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Magnetic resonance images of patients with temporomandibular disorders: Prevalence and correlation between disk morphology and displacement

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ABSTRACT

Using magnetic resonance imaging (MRI), this study aimed to evaluate the morphology of the articular disc of the temporomandibular joint (TMJ) in patients with temporomandibular disorder (TMD). There were 218 TMJ of 109 assessed patients; 88 were females and 21 males, and all were diagnosed as symptomatic for temporomandibular disorder. The articular disc positions were classified in the normal position and with anterior disc displacement with and without reduction. Regarding the morphology, the discs were classified as follows: biconcave (normal), biplanar, rounded, biconvex, folded, thickening in the posterior band, thickening in the anterior band and hemiconvex. The results indicated that females were the most affected by morphological changes of the articular disc ($p = 0.008$/Cramer's $V = 0.295$). There was no statistical significance when correlating the disc morphology with the sides (right and left). There was a significant correlation between the position and morphology of the articular disc ($p < 0.001$/Cramer's $V = 0.609$), and in the normal position of the discs presenting biplanar and biconcave morphologies. In TMJ with anterior displacement of the disc with reduction (ADDR), there was a greater correlation with rounded, hemiconvex and biconvex morphologies. Already in the TMJ with displacement without reduction (ADDWR), there was a higher prevalence of folded discs. It can be concluded that morphological changes in the disc are influenced by the type of displacement, and more serious deformations are associated with ADDWR cases.

1. Introduction

The temporomandibular joint (TMJ) is one of the body's most complex joints. It is a type of synovial joint formed by the mandibular condyle articulated in the mandibular fossa of the temporal bone. Separating these two bones is the articular disc, which is an active component of the TMJ allowing the complex movements of this joint. The articular disc is composed of dense fibrous connective tissue, practically devoid of blood vessels and nerve fibers. Due to its thickness, the disc can be divided at the intermediate zone, a more slender central area, with thicker anterior and posterior bands [1].

The normal morphology of the disc is classified as biconcave, which is determined by the morphology of the condyle and mandibular fossa. Irreversible morphological changes in the articular disc may occur in cases of structural changes in the joint or by destructive forces [1,2]. Several authors have found varying forms of the articular disc, classifying them as biplanar, biconvex, hemiconvex, rounded, thickening of the band and thickening of the posterior band in addition to the biconcave shape (normal) [3–10].

From a clinical perspective, changes in the morphology of the disc are signs of TMJ pathology and dysfunction and are related to the progression of disc displacement. With or without reduction, the anterior disc displacement is an intracapsular dysfunction that leads to degenerative changes in the disc and joint surfaces [4].

Currently, there is a consensus that magnetic resonance imaging (MRI) is the gold standard for determining the position and morphology of the articular disc. Disc displacement with or without reduction is clearly demonstrated in the MRI with the jaw in the closed and open mouth positions. In magnetic resonance images (MRI), the relatively low signal intensity of the disc in the normal TMJ can be distinguished from the surrounding soft tissues. In general, the disc in the abnormal TMJ has markedly lower signal

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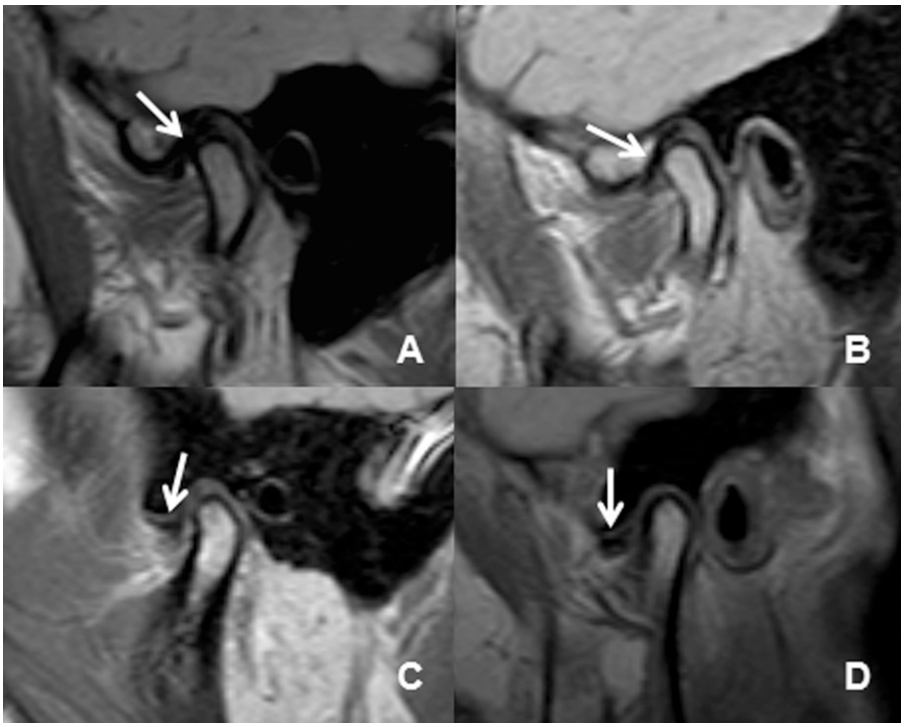

Fig. 1. Sagittal MRI sections illustrate the prevalent morphologies of the articular disc. (A) Biconcave (normal), (B) biplanar, (C) hemiconvex, and (D) folded.

intensity than the normal disc [11]. The deformation of the disc is frequently found in non-reducing conditions, and the normal biconcave configuration seems to change as a result of the displacement. The imaging assessment of disc deformation is essential if surgical repositioning of the disc is being considered. Evidence of gross deformation may prevent this type of surgery [12]. However, there is need to expand the knowledge on disc morphology and its correlation with the different types of disc displacement. Therefore, this study aimed to evaluate, in an MRI, the morphology of the articular disc in patients diagnosed with temporomandibular joint disorder (TMD) and to correlate these findings with the anterior disc displacement with and without reduction.

2. Materials and methods

After approval of the project by the Ethics Committee of the Federal University of Juiz de Fora, Minas Gerais, Brazil (no. 027/2011), the MRIs of 218 TMJ were evaluated from 109 patients; 88 (80.73%) were female and 21 (19.27%) were male, from the Department of Radiology archives at the School of Dentistry of the Federal University of Juiz de Fora. All of the patients included in this retrospective study were diagnosed as symptomatic for temporomandibular disorder using RDC/TMD.

A radiologist experienced in MRIs for TMJ evaluated sagittal sections of the TMJ on right and left sides. The evaluation was performed twice with a one-month interval between them in order to determine the reproducibility. For the morphology evaluation of the disc, only images taken in the closed mouth position were used. For the disc position evaluation, both open and closed mouth images were analyzed.

The positions of the articular disc were classified as normal, anterior disc displacement with reduction (ADDR) and anterior disc displacement without reduction (ADDWR). Regarding the morphology, the articular discs were classified as biconcave (normal), biplanar, rounded, biconvex, folded, thickening of the posterior band, thickening of the anterior band and hemiconvex.

The genders were correlated; the sides (right and left) and the positions of the articular disc with the morphological changes used the chi-squared test and Cramer's correlation coefficient. To evaluate the intra-examiner concordance (reproducibility), the Kappa test was applied. The program SPSS® version 11.0 was utilized, with a significance level of 5% ($p \leq 0.05$).

3. Results

To verify the reproducibility of the evaluations obtained by the kappa index, the intra-examiner comparison was used, showing almost perfect agreement for both the morphology of articular disc (0.94) and for the disc position (0.98). More prevalent morphologies of the articular disc are illustrated in Fig. 1.

The prevalence was calculated for morphologies and positions of the articular disc in relation to gender (Table 1) and regarding the side (Table 2). In order to cross the categorical variables evaluated, the chi-square test and the Cramer's correlation coefficient were applied. The correlation between the disc morphology and gender (Table 1) was statistically significant ($p = 0.008$/Cramer's $V = 0.295$): Females were more prevalent in all morphological variations of the articular disc. As for the correlation between the morphology of the disc and the side (Table 2), there was no statistically significant difference ($p = 0379$).

The correlation result between the variables of morphology and articular disc position is shown in the bi-plot graph, as a result of applying the correspondence analysis (Fig. 2). There was a statistically significant correlation between these variables ($p < 0.001$/Cramer's $V = 0.609$).

4. Discussion

The temporomandibular joint is a fibrocartilaginous disc located between the condyle and the mandibular fossa, which prevents them from directly articulating. During mandibular movements, this flexible disc is able to adapt to the functional demands of the articular surfaces; it acts not only by separating the articulation in