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Evaluation of temporomandibular joint disk displacement and its correlation with pain and osseous abnormalities in symptomatic young patients with magnetic resonance imaging

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Objective. To evaluate the occurrence of temporomandibular joint disk displacement and its correlation with pain and osseous abnormalities using magnetic resonance imaging (MRI) in patients under 21 years of age.
Study Design. MRI images in open- and closed-mouth positions from 102 patients, under 21 years of age (mean age 17 years), were studied retrospectively. Patients were divided into six groups according to the disk−condyle relationship. Chi-square, Marascuilo procedure, and Cochran-Mantel-Haenszel tests were used to evaluate the relationships among pain, abnormalities, and the groups.
Results. There was a statistically significant correlation between bilateral disk displacement without reduction and pain ($P = .011$), and osseous changes ($P < .0001$). There was no proven link between pain and osseous abnormality ($P = .414$).
Conclusion. Young patients are susceptible to all stages of disk displacement. There was a strong correlation only between each variable (osseous abnormalities and pain) and the most severe stage of disk displacement (bilateral disk displacement without reduction). (Oral Surg Oral Med Oral Pathol Oral Radiol 2014;■:1-6)

Temporomandibular disorders (TMDs) are defined as a subgroup of abnormal conditions involving masticatory muscles, osseous and ligamentous components of the temporomandibular joints (TMJs), and associated neurologic structures.[1-3] Common among adults, TMD does not appear to be a usual finding in children but tends to increase in frequency with age during adolescence.[4]

Despite better knowledge of the structure and function of the TMJ, the specific pathophysiology of TMDs is not completely understood.[1] It is well known that morphologic changes may be observed in the TMJ bone structures (mandibular condyle and articular eminence of the temporal bone) of patients with TMDs, including osteophytes, erosion, avascular necrosis, and subchondral cysts with intra-articular loose bodies and/or flattening.[3] Furthermore, the most common symptoms are pain, muscle tenderness, a "clicking" or "popping" sensation within the joint, headache, earache, and restricted mouth opening.[5]

Disk displacement (DD) is a common disorder of the TMJ, usually reported in young to middle-aged female adults (20 to 50 years of age).[1,6] In adolescents, it has also been shown that females have a greater incidence of DD and associated pain compared with males.[2,4] Moreover, there appears to be a high incidence of DD in young preorthodontic patients (ages 6-15 years), with no gender predilection, and a tendency to more advanced stages of DD with increasing age.[7]

Magnetic resonance imaging (MRI) is considered the best method of evaluating DD, since it provides excellent soft tissue contrast without radiation or surgical invasion.[8,9] MRI scans taken with the patient in open- and closed-mouth positions are widely used to evaluate the position, configuration, and posterior attachment of the disk, as well as the mandibular marrow status, presence of joint effusion, and anatomic details of the TMJ.[1,2,8,9] Its accuracy for assessment of the position and form of the disk has been reported to

Statement of Clinical Relevance

This retrospective magnetic resonance imaging study of patients under 21 years of age found that these young patients are susceptible to all stages of disk displacement and that there is a strong correlation between osseous abnormalities or pain and the most severe stage of disk displacement.

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be up to 95%.[10,11] On the other hand, it has demonstrated variable sensitivity (30%-82%) for the detection of osseous abnormalities, depending on the type and severity of such abnormality.[12,13] However, this uneven sensitivity should not restrict the evaluation of bone abnormalities when a MRI scan has been acquired to investigate DD.

The majority of the literature to date has related gender, anatomic or clinical findings, and imaging features with TMJ characteristics. Only a few studies have specifically correlated disk displacement findings from young patients. For this reason, the aim of this study was to evaluate the occurrence of TMJ disk displacement and its possible correlation with pain and osseous abnormalities using MRI in patients under 21 years of age.

MATERIALS AND METHODS

This retrospective cross-sectional study protocol was approved by the last author's Institutional Review Board and is in compliance with the Helsinki Declaration. All patients provided written informed consent.

MRI scans of 102 patients (22 males and 80 females), aged between 10 and 20 years (mean age 17 years), were studied retrospectively. The patients had been referred to the same radiology practice for MRI to investigate possible TMD-related findings. Before MRI, a professional with 15 years of experience in TMJ evaluation performed a clinical examination on all patients. To be included in the study, the subject had to present at least one of the following signs and symptoms: pain in joints and/or muscles, joint sounds, limitation of movement, history of headaches, and otologic complaints. Gender and the presence of joint pain, as reported by the subject, were registered for statistical purpose.

The MRI studies were conducted on a 1.5-T GE Signa scanner (General Electric, Milwaukee, WI). A bilateral TMJ dual-phased array coil (Signa; GE Medical System, Milwaukee, WI) was used, and the patients were placed in the supine position, with the sagittal plane perpendicular to the horizontal plane, and the Frankfort plane parallel to the scanner gantry. The protocol used a 256 × 256 matrix, 145-mm field of view, and a pixel size of 0.60 × 0.57 mm. Ten slices, 2-mm thick, were obtained for each TMJ in each sequence. Oblique parasagittal slices were obtained and corrected for the horizontal angulation of the condyle in all the following sequences: closed-mouth axial T1-weighted, coronal T1-weighted, and axial T2-weighted, as well as open-mouth axial T1-weighted. For the acquisition of images in the open-mouth position, a Burnett TMJ device (TMJ-200 s/n 0650; Medrad Inc., Pittsburgh, PA) was used to stabilize the maximal open-mouth position and to minimize motion artifacts.

Two experienced radiologists performed the MRI image evaluation, in a consensus approach, of all images without any clinical information. The position of the disk in closed-mouth images was evaluated and classified according to Ahmad et al.[11] as "normal" or "displaced." The patients with disk displacement were subclassified according to the disk−condyle relationship in open-mouth images into (1) disk displacement with reduction (DDwR), when the normal relationship between the disk and condyle was restored on mouth opening; and (2) disk displacement without reduction (DDwoR), when the disk was still displaced on mouth opening. Exclusion criteria included cases in which the position of the disk was indeterminate or the disk itself was not visible.[11]

Patients were then divided into six groups, on the basis of a previous study.[14] These groups were determined by the results of TMJ MRI according to both TMJ disks status, in the following order: bilateral normal TMJs (Normal/Normal); unilateral DDwR and normal contralateral TMJ (DDwR/Normal); bilateral DDwR (DDwR/DDwR); unilateral DDwoR and normal contralateral TMJ (DDwoR/Normal); unilateral DDwR and DDwoR in the contralateral TMJ (DDwR/DDwoR); and bilateral DDwoR (DDwoR/DDwoR).

The assessment of osseous abnormalities was adapted from Ahmad et al.[11] and included osteophytes, flattening, erosion, sclerosis, edema, thickness of cortical eminence and/or condyle, focal or diffuse necrosis, bifid condyle, condylar hypoplasia or hyperplasia, and the presence of free bodies.

The prevalence of the morphologic changes of bone structures of the TMJ and the prevalence of the position of the disk in the closed-mouth position were summarized as percentages. Chi-square test followed by the Marascuilo procedure for comparison of the K proportion was performed to evaluate the association of disk displacement with pain and with osseous abnormalities. The correlation between both variables (pain and osseous abnormalities) was assessed by creating six contingency tables (each corresponding to a TMJ group). Cramer's V, Chi-square test, and P values were calculated for each sub-table. These statistics were calculable only if the marginal sums were nonzero in each sub-table. Cramer's V shows the strength of the links between the variables. It is close to zero when there is no link. The general correlation coefficient method of the Cochran-Mantel-Haenszel test was used to evaluate the relationship between pain and abnormalities, considering all disk displacement status. Data analysis was performed using XLStat (version 2014.2.1, Addinsoft Inc., Brooklyn, NY). The *a priori* level of significance was set at $P < .05$.