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Correlation between patient complaint, temporomandibular disorder diagnosis and mandible head morphology

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Abstract

The aim of this study was to evaluate the correlation between patient complaints, clinical diagnosis of temporomandibular disorder (TMD) based on the diagnostic criteria for TMD, and morphology of the mandibular condyle obtained by cone-beam computed tomography (CB-CT). Data were collected from 40 patients. The anatomy of the mandibular condyle was assessed using CB-CT, the diagnosis of TMD according to diagnostic criteria for TMD, and patients' complaints was registered at the appointment. Data were explored and all statistical references were completed in bicaudal tests, with 95% confidence level (α=0.05). The Chi-squared test was used with Bonferroni correction (z-tests). Main complaints found were grouped as muscular, articular, muscular and articular, or headache and articular symptoms. Clinical diagnosis of TMD involved myalgia, local myalgia, myofascial pain, myofascial pain with reference, myofascial pain with arthralgia, arthralgia, or disc displacement with reduction. At least one joint showed condylar flattening, erosion, sclerosis, or osteophytes. No correlation was observed between main complaints, clinical diagnosis, and morphology of the mandibular condyle in all comparisons. The findings suggest that due to the absence of clinical and morphological correlation, CB-CTs should be requested only in specific cases, when doubt remain after careful TMD diagnosis, to avoid their over-indication.

Keywords: Temporomandibular Joint; Facial Pain; Cone Beam Computerized Tomography.

Introduction

Temporomandibular disorder (TMD) is an umbrella term applied to dysfunctions associated with the temporomandibular joint (TMJ) and related muscles. The National Institutes of Health cited many factors that "may be implicated" in the etiology of TMD, including age, sex, stress, depression, somatic symptoms, orthodontic treatment, occlusal or masticatory dysfunction, extraction of third molars, facial trauma, and degenerative arthritis (1). TMD is a significant problem of public health that affects 5% to 12% of the population and it is the second most common musculoskeletal condition resulting in pain and incapacitation, which the incidence is only lower than lower back pain. TMD when associated to pain can affect the patient's activities of daily living, as well as their psychological function and quality of life (2).

Patients usually consult their clinicians for TMD, particularly if associated to pain. Diagnostic criteria for TMD with clear, reliable and valid operational definitions, examinations, and imaging exams are needed for a physical diagnosis in both clinical and research scenarios (3). Morphological changes and degenerative pathological processes may affect the mandibular condyle, which may present faceting, osteophyte formation, pseudocysts, erosions, and bone scleroses, among others (4).

A biobehavioral evaluation of pain and psychological function is also required to provide valuable information to determine if the patient's dysfunction, particularly if chronic, requires the assessment of a multidisciplinary team. Conducted jointly by research centers worldwide, the new double axes of the diagnostic criteria for TMD will provide evidence-based data for patient's examination and faster communication during consultation, imaging referrals, and **prognosis**. The new diagnostic criteria for TMD protocol is useful in all clinical scenarios, and supports the full range of diagnostic activities, from classification to final evaluation and diagnosis. This protocol provides a common language for all clinicians while providing valid methods for researchers to phenotype subjects, mainly for TMDs associated with pain (3).

Computed tomography (CT) and cone beam CT (CB-CT) are excellent exams to assess bone surface; however, visualization of TMJ soft tissues is unclear. For this reason, CT is the exam of choice to evaluate TMJ hard tissues, while magnetic resonance imaging (MRI) is ideal to evaluate the soft tissues (5). Changes in the morphology mandibular condyle may be due to age, gender, facial pattern, functional load, occlusal force, malocclusion, and degenerative processes, such as osteoarthritis. The advantages of CB-CT include high resolution associated with low radiation. For these reasons, the number of studies using this imaging exam to evaluate hard tissues of the TMJ has increased significantly (6,7). Due to the advances in imaging exams, clinicians often request in the hope that high-quality images and radiology reports will clarify or corroborate their diagnosis and proposed treatment. However, referrals to imaging exams might excessive subjecting patients to unnecessary doses of radiation.

The purpose of this study had a confirmatory character that was to investigate the correlation between patient's complaints, clinical diagnosis of TMD based on the protocol of diagnostic criteria for TMD, and morphology of the mandibular condyle using CB-TC. The null hypothesis tested was that there would be no statistical correlation among the factors.

Methodology

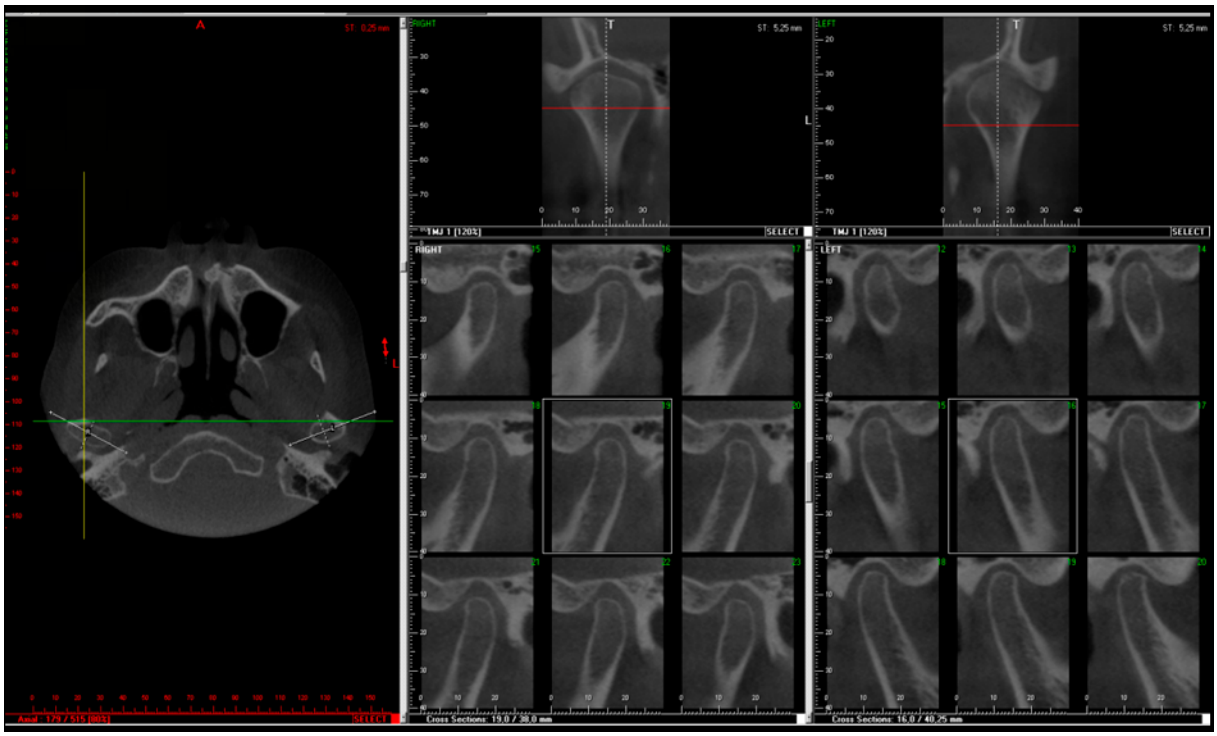
The study was conducted at the Dental Radiology and Imaging Department and at the Department of Temporomandibular Disorders of the São Leopoldo Mandic Faculty in the city of Campinas, SP (Brazil). The Research Ethics Committee of the institution approved the project. All subjects received an informed consent. Sample size was established with power analysis, seeking for a correlation coefficient of 0.4 between diagnoses, and considering α (bidirectional) = 0.05, and power = 0.80, resulting in 38 patients.

The sample consisted of 40 patients, which search for appointment complaining of TMJ pain. The inclusion criteria involved data from patients who had been examined as follows: patients evaluated with the original version of the diagnostic criteria for TMD protocol (7) by a single trained examiner; temporomandibular joints examined with cone beam computed tomography (CB-CT) with closed mouth (80 TMJs) after referral from the TMD department; patients' that main complaints were registered. Patients were excluded if they presented associated syndromes, if TMJ exams were insufficiently detailed or performed with open mouth, if their clinical records were incomplete, or if they failed to attend the diagnostic criteria for TMD protocol clinical evaluation.

Data collection and image interpretation were conducted on an ICAT® tomographic (Imaging Science, Hatfiled, PA, USA) configured for the TMJ, with closed mouth (maximal intercuspal position). Image acquisition was standardized with field of view (FOV) of 13 cm, 40 seconds of acquisition, and 0.25 mm voxels (8).

CTs followed an analysis pattern in XORAN software (Xoran Technologies LLC, Ann Arbor, MI, USA, version 3.1.62), in the following sequence: 1) Images in the multiplanar reconstruction (MPR) window were observed in the frontal, sagittal, and axial sections (Figure 1); 2) The TMJ tool was used to mark the long axes of the right and left mandibular condyles. This resulted in central paracoronal sections (anterior view of the mandibular condyle) and parasagittal sections (perpendicularly to the long axes of mandibular condyle) shown in the TMJ window of the software.

Figure 1. Frontal, sagittal, and axial sections of the TMJ in XORAM software



All TMJs showed anatomical changes, which were analyzed in more detail in the parasagittal sections and in the paracoronal direction (8). Two trained and experienced radiologists interpreted tomographic sections. The evaluations were repeated until the examiners obtained a high inter-examiner reliability as measured by Cohen's Kappa (0.81).

After the images and patient records were analyzed, 30% of the patients' data were reinterpreted to assess data reproducibility. Data were explored using the IBM® SPSS® software (Statistics23 software, NYSE: IBM; Armonk, United States), and all statistical inferences were performed using bicaudal tests considering a test power (1-β) of 0.80 (β=0.2), with confidence levels of 95% (α=0.05). The Chi-squared test was used and adjusted for all paired comparisons in the rows with Bonferroni corrections (z-tests).

Results

This study included 29 female and 11 male volunteers with the ages ranging from 17 to 65 (mean 35.1 ± 10.9 years). In this sample, the main complaints were grouped according to symptoms: muscular (n=13; 32.5%), articular (n=11; 27.5%), muscular and articular (n=10; 25%), and headache and articular (n=6; 15%).

The clinical diagnosis of TMD involved myalgia and local myalgia (n=9; 22.5%), myofascial pain, myofascial pain with reference (n=15; 37.5%), myofascial pain with arthralgia, arthralgia (n=10; 25.0%), and disc displacement with reduction (n=6; 15.0%). At least one side showed condylar flattening in 77.5% of cases (n=31), erosion in 22.5% (n=9), sclerosis in 15% (n=6), and/or osteophyte in 40% (n=16).

None of the comparisons (clinical complaint vs. tomography findings, tomography findings vs. clinical diagnosis, clinical diagnosis vs. tomography findings) showed significant differences in proportion, which might also be a result of the small number of individuals in some groups (n<5). Comparisons between condylar conditions, main complaint, and clinical diagnosis are shown in Tables 1, 2 and 3. CB-CT findings could not be compared according to each clinical diagnosis because some condyles showed more than one morphological change.

Table 1. Proportion of each tomography finding according to each main complaint

		Main complaint				
		Muscular	Articular	Muscular and Articular	Headache and Articular	Total
Flattening	Absent	3a	2a	3a	1a	9
	Present	10a	9a	7a	5a	31
	Total	13	11	10	6	40
Chi-squared=0.560; p=0.906.						
		Main complaint				
		Muscular	Articular	Muscular and Articular	Headache and Articular	Total
Erosion	Absent	10a	7a	8a	61	31
	Present	3a	4a	2a	01	9
	Total	13	11	10	6	40
Chi-squared=2.993; p=0.393						
		Main complaint				
		Muscular	Articular	Muscular and Articular	Headache and Articular	Total
Sclerosis	Absent	11a	9a	101	4a	34
	Present	2a	2a	01	2a	6
	Total	13	11	10	6	40
Chi-squared=3.435; p=0.329						
		Main complaint				
		Muscular	Articular	Muscular and Articular	Headache and Articular	Total
Osteophyte	Absent	7a	6a	7a	4a	24
	Present	6a	5a	3a	2a	16
	Total	13	11	10	6	40
Chi-squared=0.869; p=0.833						

Table 2. Proportion of each tomography finding according to each TDM diagnosis

		Clinical diagnosis of TMD				
		Myalgia and Local myalgia	Myofascial pain, Myofascial pain with reference	Myofascial pain with arthralgia, Arthralgia	Disc displacement with reduction	Total
Flattening	Absent	4a	1a	3a	1a	9
	Present	5a	14a	7a	5a	31
	Total	9	15	10	6	40
Chi-squared=5.082; p=0.166.						

		Clinical diagnosis of TMD				
		Myalgia and Local myalgia	Myofascial pain, Myofascial pain with reference	Myofascial pain with arthralgia, Arthralgia	Disc displacement with reduction	Total
Erosion	Absent	7a	12a	7a	5a	31
	Present	2a	3a	3a	1a	9
	Total	9	15	10	6	40
Chi-squared=0.494; p=0.920.						

		Clinical diagnosis of TMD				
		Myalgia and Local myalgia	Myofascial pain, Myofascial pain with reference	Myofascial pain with arthralgia, Arthralgia	Disc displacement with reduction	Total
Sclerosis	Absent	6a	151	8a	5a	34
	Present	3a	1	2a	1a	6
	Total	9	15	10	6	40
Chi-squared=5.229; p=0.156.						

		Clinical diagnosis of TMD				
		Myalgia and Local myalgia	Myofascial pain, Myofascial pain with reference	Myofascial pain with arthralgia, Arthralgia	Disc displacement with reduction	Total
Osteophyte	Absent	6a	9a	6a	3a	24
	Present	3a	6a	4a	3a	16
	Total	9	15	10	6	40
Chi-squared=0.417; p=0.937.						

Table 3. Relationship between clinical diagnosis and each tomography finding

		Flattening			**Erosion**			**Sclerosis**			**Osteophyte**		
		No	Yes	Total	No	Yes	Total	No	Yes	Total	No	Yes	Total
Myalgia and Local myalgia	No	5a	26a	31	24a	7a	31	28a	3a	31	18a	13a	31
	Yes	4a	5a	9	7a	2a	9	6a	3a	9	6a	3a	9
	Total	9	31	40	31	9	40	34	6	40	24	16	40
		Chi-squared=3.207; p=0.073.			Chi-squared=0.001; p=0.982.			Chi-squared=3.061; p=0.080.			Chi-squared=0.215; p=0.643.		
		Flattening			**Erosion**			**Sclerosis**			**Osteophyte**		
		No	Yes	Total	No	Yes	Total	No	Yes	Total	No	Yes	Total
Myof. pain, Myiof. pain w/ limited opening, Myalgia w/ myof. pain	No	8a	17a	25	19a	6a	25	19a	6a	25	15a	10a	25
	Yes	1a	14a	15	12a	3a	15	15a	0a	15	9a	6a	15
	Total	9	31	40	31	9	40	34	6	40	24	16	40
		Chi-squared=3.450; p=0.063.			Chi-squared=0.086; p=0.769.			Chi-squared=4.235; p=0.040.			Chi-squared=0.000; p=1.000.		
		Flattening			**Erosion**			**Sclerosis**			**Osteophyte**		
		No	Yes	Total	No	Yes	Total	No	Yes	Total	No	Yes	Total
Myofascial pain with arthralgia, Arthralgia	No	6a	24a	30	24a	6a	30	26a	4a	30	18a	12a	30
	Yes	3a	7a	10	7a	3a	10	8a	2a	10	6a	4a	10
	Total	9	31	40	31	9	40	34	6	40	24	16	40
		Chi-squared=0.430; p=0.512.			Chi-squared=0.430; p=0.512.			Chi-squared=0.261; p=0.609.			Chi-squared=0.000; p=1.000.		
		Flattening			**Erosion**			**Sclerosis**			**Osteophyte**		
		No	Yes	Total	No	Yes	Total	No	Yes	Total	No	Yes	Total
Disc displ. w/ reduction	No	8a	26a	34	26a	8a	34	29a	5a	34	21a	13a	34
	Yes	1a	5a	6	5a	1a	6	5a	1a	6	3a	3a	6
	Total	9	31	40	31	9	40	34	6	40	24	16	40
		Chi-squared=0.138; p=0.711.			Chi-squared=0.138; p=0.711.			Chi-squared=0.015; p=0.901.			Chi-squared=0.204; p=0.588.		

Discussion

Results obtained after the interpretation of CB-CT images showed no correlation between patient's clinical complaints and clinical diagnosis of TMD. Therefore, the null hypothesis tested was accepted. Considering the results associating patient's complaint and tomography findings, the results of the current study are in agreement with a previous report (8), where condylar changes caused by osteoarthritis and observed in CB-CT showed weak or no correlation with patient's report of pain and functional limitations such as opening, protrusion, and laterality. Authors speculate that one of the potential reasons for this lack of correlation is the multidimensional experience of pain. The International Association for the Study of Pain defines pain as a sensory and emotional experience (9). Studies on the subject elicit the sensory discriminative dimension of pain based on a verbal classification of pain intensity. One of the reasons might be that studies should use multidimensional tools to assess pain, including cognitive, motivational, and evaluative components instead of only the patients' reports or sensory discriminative aspects observed in many studies (10).

The results of the current study are in agreement with a previous study as to the lack of relationship between clinical diagnosis and tomography findings (3). Over or underestimating the use of CB-CTs for specific clinical diagnoses is a concern issue. Studies have pointed out that radiology findings impact the treatment provided to patients; therefore, CB-CTs are valuable tools for TMJ assessments. Patients from several diagnostic groups tested would benefit from a CB-CT (except those with myofascial pain), as long as it has a correct indication (11,12). CB-CTs have shown to be important for the diagnosis of specific conditions, as previous studies have shown (5,11-13). For example, this imaging test may be considered standard practice for the assessment of TMJ osteoarthritis because of its high specificity and reliability.

Considering imaging findings of joint flattening, erosion, sclerosis, and osteophytes, studies have shown that CB-CTs are valuable tools to assess the temporomandibular joint (13,14). CB-CTs provide excellent visualization of a broad spectrum of pathologies and bone changes, including osteophytes, condylar erosion, remodeling, ankylosis, displacements, and abnormal growth, such as condylar hyperplasia (13). Autopsy studies have shown 75% sensitivity and 100% specificity of CB-CTs to detect bone changes, with positive and negative predictive values of 100% and 78%, respectively (15). The correlation between tomographic changes and clinical symptoms of TMD, such as flattening, erosion, osteophytes, and sclerosis, has been reported in literature (3). Authors observe that intense crepitation in opening and closing, laterality, and protrusion were associated to higher risk of degenerative findings in CB-CTs. Osteoarthritis is also a key factor in increasing the likelihood of tomographic changes.

The estimation of the associations in this study were based on the patient complain and clinical diagnosis. The use of only patient complains could be adopted, including evaluation of joint sounds, the presence of joint pain upon palpation and pain intensity. Moreover, each TMJ was used as a unit of analysis, and not the patient, which would englobe both joints. Therefore, it was not made specific differentiation of patients with unilateral TMD diagnosis and unilateral CB-CT findings of those with both TMJ affected. Lastly, future complementary evaluations if CB-TC findings (any of them) would be differently associated with TMDs related to the TMJ, i.e., TMJ arthralgia + intra-articular joint disorders + degenerative joint disorder, would be also appropriate.

From the results obtained, it is possible to point out that the worse the appearance of the head of the jaw is when faced with imaging tests, the lower the clinical TMD semiology presented by patients. These findings are corroborated by studies found in the literature (16,17) where this characteristic is explained by the physiological adaptation of the tissues, reducing the patient's symptoms.

Conclusion

There was no correlation between patients' complaints, clinical diagnosis of TMD, and morphology of the mandibular condyle obtained by CB-CT. The findings of the present study suggest that CBCTs should only be requested after detailed clinical evaluation to avoid unnecessary radiation.

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