

Research Article

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Temporomandibular Joint Internal Derangement and Osteoarthritis- MRI Evaluation

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Abstract

Introduction: This prospective analysis was performed to establish the relationship between degenerative bone changes accompanying various types of temporomandibular joint (TMJ) internal derangement using magnetic resonance imaging (MRI), as well as assessing morpho functional changes in uni/bilateral TMJ pathology.

Materials and Methods: This study enrolled 222 TMJ pain patients. MRI was performed on a Siemens Magnetom Verio MRI scanner (Germany) with magnetic field strength of 3.0 T at the Central Clinical Hospital, Baku, Azerbaijan.

Results: Signs of osteoarthritis prevailed in anterior disc dislocation without reduction: osteophytes of mandibular condyle (74.8%), flattening of the condyle (40.2%), erosion (31.8%), subchondral sclerosis (88.8%). With a normal TMJ disc position there was unilateral osteoarthritis in 2.3% of patients and bilateral osteoarthritis in 4.1% of patients as well as various types of kinematic disturbances in 19% of those examined. Bilateral disc dislocation was characterized by bilateral osteoarthritis in 26.1% of cases and unilateral in 12.2%.

Conclusion: Thus, a study of the morphological features of the TMJ, its individual structures and functions, the presence of pathological changes of an inflammatory and degenerative nature showed that, depending on the position of the TMJ disc, the above indicators may vary.

Keywords: temporomandibular joint internal derangement; magnetic resonance tomography; morphometric measurement; degenerative changes of tmj bone structures

Introduction

Recent studies have noted a close relationship between the types of articular disc displacement and the occurrence of degenerative bone changes [1].

Temporomandibular joint osteoarthritis (TMJ OA) is a disease with a multifactorial etiology, involving many pathophysiological processes, and requiring comprehensive assessments to characterize progressive cartilage degradation, subchondral bone remodeling, and chronic pain [2].

When the balance between the joint's adaptive capacity and the stresses placed on the joint is lost, dysfunctional remodeling can cause changes in the condyle shape, size, and volume [3]. Osseous changes of TMJ OA manifest as flattening, osteophyte formation, sclerosis, erosion, joint mice, and subchondral bone cysts [4].

In this regard, identifying signs of TMJ OA, as well as features of combined (uni-bilateral) pathology can contribute to a more accurate assessment of the condition of the joint and the development of appropriate patient management tactics.

Materials and Methods

This study enrolled 222 TMJ pain patients. MRI was performed on a Siemens Magnetom Verio MRI scanner (Germany) with magnetic field strength of 3.0 T at the Central Clinical Hospital, Baku, Azerbaijan. A standard 16-element radiofrequency neurovascular head coil was used.

Both static and kinematic magnetic resonance imaging were used to examine the TMJ. According to the MRI data, patients were divided into groups for further examination. The basis for dividing joints into groups was the position of the articular disc in the sagittal oblique projection, in which the criterion for the location of the intermediate zone was taken as a basis. In the presence of disc dislocation, the presence or absence of reduction of the TMJ disc when opening the mouth was also assessed.

The first control group was made up of joints without displacement of TMJ intraarticular disc (this group included 182 joints).

The second group (n=148) included joints with anterior disc dislocation with reduction (ADDWR) when opening the mouth.

The third group (n=107) included joints with anterior disc dislocation without reduction (ADDWoR) when opening the mouth.

The fourth group (n=7) included joints with posterior disc dislocation with reduction (PDDWR) when opening the mouth.

Statistical Analysis

Method of variation statistics, The Chi-square test, the Fisher's exact test, ANOVA test were used to perform the statistical analysis comparing continuous variable differences across the four groups.

Results

Signs of osteoarthritis prevailed in anterior disc dislocation without reduction: osteophytes of mandibular condyle (74.8%), flattening of the condyle (40.2%), erosion (31.8%), subchondral sclerosis (88.8%). As the degree of TMJ disc dislocation progresses, the volume of the condyle decreases (from 373.8mm² with a normal disc position to 251.3mm² with anterior disc dislocation without reduction). With a normal TMJ disc position there was unilateral OA in 2.3% of patients and bilateral osteoarthritis in 4.1% of patients as well as various types of kinematic disturbances in 19% of those examined. Bilateral disc dislocation was characterized by bilateral OA in 26.1% of cases and unilateral in 12.2%.

Discussion

Of 444 joints, one of the signs of osteoarthritis was observed in 219(49.3%) patients. With a normal disc position, out of 182 joints, 44(24.2%) had one of the

signs of OA. In TMJ with dislocated disc at least one sign of OA was detected in 175(66.8%) joints. An assessment of OA by group of patients revealed that this change was most common in the group with ADDWoR (90; 84.1%). At the same time, joints from the group with ADDWR took second place (82; 55.4%). The lowest percentage occurred with a normal disc position (44; 24.2%), despite the fact that in the absence of dislocation, the presence of OA was not an expected finding. In case of PDDWR OA was observed in almost half of the cases (3; 42.9%), but it must be remembered that this group had the smallest number of patients.

Since OA manifests itself with such signs as the formation of subcortical cysts, erosion, osteophytes, subchondral sclerosis, flattening and remodeling of the mandibular condyle, we attempted to analyze these symptoms depending on the position of the disc. At the same time, attention was paid to the relationship between various pathological types of dislocation and individual manifestations of OA.

Of 444 TMJ flattening of the mandibular condyle was detected in 80(18.0%) cases. Moreover, in the group with pathological disc position, this sign prevailed in comparison with the normal disc position (25.2% and 7.7% respectively), which is logical from the point of view of the above classification. However, since this indicator is a transitional sign of OA, its timely assessment is important.

In our study, the analysis was carried out for different types of disc dislocation, which showed the following distribution (Table 1).

Table 1: Percentage ratio of the condyle flattening presence.

		NDP	ADDWR	ADDWoR	PDDWR	χ^2	p	PU
Flattening	No	n	168	126	64	6	49,799	<0,001
		%	92.3%	85.1%	59.8%	85.7%		
	Yes	n	14	22	43	1		
		%	7.7%	14.9%	40.2%	14.3%		

According to the results, there was a significant difference between groups, which was reflected in the percentages. The highest percentage was found in ADDWoR (40.2%), while the lowest was found in joints with normal disc position (7.7%). Out of 444 TMJ, condyle marginal osteophytes were identified in

163(36.7%) cases, of which 142 joints (54.2%) belonged to joints with a pathological position of the disc. Moreover, the sign was detected predominantly in joints with ADDWoR (74.8%). There were significant differences between groups (P<0.001). Data are presented in Table 2.

Table 2: Condyle marginal osteophyte indicators in study groups.

			NDP	ADDWR	ADDWoR	PDDWR	χ^2	p	PU
Osteophyte	No	n	161	52	26	6	119.138	<0.001	<0.001
		%	88.5%	54.2%	24.8%	85.7%			
	Yes	n	21	44	79	1			
		%	11.5%	45.8%	75.2%	14.3%			

Such a sign of OA as erosion, out of 44 TMJ, was detected in 48 (18.3%) cases, and all joints had a pathological location of the articular disc. Similar to the presence of marginal osteophytes this sign predominated on joints with ADDWoR (34; 31.8%). In ADDWR group erosions were noted in 14(9.5%) joints.

This sign was absent among joints with PDDWR. This may be explained by less trauma to the mandibular condyle compared to other types of TMJ disc dislocation. AS can be seen from Table 3, erosion as manifestation of TMJ pathology is characterized by a statistically significant intergroup difference ($\chi^2=71.965$; $P<0.001$; $PH<0.001$).

Table 3: Present of erosions percentage ratio in the group of surveyed.

			NDP	ADDWR	ADDWoR	PDDWR	χ^2	p	PU
Erosions	No	n	182	134	73	7	71.965	<0.001	<0.001
		%	100.0%	90.5%	68.2%	100.0%			
	Yes	n	0	14	34	0			
		%	0.0%	9.5%	31.8%	0.0%			

Of the 444 TMJ examined, subchondral sclerosis of the condyle was detected in 263(59.2%) cases. Among the joints with this sign, 56 joints (30.8%) with NDP, 207(79.0%) joints had a pathological location of the

articular disc. TMJ condyle subchondral sclerosis was also predominantly found in ADDWoR (88.8%) (Table 4).

Table 4: Present of condyle subchondral sclerosis percentage ratio in the group of surveyed.

			NDP	ADDWR	ADDWoR	PDDWR	χ^2	p	PU
Sclerosis	No	n	126	41	12	2	110.655	<0.001	<0.001
		%	69.2%	27.7%	11.2%	28.6%			
	Yes	n	56	107	95	5			
		%	30.8%	72.3%	88.8%	71.4%			

According to our data, similar changes in condyle morphology occurred with almost the same frequency in ADDWR and PDDWR. However, it is possible that such a high rate PDDWR group is due to the small number of joints in this group.

A study of OA signs revealed that 48(21.6%) patients with normal disc position on both sides had no signs of OA. At the same time bilateral OA against the background of normal disc position occurred in 9(4.1%) patients. The remaining patients from the group with normal disc position were characterized by the presence of unilateral OA (5 patients, 2.3%).

In cases where disc dislocation was observed on one side and the disc position on the other side was normal, the number of patients with bilateral OA was 19(8.6%). In a similar situation the absence of OA on both sides was noted in 24 (10.9%) patients. At the

same time in patients with unilateral dislocation OA of one of the joints was observed in 15(6.8%) cases. Bilateral disc dislocation characterized by the absence of OA in both joints in 17(7.7%) patients and its presence in both joints in 58 (26.1%) cases. In the same group (bilateral dislocation) unilateral OA occurred in 27(12.2%) patients.

Conclusion

Signs of OA prevailed in ADDWoR when opening the mouth: marginal osteophytes (74.8%), flattening (40.2%), erosions (31.8%), subchondral sclerosis (88.8%). With a normal TMJ disc position there was unilateral OA in 2,3% of patients and bilateral OA in 4.1% of patients.

Bilateral TMJ disc dislocation was characterized by bilateral OA in 26.1% cases, and unilateral in 12.2%.

Thus, a study of the morphological features of the TMJ, its individual structure and functions, the presence of pathological changes of an inflammatory and degenerative nature showed that depending on the position of the TMJ disc the above indicators may vary.

These differences are characterized by an unequal degree of reliability, however, the data obtained indicate a significant influence of the position of the disc on the functional state of the TMJ which cannot but affect the development of irreversible degenerative disorders in the future.

Conflict of Interest

The author declares no relevant conflicts of interest related to this article.

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