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Correlation between Clinical Symptoms and Cone Beam Computed Tomography Finding in Temporomandibular Disorders Patients

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***Abstract*---**Background: Abnormalities of temporomandibular joint, masticatory muscles, and/or related structural abnormalities are known as temporomandibular disorders. The use of cone beam computed tomography for temporomandibular imaging is becoming more prevalent. Aim: This study was carried out to analyse correlation between clinical symptoms and cone beam computed tomography finding in temporomandibular disorders patients. Methods and

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materials: This study looked at cone beam computed tomography pictures and clinical records of 40 patients with temporomandibular joint issues who sought treatment in Sangli district of Maharashtra between 2016 and 2018. The type of condylar bony change was classified based on the cone beam computed tomography images using both Koyama et al's classification and Ahmad et al's image analysis criteria. An orofacial pain specialist took a complete history and did a clinical assessment on all of the participants. The average pain intensity level self-reported in the previous week was graded on a 0 to 10 verbal rating scale, with "0" indicating no pain and "10" indicating the worst pain possible. Results: The greatest condyle bony change and verbal pain rating had a poor association. There was no statistically significant link between maximum condyle alteration and maximum openness. The maximal condyle alteration and protrusion had a very modest correlation. Similarly, there was little association between right and left lateral range of motion. There was a strong correlation between Koyama's and Ahmad's classifications. For both classifications, there was a statistically significant strong connection between the average and maximum alterations for the condyle and glenoid fossa. Conclusion: In temporomandibular disorders, there was little link between condylar alterations observed in cone beam computed tomography, pain, and other clinical signs and symptoms while there was a high correlation between cone beam computed tomography findings and average and maximum condylar bony changes in temporomandibular disorders.

***Keywords*---**temporomandibular joint disorders, clinical symptoms, cone beam computed tomography.

Introduction

The bony components of the temporomandibular joint (TMJ) are tiny, and superimpositions from the base of the skull typically result in a lack of distinct delineation of the joint. TMJ osteoarthritis has been diagnosed using a variety of imaging methods (OA). Superimpositions, a high radiation dose, and a long scanning time are all serious drawbacks. Because of these drawbacks, the use of cone beam CT (CBCT) for TMJ imaging is becoming more prevalent. It's a relatively new imaging modality that can yield high-quality diagnostic images with a lower dosage of radiation than medical CT.[1,2]

TMJ, masticatory muscles, and/or related structural abnormalities are known as temporomandibular disorders (TMD). TMJ osteoarthritis (TMJ OA), commonly known as degenerative joint disease (DJD), is an age-related condition defined by the degradation of the articular surfaces of the mandibular condyle and glenoid fossa, which is frequently caused by increasing joint loading.Resorption of the subarticular bone occurs as a result of continuous stress.[3,4] The steady increasing deterioration of articular tissues is a hallmark of TMJ OA. The subchondral cortical layer is lost with severe degeneration, and erosion and other radiographic indications of OA emerge. TMJ OA is frequently advanced by the

time it is noticed clinically or radiographically. Previous investigations using various imaging modalities to connect pain severity levels with the quality of bony changes in TMJ OA were inconclusive.[5,6] This study was carried out to analyse correlation between clinical symptoms and cone beam computed tomography finding in TMD patients

Materials and Methods

This study looked at CBCT pictures and clinical records of patients with TMJ issues who sought treatment in Sangli district of Maharashtra between 2016 and 2018. Meeting the research diagnostic criteria (RDC) for TMD (RDC/TMD) was one of the study's inclusion criteria. The presence of arthralgia and either TMJ crepitations or CBCT bone abnormalities such as erosion, sclerosis, flattening of joint surfaces, or osteophyte growth indicate Group IIIb osteoarthritis of the TMJ. A history of TMJ surgery, condylar fracture, jaw trauma, and polyarthritis were among the 12 exclusion criteria (such as rheumatoid arthritis, gout arthritis and psoriatic arthritis). Subjects with missing data were also omitted from the study.
An orofacial pain specialist took a complete history and did a clinical assessment on all of the participants. The average pain intensity level self-reported in the previous week was graded on a 0 to 10 verbal rating scale, with "0" indicating no pain and "10" indicating the worst pain possible. Mandibular range of motion (maximum mouth opening, right and left lateral range of motion, and protrusion), TMJ pain on palpation and jaw functions, and the presence or absence of TMJ crepitations were among the clinical examinations. Galileos (Sirona Dental Systems Inc., Bersheim, Germany) was used to take the CBCT pictures, with a voltage of 85 kV and a current of 7 mA. The effective dose was around 70 Sv13, with a field of view of around 6 inches.[14]

Multiplanar pictures were exported in digital imaging and communications in medicine (DICOM) format files, and reconstructed three-dimensional data was recorded in a proprietary data format file. The images that were chosen for export to DICOM media were viewed using In vivo Dental (Anatomage, Inc. San Jose, CA) software. In the software's multiplanar reformatted view, images were seen in the axial, coronal, and sagittal planes. The joint's corrected axis cross-sections were also examined. Three oral and maxillofacial radiologists with more than 20 years of expertise and routinely interpreting TMJ CBCT pictures analysed all of the images. The display was a Lenovo (Lenovo, Morrisville, NC) T60p with a resolution of 1024 x 768 pixels.

The type of condylar bony change was classified based on the CBCT images using both Koyama et al's classification[15] and Ahmad et al's image analysis criteria.[16] If there was any doubt about which classification should be assigned, the volume was revisited with the radiologist who originally interpreted the image until an agreement was reached. All data was entered into Excel 2007 (Microsoft, Redmond, WA), and statistical testing was performed using SAS version 9.1 (SAS Institute Inc., Cary, NC). As a covariate, only the maximal bony change of the condyle was employed. The relationship between the greatest condyle change, verbal pain assessment, and mandibular ranges of motion was investigated using generalised linear modelling. The average and maximum condyle and glenoid fossa alterations for both the Koyama et al[15] and Ahmad et al[16] categories were

correlated using Spearman's rho correlation. Nine participants were chosen at random and their CBCT interpretations were evaluated by a second observer to determine interexaminer reliability in assigning a classification.

Results

The inclusion and exclusion criteria were met by a total of 40 patients (32 females and 8 males). The patients ranged in age from 17 to 72 years old, with a standard deviation (SD) of 19 years. The mean self-reported pain rating was 5.8 (SD 1.9), with a range of 3–9. The average maximum opening was 46.8 mm (range 31–67 mm, SD 10.2 mm), the average protrusion was 6.8 mm (range 4–12 mm, SD 2.1 mm), the average right lateral movement was 8.5 mm (range 4–12 mm, SD 2.1 mm), and the average left lateral movement was 9.0 mm (range 1–14 mm, SD 2.4 mm). TMJ crepitation was found in only 6 (20%) of the patients'right TMJs and only 8 patients' left TMJs (27 percent). TMJ crepitations were present in 5 (17%) of the individuals.

On all variables, there were strong interexaminer (kappa coefficient 0.76–1, p 0.001) and intraexaminer (kappa coefficient 0.74–1, p 0.02) agreements. Interexaminer study of the right and left glenoid fossas yielded perfect agreement. The greatest condyle bony change and verbal pain rating had a poor association (Table 1). There was no statistically significant link between maximum condyle alteration and maximum openness. The maximal condyle alteration and protrusion had a very modest correlation. Similarly, there was little association between right and left lateral range of motion. As demonstrated in Table 2, there was a strong correlation between Koyama's and Ahmad's classifications.[15,16] For both classifications, there was a statistically significant strong connection between the average and maximum alterations for the condyle and glenoid fossa.

Table 1
Correlation of maximum bony change of the right and left condyles with pain rating and mandibular range of motion

	Koyama's classification		Ahmad's classification	
	R^2	p-value	R2	p-value
Pain rating	0.1441	0.3993	0.0272	0.9491
Mouth opening	0.2911	0.0625	0.2627	0.0957
Protrusion	0.0872	0.7007	0.1656	0.3618
Right lateral movement	0.0394	0.9097	0.0868	0.6876
Left lateral movement	0.0942	0.6496	0.1705	0.3238

Table 2
Correlation between Koyama et al's[15] and Ahmad et al's[16] classifications based on the average and maximum changes for condyle and glenoid fossa (Spearman's correlation coefficient)

Ahmad classification	Koyama classification			
	Ave condylar changes	Max condylar changes	Ave glenoid fossa changes	Max glenoid fossa changes
Ave condylar changes	0.9344			
Max condylar changes		0.7697		
Ave glenoid fossa changes			0.8303	
Max glenoid fossa changes				0.7758

Ave, average; Max, maximum.
$p < 0.0001$.

Discussion

The radiographic findings in this study correlated poorly or not at all with the clinical indications and symptoms, which is similar with prior TMJ OA studies. The multifaceted feeling of pain is one of the explanations for the lack of correlation. The International Association for the Study of Pain describes pain as a sensory and emotional experience.[7,8] Verbal pain intensity ranking elicits the sensory discriminative dimension of pain. Instruments like the McGill Pain Questionnaire and the Gracely Box Scale, on the other hand, are superior at determining the cognitive-motivational and evaluative dimensions. If obtained, these data may or may not reveal additional correlations between pain and TMJ OA bone changes. Instead of relying solely on sensory discrimination, future prospective research should include multidimensional instruments to assess pain, incorporating cognitive, motivational, and evaluative components. Second, masticatory muscle pain is frequently associated with TMJ OA, and due to the close proximity of the structures, patients are difficult to discern pain of masticatory origin from pain of TMJ origin.[9,10]

While some individuals with radiographically normal TMJs complain of discomfort, others with DJD may be pain-free. Because these relationships aren't well-founded, predicting radiography findings from clinical indications and symptoms might be difficult. Patients may feel symptoms for months before radiographs reveal bone abnormalities. Radiographs may show normal in the early stages of TMJ OA and are therefore ineffective n making proper diagnosis.[11,12]

Wiese et colleagues found no link between degenerative bone changes in TMJ tomograms and any pain-related variables in their investigation. They explained

that the lack of relationship could be owing to the disparity in the beginning of pain and observable radiographic bone changes, because radiographs represent the consequence of a prior process rather than continuing processes. This is really relevant to our cross-sectional research. Instead of a single measure, prospective cohorts will be able to capture pain intensity levels and radiographic recordings of the disease process at multiple time points.[13,14]

In this work, we employed two classification systems to ensure that our findings could be replicated by another classification system. There was no link between maximum condyle change and verbal pain rating or mandibular ranges of motion using Koyama's and Ahmad's criteria. This is the only study that we are aware of that compares the bone alterations of osteoarthritic TMJ using two different classification systems. Because Ahmad's criteria are simpler than Koyama's and are based on the RDC/TMD, the discovery that both categorization systems showed extremely significant correlations for average and maximum bony changes may suggest that Ahmad's criteria should be used.[15,16]

Conclusion

While there was a high correlation between CBCT findings and average and maximum condylar bony changes in TMJ disorders, but there was poor or no correlation between pain intensity and mandibular ranges of motion with maximum condylar bony change, according to the findings of this study. Factors that mitigate this lack of association should be investigated further.

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