess the correlation between pain intensity or joint sounds on the occurrence of degenerative bone changes. P values less than 0.05 were considered statistically significant.

RESULTS

TABLE 1 Distribution of gender according to degenerative changes.

Degenerative changes	Female Degenerative condyles n (%)	Male Degenerative condyles n (%)
Erosion	8(26.67)	11(36.67)
Flattening	4(13.33)	1(3.33)
Osteophyte	3(10)	1(3.33)
Sclerosis	2(6.67)	0

This study was performed with 50 patients. The percentage of women (56.67%) was higher than men (43.33%). Subject ages ranged from 18 to 60 years. Erosion was shown 26.67% in females and 36.67% in males. Followed by Flattening 13.33% in females and 3.33% in males. Osteophyte is 10% in females and 3.33% in males. Sclerosis 6.6%in female. Most of the degenerative changes were seen in females.

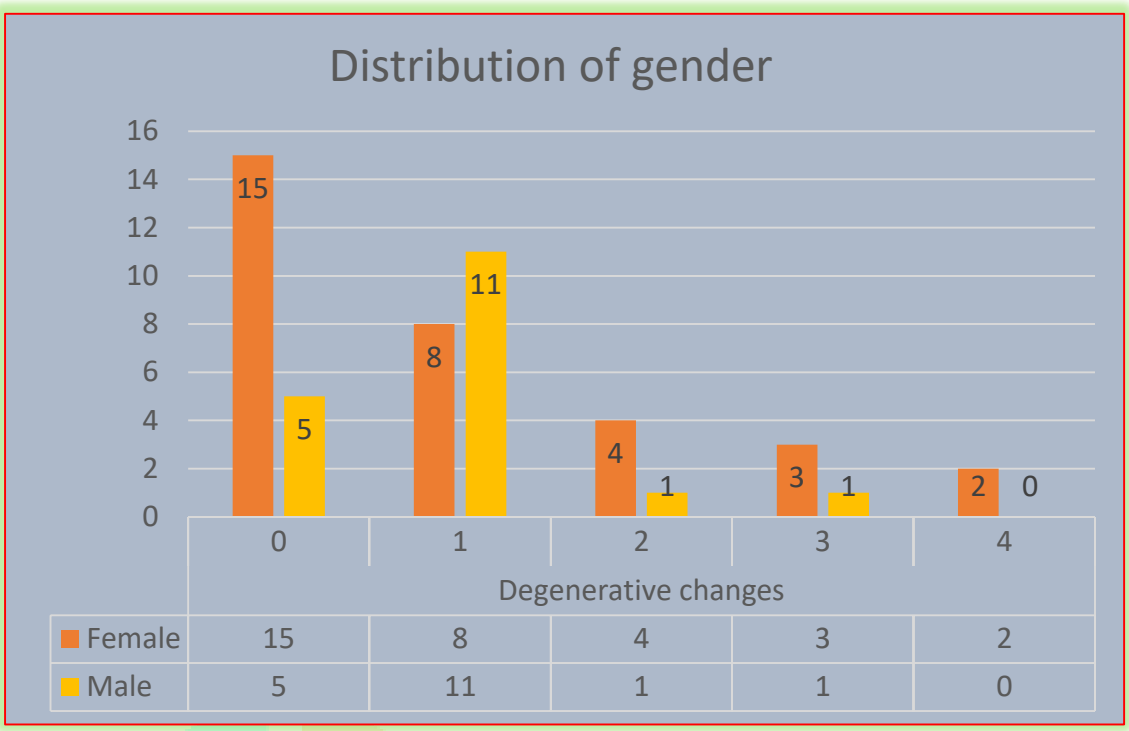


TABLE 2 Association of pain scale with degenerative changes seen in temporomandibular joint

Pain intensity (VAS)	Degenerative condyles n (%)
0	4(13.33)
4	4(13.33)
5	4(13.33)
6	6(20)
7	8(26.67)
8	3(10)
9	1(3.33)

Table 2 presents the distribution of degenerative condyles according to pain intensity. When the multiple radiographic findings were detected in one condyle, each finding was counted separately. The pain intensity that showed the greatest degenerative alterations was "VAS 7" (26.67%), followed by "VAS 6" (20%).

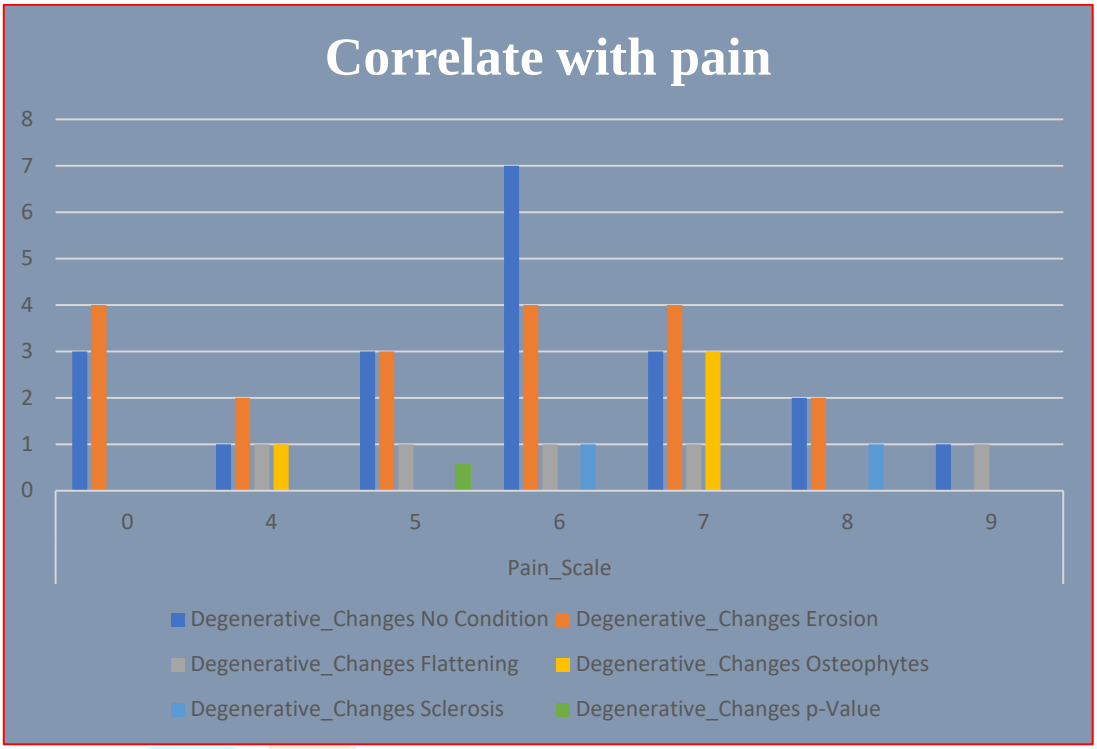
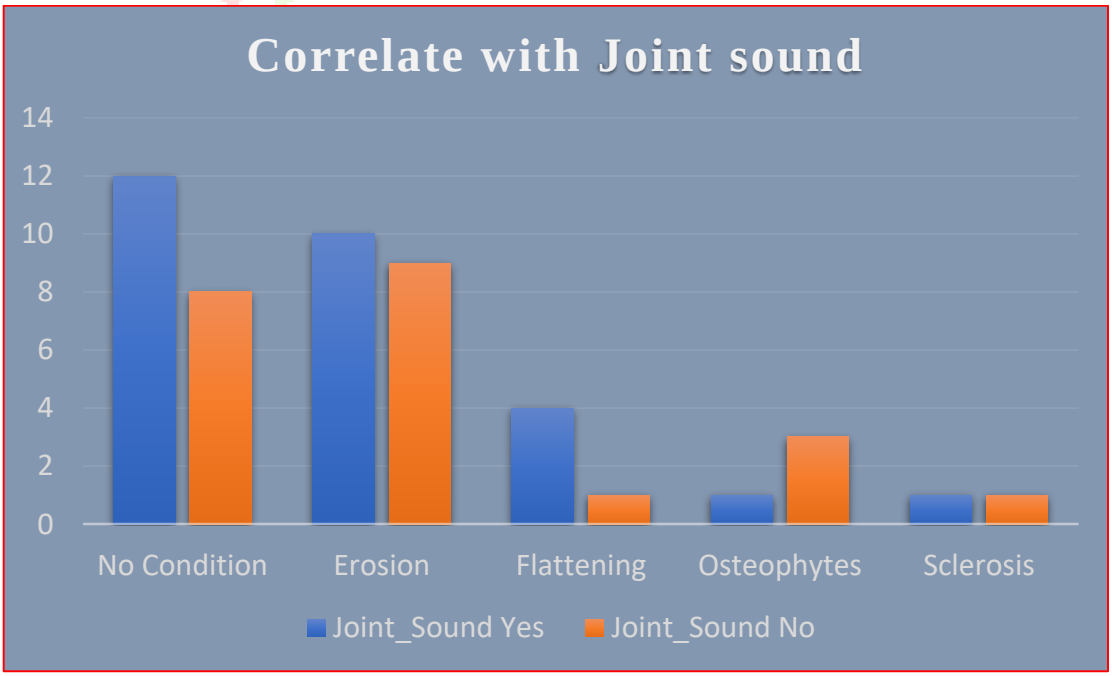


TABLE 3 correlation of Joint sound with degenerative changes seen in temporomandibular joint

Degenerative changes	Joint sound present n	Joint sound absent n
Erosion	10	9
Flattening	4	1
Osteophyte	1	3
Sclerosis	1	1

Table 3 presents that patients with TMJ sounds, erosion was most frequently observed, followed by flattening; in those without sounds, erosion was most frequently observed, followed by osteophyte. In patients with TMJ sounds, the percentage of degenerative changes was 53.33%, while 46.67% of patients had no TMJ sounds. According to this percentage degenerative changes were seen more in TMJ sounds patients. According to the results, degenerative changes were seen in both joint sounds present and absent patients.



DISCUSSION

When the multiple radiographic findings were detected in one condyle, each finding was counted separately. The most frequent bony change was "erosion" (19 joints, 63.33%) followed by "flattening" (5 joints, 16.67%), "osteophyte" (4joints 13.33%), and "sclerosis" (2 joints 6.67%). The combination of erosion and flattening ("erosion + flattening") was the most common bony change (12.7%). Erosion and flattening were the most prevalent changes in all groups. Bone deformation characterized in DJD is osteophytes, erosion, flattening, and sclerosis. The frequency of Erosion was directly proportional to pain. The frequency of Osteophyte was inversely proportional to joint sound. Generally, bone deformation characterized in DJD is osteophytes, erosion, flattening, and sclerosis. Each type of bony change occurs in different stages of DJD and has different clinicopathological meanings [11].

As a condyle has adapted to degenerative changes, tissue remodeling has happened and radiographic and/or morphologic appearances of condyles have changed accordingly each type of bony change occurs in different stages of DJD and has different clinic pathological meanings. SunMee Bae et al found osteophyte and erosion could be pain-related variables in DJD[1]. Our study found that degenerative changes (osteophyte and erosion) same as mentioned in the above study. Shoaleh Shahidi et al observed a high prevalence of bony changes visible on CBCT imaging in all subjects, with or without TMD. The findings of this study revealed that the incidence of various TMJ derangements on CBCT images was comparable between symptomatic patients with TMJ disorder and asymptomatic individuals, suggesting that CBCT imaging might not be necessary for TMD patients and more attention should be given to clinical examination.[4] Zahra Vasegh et al noticed that The most prevalent types of condylar bony changes observed were osteophyte (63.5%) followed by fattening of the articular surface (42%), erosion (40%), ankylosis (10%) and sclerosis (10%).[5] Several papers reported the distribution of condylar bony changes and their combinations.[10]Lucia H. Cevidanes et al observed flattening was observed in 60% of the subjects, and osteoarthritic changes were found in 95% of the cases. Osteoarthritic changes varied from surface irregularities to erosions. 15% of asymptomatic subjects presented some degree of condylar flattening, erosions, and osteophytes were not observed in this study.[9] Kyung-Soo Nah et al observed the most frequent condylar bony change was sclerosis (133 joints, 30.2%) followed by surface erosion (129 joints, 29.3%), flattening of the articular surface (112 joints, 25.5%). Osteophytes were found in (35 joints, 8.0%) and subcortical cysts in (24 joints, 5.5%).[10]

Moncada G et al determined degenerative bony changes on MRI, and found that the most frequent degenerative bone changes were: flattening of condyle anterior surface (n=55), followed by joint surfaces erosion and irregularities (n=32), flattening of temporal eminence functional surface (n=36), subchondral cysts (n=7), osteophytes (n=2), and idiopathic condyle resorption.[11] Syeda Arshiya Ara et al noticed Condylar morphological variants on a digital Panoramic radiograph and found that Flattening was most commonly seen in condylar morphology in 25 (41.7%), followed by an osteophyte, sclerosis, small rounded, excavated, ossicle, ely's cyst, erosion.[12] G Palconet al noticed that poor correlation between condylar changes (as observed on CBCT images), pain, and other clinical signs and symptoms in TMJ OA which was contraindicated from our study.[13]Chih-Mong Tsai et al noticed that 11 TMJs were diagnosed as normal (with no pain nor osseous degenerative changes), four as arthralgia (with pain or tenderness but no osseous degenerative changes), seven as osteoarthrosis (with osseous degenerative changes but no pain), and 36 as osteoarthritis (with both pain and osseous degenerative changes).[14]

Kug Jin Jeon et al observed osseous changes in the condylar head on CBCT. Normal findings were present regarding osseous changes of the condylar head in 65.1% of patients. TMJ pain was significantly associated with sclerosis and also found that female patients accounted for a 3.5 times higher proportion of TMD patients than male patients.[15]in our study also female patients were shown more degenerative changes than male patient. Ranj Adil Jalal et al observed that the most frequent clinical symptom was facial pain (25%), and the slightest symptom was clicking (2.5%) during mouth opening. The commonest change in CBCT of RA patients was condylar head erosion (67.5%), and the less common change was articular eminence erosion (7.5%). The commonest changes in MRI of RA patients were an osseous change of condylar head (80%), and the minor change was effusion (10%), while in controls were an osseous change of condylar head (30%) and condylar head flattening (10%). [16] Wiese et al observed that Increasing age and female gender as well as coarse crepitus were

associated with an increased risk of radiographic degenerative changes in the TMJ. None of the pain-related variables were associated with radiographic findings. [17]

The limitation of our study was the limited sample size. And we evaluated only the first-visit results and excluded the follow-up results.

CONCLUSIONS

Based on the findings of this study, the prevalence of bony changes of TMJs were erosion, flattening, osteophyte, and subchondral sclerosis respectively. According to the results of this study, the prevalence of bony is more common in women. The study found a correlation between pain intensity, joint sounds, and degenerative bony changes in CBCT images. Osteophyte and erosion could be pain and joint sound-related variables in DJD patients.

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