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Original Article

Comparison of condylar and ramal asymmetries in different temporomandibular joint disorders

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Abstract

Aim: The aim of this study is to compare condylar and ramal asymmetries in different temporomandibular joint disorders.
Material and Methods: A total of 91 patients ranging in age from 15 to 79 were included in this study. The study groups were as follows: temporomandibular joint osteoarthritis (OA) group (N=24), disc displacement with reduction (DDWR) group (N=26), disc displacement without reduction (DDWoR) group (N=20), and control group (N=21). All patients' vertical condylar and ramal heights were measured from panoramic radiographs, and condylar (CAI) ramal (RAI), and total (TAI; condylar + ramal) asymmetry indices were calculated according to Habets el al's formula.
Results: Statistical evaluations were made with the Kruskal–Wallis test using SPSS. Although TAI (p=0.110) and age (p = 0.610) did not differ significantly among the four groups, RAI (p=0.003) and CAI (p = 0.034) did. In intergroup estimates for RAI comparisons, significant differences were observed between the OA and DDWR groups (p=0.004, p=0.033) and between the OA and control groups (p=0.033). Evaluations of CAI among groups showed significant differences only for the OA vs. control group comparison (p=0.022).
Conclusion: These results show that OA, a degenerative disease, has greater effects on vertical condylar and ramal asymmetry than on disc displacements and that there are no significant differences between the control and disc displacement groups in terms of CAI.

Keywords: Condylar asymmetry; ramal asymmetry; temporomandibular joint disorders

INTRODUCTION

Temporomandibular joint disorders (TMD) are common diseases that affect joint components and the anatomical structures associated with these components, including rheumatologic and degenerative problems as well as myofascial pain and internal joint irregularities. Pain, limited mandibular motion, deviation, joint sounds, closed or open locking and malocclusions are common characteristics of TMDs (1).

TMDs are one of the most common causes of orofacial pain (2). These multifactorial diseases are accompanied by stress, arthrogenic factors, parafunctional habits, muscle hyperactivity, and structural problems. Condylar asymmetry is among the structural problems(3).

Various systems have been developed to assess TMDs. The Research Diagnostic Criteria for temporomandibular disorders (RDC/TMD) are the standard criteria for diagnosing TMDs. This system is composed of two components: axis 1 and axis 2. Axis 1 is the differential diagnosis of diseases such as myofascial pain, disc displacement, and osteoarthritis; axis 2 deals with pain-related disability and the patient's psychological status (4).

Osteoarthritis, a degenerative disease with inflammatory changes, often results from mechanical overload of the temporomandibular joint (TMJ). Factors contributing to the condition include discopathy and rheumatoid arthritis. Reduced jaw mobility, sounds on opening, and pain are the main symptoms of OA. In this degenerative disease, hard tissue of the region is affected by erosion, flattening, and osteophites (5).

In some cases of TMD, internal derangement resulting in gradual displacement of the articular disc is observed. This clinical condition, which is evaluated as Axis I Group II according to the RDC/TMD classification, basically

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consists of an articulatory disc depleted to the anterior, captured by the condyle during function with reduced, non-reduction disc displacement. This condition can progress to osteoarthritis in the future (6).

Mandibular asymmetry, which affects the lower third of the face, is important because it has direct effects on appearance. The mandible serves as part of the stomatognatic system. For this reason, mandibular asymmetry can create both aesthetic and functional problems. In addition, the relationship between mandibular asymmetry and TMDs increases the importance of this condition. Condylar asymmetry is one of the major causes of mandibular asymmetry and hence facial asymmetry (7).

A basic method of determining asymmetry between mandibular condyles was introduced by Habets et al (8). This method gives an asymmetry index that reflects the proportional relationship between differences in and sums of mandibular condylar and ramal vertical heights (9). Here we compare asymmetry scores in a control group with that in groups of patients diagnosed with three different TMDs.

MATERIAL and METHODS

We conducted our study retrospectively using panoramic radiography (Vatech, Hwaseong, Republic of Korea) and demographic records of 91 patients (72 female, 19 male) from the files of the Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Harran University, Turkey. This study has been approved by Harran University Research and Application Hospital Managing Board with reference number 16/01/2020-E.2824. We selected for the study 70 patients with one of three TMD diagnoses (OA, n = 24; DDWR, n = 26; or DDWoR, n = 20), and 21 individuals without any TMJ complaints. Clinical and radiological diagnosis of the TMD having patients (OA, DDWR, DDWoR) was made in accordance with the RDC/TMD protocol. Patient data forms used to verify three kind of TMDs and panoramic radiographs of these patients were used to determine the vertical condyle and ramus heights. Unsuitable films on which the contours of the condyles and ramus were not detectable or the films with distortion, magnification and superposition which restrains measuring were excluded.

Panoramic images were obtained with PaX-I (Vatech) with mA = 8, kVp = 60, and time = 10 s. Images were exported from EasyDent version 4.1.5.9 (Vatech). For both sides of the panoramic images, the most lateral points of the ramus and condyle were marked as A and B recpectively. For each side, a straight line X was created between points A and B. Later, a second line Y was drawn from the most superior of the condyles perpendicularly. The intersection of these two lines was named point C (Figure 1). Condylar height (CH) was defined as the distance between points C and B. The distance between points A and B was called ramal height (RH). The total height (TH) was recorded as the sum of the condylar and ramal heights.

All drawings and measurements were made by one of the authors via EasyDent without knowing which patient the panoramic film belonged to. Asymmetry in condylar, ramal, and total heights were calculated with the formula introduced by Habets et al (8) (Figure 1).

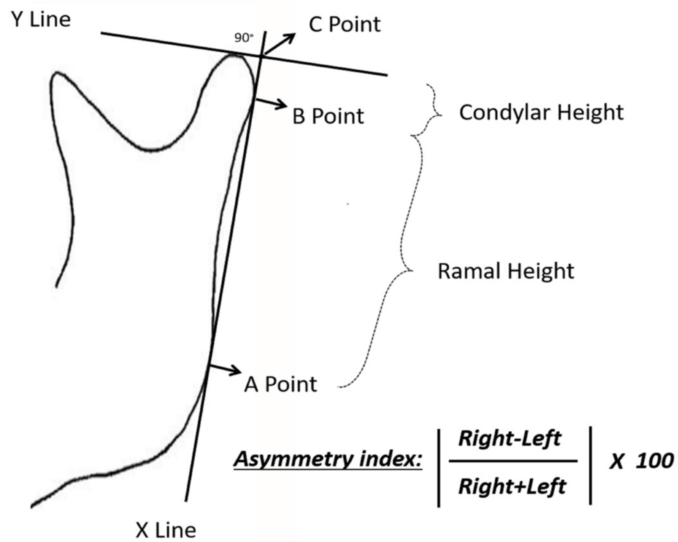

Figure 1. Measuring method for condylar and ramal asymmetries according to Habets et al (8).

Statistical analyses

Statistical analyses were performed with SPSS, version 20.0 (IBM, Armonk, NY, USA). Significance was set at 0.05. Descriptive statistics were calculated. The intergroup distribution by sex was examined with the chi-square test. The Shapiro–Wilk test was used to determine whether CAI, RAI, TAI, and age were normally distributed. The Kruskal–Wallis test was used to determine whether there were significant differences among the four groups. For intergroup assesments, pair-wise comparisons made to show the statistically differences present or not for two group comparisons. Intraclass correlation coefficients (ICCs) were calculated for repeated measurements in 20 patients to control for methodological error, and high compatibility was found between measurements (range = 0.9–1).

RESULTS

The study sample consisted of 91 patients; 70 had been diagnosed with one of three TMDs (OA, DDWR, or DDWoR), and 21 were controls. The female-to-male ratios of the groups were as follows: OA, 70.8%; DDWR, 80.8%; DDWoR, 85.0%; and control, 81.0%. According to the chi-square test, the difference in sex distribution among the four groups was not significant (p = 0.682).

Mean age was 32.16 ± 2.86 for the OA group, 30.07 ± 2.02 for the DDWR group, 36.50 ± 3.12 for the DDWoR group, and 35.90 ± 3.12 for the control group. According to the Shapiro–Wilk test the age variation in the groups was not normally distributed; therefore, the Kruskal–Wallis test was used to analyze the age variation among groups. No significant difference among the groups was detected (p = 0.610).

Median (minimum–maximum) CAI, RAI, and TAI values are shown in Table 1. The three variables were not normally distributed. The Kruskal–Wallis test showed significant differences among the four groups in CAI and RAI but not TAI. Between-group assessments showed that the OA group had a significantly higher RAI than either the control (p = 0.033) or DDWR (p = 0.004) groups, the OA group had a significantly higher CAI than the control group (p = 0.022), and there were no significant differences in TAI (p = 0.110) (Table 2).

DISCUSSION

A considerable prevalence of TMDs (5%–12%) has been reported in the general population, predominantly in females, as in our study (female rate = 79.1%) (4). Clinical examination, imaging, and patient history are usually used to diagnose TMDs (2).

Table 1. Descriptive variables for diagnose groups

Diagnose Groups	n	f/m ratio	Mean age± std.dev.	RAI Median (min-max)	CAI Median (min-max)	TAI Median (min-max)
OA	24	2.42	32.16 ± 2.86	2.62 (0.14-9.34)	11.66 (0.78-36.84)	2.16 (0.10-11.22)
DDWR	26	4.20	30.07 ± 2.02	0.65 (0.12-3.90)	4.39 (0.49-37.31)	1.27 (0.22- 6.07)
DDWoR	20	5.66	36.50 ± 3.12	1.22 (0.15-5.12)	6.53 (0.68-30.43)	1.89 (0.35-5.45)
Control	21	4.25	35.90 ± 3.12	0.82 (0.35- 3.39)	3.18 (0.79-10.00)	0.93 (0.11-238)

Table 2. Statistical comparisons of whole study

Variable	Vairable distrubution	Statistically analyse way	P value for all diagnose groups	Between group comprasons after Kruskal-Wallis test
Age	non-normally	Kruskal-Wallis	0.610	-
RAI	non-normally	Kruskal-Wallis	**0.003***	**OA****-DDWR (p:0.004) **OA****- Control (p:0.033)
CAI	non-normally	Kruskal-Wallis	**0.034***	**OA****-Control (p:0.022)
TAI	non-normally	Kruskal-Wallis	0.110	-
Gender	- (nominal variables)	Chi-Square	0.682	-

RAI, Ramal Asymmetry Index; CAI, Condylar Asymmetry Indecx; TAI, Total Asymmetry Index
* Statistically Significant Difference Between Groups
** Statistically Significant Difference İn Favour Group Marked

RDC/TMD is a set of standard criteria for TMDs involving both clinical and radiographic examination (4). Here we determined whether asymmetry in the mandibular ramus and condyle differs among groups diagnosed with three different TMDs and a control group with reference to RDC/TMD. To the best of our knowledge, condylar and ramal asymmetry have not previously been compared by TMD diagnosis. It was hypothesized that CAI, RAI, and TAI would differ between the OA and control groups. The disc displacement groups (DDWR and DDWoR) were not expected to have condyle or ramal asymmetry significantly different from that of control subjects.

Asymmetry and TMJ function are vital to dentofacial appearance and function (9). One of the most used clinical diagnostic tests for detecting TMDs is CAI (10). According to previous studies, the morphology of the mandibular condyle can vary by cause of TMD (11,12).

According to Bezuur et al, (13). CAI is higher in TMDs of myogenic origin than TMDs of arthrogenic origin. In a study of CAI and Heklimo's clinical dysfunction scores, Khojastepour et al (14). Found that patients with condylar asymmetry are more susceptible to TMD, but this index is not a safe criterion for TMD symptoms.

In our study, although the two disc displacement groups (DDWR and DDWoR) showed similar asymmetry to the control subjects, the OA group showed higher asymmetry for both condylar and ramal vertical measurements than controls. Fuentes et al (15). reported that Habets el al's (9) method, which was used in the present study, provides acceptable clinical knowledge of CAI and that panoramic radiographs are the most beneficial imaging modality for determining mandibular posterior asymmetry.

A meaningful relationship between asymmetry of the condylar process and TMD has been detected by some authors, (3,8,12,13) but other literature (16) does not support this relationship. According to results presented here, OA patients have clear asymmetry in both the condylar and ramal portions of the mandibula regarding height measurements, but patients in the two disc displacement groups show no signs of asymmetry compared to asymptomatic controls. We attribute the two different views found in the literature to the fact that there may have been no distinction between TMD diagnosis groups, or only one diagnosis group, in studies that have evaluated condylar and ramal asymmetry.

Panoramic radiography was used in our study to determine condylar height, ramal height, and total height of the mandibula. Magnification of the radiographic images in both vertical and horizontal planes reflects reality, but vertical magnification depends on projection factors only. It is stated that magnification of panoramic radiographs is uniform and does not materially affect diagnostic decisions (17). Kambylafkas et al. (18) suggested that panoramic radiography is useful for evaluating vertical posterior asymmetry as we did in this study. In the present study, poor-quality and distorted radiographs and those with patients unsuitably positioned were excluded. Vertical and angular measurements were considered acceptable if the subjects had been positioned properly in the equipment (19).

In the present study only slight asymmetry (3.18) in condyles only was found in the control group, which did have not any complaints of TMJ or asymmetry. This finding is similar to previous studies (19).

There are a number of studies in the literature regarding skeletal morphology and TMDs, in particular facial asymmetry. The challenge in understanding the relationship between TMDs and asymmetry is describing clear cause and effect. Some literature (18) notes that TMJ disc displacement events are reducible or cannot be a cause of asymmetry. Other studies (20) report bony changes on the condylar surface of the mandibula in patients with disc displacement. These changes in the mandibular condyle can include shortening of the mandibula and distal deviation of the condylar head, with resulting mandibular asymmetry.

In the present study, only the OA group showed statistically significant differences from the control group in condylar and ramal asymmetry. The disc displacement groups (DDWR and DDWoR) had similar condylar and ramal height measurements to those of the control group. The lack of difference among the groups in terms of sex distribution according to the chi-square test (p = 0.682) increases the reliability of our study.

CONCLUSION

In this study, associations between both condylar and ramal asymmetry and three different TMDs (and also control group) were investigated in totally 91 patients. The OA TMD group had greater condylar asymmetry than control subjects and also greater ramal asymmetry than both control and DDWR subjects. The disc displacement groups and the control group had similar condylar and ramal asymmetry. These results indicate that degenerative and advanced-stage TMDs are associated with greater asymmetry. It was found that the presence of asymmetry may be an important finding of degenerative TMDs, and also asymmetry is not expected in disc displacement patients.

Competing interests: The authors declare that they have no competing interest.

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