Is inflammation a mechanism in arthrogenic TMJ Otalgia?

É a inflamação um mecanismo na Otalgia com origem na ATM?

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ABSTRACT

Objective. To test the hypothesis that otalgia occurs frequently in CMDs patients and increases with the severity of Temporomandibular internal derangements (TMJ-IDs). **Method.** 221 CMDs patients and two control groups were evaluated. We used clinical examination, questionnaires, biomechanical tests and established criteria for TMJ-IDs. Individuals were allocated to TMJ-ID groups to compare otalgia frequencies. Following assessment of frequency of otalgia in the CMD group, individuals were allocated to TMJ-ID subgroups with capsulitis, retrodiskal pain, disk-attachment pain, arthralgia and osteoarthritis (OA). **Results.** Otalgia frequency was higher in CMDs patients than in the two control groups and the difference was statistically significant ($p<0.0001$ and $p<0.003$). Otalgia frequency increased with the severity of TMJ-IDs (Chi-square trend analysis $p<0.0001$). Frequency of otalgia was higher in the disk attachment pain, arthralgia and osteoarthritis subgroups. **Conclusion.** The frequency of otalgia was higher in CMDs and increases with the severity of TMJ-ID. Those presenting more severe TMJ-IDs demonstrated higher frequencies of otalgia. The results of this study suggest a relationship between disk displacement, stages of internal joint derangements, pain and TMJ otalgia.

Keywords. Inflammation, Otalgia, Temporomandibular Joint Disorders.

Citation. Molina OF, Aquilino RN, Rank R, Santos ZC, Eid NLM, Tavares PG. Is inflammation a mechanism in arthrogenic TMJ Otalgia?

RESUMO

Objetivo. Testar as hipóteses de que a otalgia é mais frequente em indivíduos com distúrbios craniomandibulares (DCMs) e que aumenta com a severidade do distúrbio interno da articulação temporomandibular (DIAs-ATM). **Método.** Avaliamos 221 pacientes com DCMs e DIAs-ATM. História dos sintomas, avaliação clínica e testes diagnósticos para DIAs-ATM foram usados. **Resultados.** A prevalência de otalgia foi mais alta nos pacientes com DCMs do que nos controles e a diferença foi estatisticamente significante ($p<0.0001$ e $p<0.003$). A prevalência de otalgia foi diferente entre grupos com DIAs-ATMs ($p<0.003$) e aumentou com a severidade desses distúrbios (análise de tendências $p<0.0001$). A frequência de otalgia foi mais alta nos indivíduos com dor nas inserções do disco, artralgia e osteoartrite. **Conclusão.** Os indivíduos com DCMs apresentam frequência mais alta de otalgia a qual aumenta com a severidade dos DIAs-ATM. Os indivíduos com DIAs mais severos apresentaram prevalências bem altas de otalgia. A inflamação e a dor são mecanismos associados no aparecimento da otalgia com origem na ATM.

Unitermos. Inflamação. Otalgia. Transtornos Temporomandibulares.

Citação. Molina OF, Aquilino RN, Rank R, Santos ZC, Eid NLM, Tavares PG. É a inflamação um mecanismo na Otalgia com origem na ATM?

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Original
Recebido em: 07/05/10
Aceito em: 31/01/11
Conflito de interesses: não

INTRODUCTION

Temporomandibular disorder (TMDs) patients can have a cluster of joint and muscle disorders that are characterized primarily by pain, joint sounds, and irregular or deviating jaw function[1]. Internal derangements of the temporomandibular joint (TMJ-IDs) are defined as a disruption within the internal aspects of the TMJ in which there is a displacement of the disc from its normal functional relationship with the mandibular condyle and the articular portion of the temporal bone[2]. Pain referred to the ear is a well documented phenomenon, which can be due to a multitude of disease processes[1]. The TMJ is the immediate anterior relation of external auditory meatus, and its capsule is supplied by an articular branch of the auriculotemporal nerve that also supplies cutaneous sensation to a large portion of the pinna of the ear. Not surprisingly, temporomandibular disorders are frequently misinterpreted by the patient as earaches[3].

An internal derangement of the temporomandibular joint (TMJ-ID) is the most frequent type of functional disorder and is characterized by several stages of dysfunction involving the condyle-disk relationships[3]. A TMJ-ID is considered to be a basic mechanism in the pathogenesis of TMJ dysfunction[4]. TMJ-IDs have been classified in several stages. One grading system classifies the severity of internal derangements according to the morphology and position of the joint disk[5]. Other classification system uses the location and clinical characteristics to classify TMJ-IDs in capsulitis, retrodiskal pain, disk-attachment pain, arthralgia and osteoarthritis[6]. Closer examination of classification systems reveals that both grading systems are related to progression, severity of disk displacement, duration, inflammation and pain. Stage one of internal TMJ derangements (TMJ-IDs) is anterior disc displacement with reduction, stage two is anterior disc displacement with reduction and intermittent locking, stage three is anterior disc displacement without reduction and stage four is perforation of the disc and posterior attachment of the TMJ[7].

Most common symptoms of TMJ-IDs are pain, muscle tenderness, a clicking or popping sensation within the joint, headache, earache, and limited ability to open the mouth. One of the most frequent symptoms in cases of unilateral deranged temporomandibular joint is pain localized to the ipsilateral ear[8]. Many studies have attempted to establish a relationship between joint pain and inflammation, pain localized to adjacent anatomic zones and positive outcome of different therapeutic strategies[9,10]. Some investigations may be criticized as having heterogeneous patients and intra-articular pathosis pools, short term follow up and even poorly defined success criteria[11].

Although the mechanism of referred associated TMJ-IDs pain including otalgia is still controversial, various factors including inflammation[8], inflammation and sensitization[12], nerve compression[13], diffusion of inflammatory mediators[14] and projection/convergence[15], have been advocated in the literature. It is apparent that there is a lack of clinical and experimental studies supporting one or all of these theories. Because many researchers have proposed a cause and effect relationship between the severity of IJD/inflammation to explain temporomandibular pain referred to the ear, the goals of this study are threefold:

1.Explore a model based on a grading TMJ-IDs system to demonstrate that inflammation and pain are important mechanisms in referred otalgia in TMJ-ID patients.

2.Assess the frequency of otalgia in different TMJ-ID subgroups.

3.Explore the hypothesis that more severe internal joint derangements are associated with higher frequencies of arthrogenic TMJ otalgia.

METHOD

Samples: Three samples were evaluated in this study: A sample of Craniomandibular Disorders (CMDs) and bruxing behavior individuals (n=221) which had been referred consecutively to a Center for the Study of CMDs and facial pain for diagnosis and treatment in the period 2003-2010. There were 203 females and 18 males in this group and the mean age was about 33.6 years (Range 13-75, SD:11.3; Table I). The second group or Control A, consisted of 32 individuals referred consecutively to the same center in the same period of time, presenting with a clinical complaint, but they could not be considered neither CMDs nor bruxers. There were 20 females and 12 males in this group and the mean age was about 33.2 years, range: 19-73, SD: 13.6. Because otalgia has also been associated with cervical pain, a third group

Table I
Demographic data in the CMD group, control groups A and B

	CMD GROUP		CONTROL A		CONTROL B	
	N: 221		N: 32		N: 31	
	n	%	n	%	n	%
GENRE						
Males	18	8.1	12	37.5	6	20
Females	203	99.1	20	62.5	25	80
Totals	221	100	32	100	31	100
MEAN AGE	33.6		33.2		36.4	
SD	11.3		13.6		12.7	
RANGE	13-75		19-73		13-62	
TOTALS	220		32		31	

(Control B) consisting of 31 individuals with cervical pain, but not fulfilling criteria neither for CMDs nor for bruxing behavior, were included in this study. There were 25 females and 6 males in this group and the mean age was about 36.4 years, range: 13-62, SD:12.7.

Inclusion and exclusion criteria in the CMD group. Inclusion criteria: Presence of three or more of the following signs/symptoms: A complaint of pain in the masticatory system, difficulties to perform normal jaw movements, tenderness to muscle and joint palpation, noises in the temporomandibular joint (TMJ) and headache of muscular or joint origin, a previous consultation with one or more specialists in Ear, Nose and Throat (ENT) to rule out a local source of otalgia when present, absence of previous surgical procedures in the ear, and seeking active treatment for their sign and symptoms. Exclusion criteria for this group: presence of neurological disease, symptoms of severe psychological disturbances and presence of three or more signs and symptoms of Craniomandibular Disorders.

Inclusion and exclusion criteria in the Control A group (no CMDs/no bruxism). Inclusion criteria: Absence of three or more signs and symptoms of bruxing behavior, absence of signs and symptoms of Craniomandibular disorders, a complaint in the masticatory system, for example presence of wear facets in the teeth, excessive biting of the tongue and/or cheek. Exclusion criteria: Presence of neurological disorders, major psychological disease and previous surgical procedure in the ear.

Inclusion and exclusion criteria in the Control B group (cervical pain). Inclusion criteria: Presence of cervical pain usually of muscular origin, no signs/symptoms of bruxism and CMDs, seeking active treatment for a specific complaint usually cervical pain and headache referred from the cervical muscles. Exclusion criteria: Presence of CMD and bruxism, a major psychological disorder, neurological disease, previous surgical procedure in the ear.

Because this study was based on a retrospective review of clinical charts from patients and controls evaluated in the period (2003-2010), and patients were evaluated not with the purposes of research, but in order to have an accurate diagnosis, this research was approved by the local committee on ethics of the dental school.

Procedures:

The disorders evaluated in this study included otalgia, capsulitis, retrodiskal pain, disk-attachment pain, arthralgia and osteoarthritis (OA) of the TMJ. In order to gather accurate information in CMD and control individuals, history taking, description of signs and symptoms, description and duration of pain in the ear , particularly its quality, a comprehensive questionnaire to assess the presence of CMDs and bruxism, clinical examination of the masticatory system, evaluation of jaw movements, palpation of joint and muscles, and established diagnostic tests for specific TMJ-IDs were used and the information was recorded in the three aforementioned groups of individuals. Patients and/or controls were included in subgroups presenting capsulitis, retrodiskal pain, disk-attachment pain, arthralgia and osteoarthritis if signs and symptoms of such disorders were present according to criteria accepted in the literature based on description of the pain and use of diagnostic mechanical tests. Once all examination and diagnostic procedures were carried out, subjects (CMDs, controls A and Controls B) were allocated to subgroups (according to criteria presented below), presenting capsulitis, retrodiskal pain, disk-attachment pain, arthralgia and OA. Then, the frequency of otalgia in each subgroup was assessed.

Criteria for the presence of capsulitis of the TMJ[6,16]

Pain on palpation over the lateral portion of the joint capsule upon opening and closing, pain elicited in a few seconds during forceful or border-sustained opening of the jaw. Such pain could be arrested in seconds by having the patient occluding the teeth forcefully in the maximal intercuspal position.

Criteria for the presence of retrodiskal pain

Presence of pain that could be elicited in seconds by pressing the upper an lower teeth in the maximal intercuspal position, pain elicited in the joint during manipulation of the mandible in centric relation, such pain could be arrested by having the patient occlude his or her teeth against cotton rolls placed over the posterior teeth, presence of joint pain during a ipsilateral jaw movement.

Criteria for the presence of disk attachment pain:

Patient´s report of intermittent TMJ pain particularly during function, history of transient locking, pain that had not been arrested using splints/analgesics and finally, reciprocal TMJ clicking.

Criteria for the presence of arthralgia[6]

A long history of internal derangements of the TMJs, chronic pain, patient´s history of a decrease in the frequency and intensity of joint noises, pain elicited by rapid opening or protrusive movements of the jaw and patient´s description of the pain as burning.

Criteria for the presence of osteoartrhitis[6]

A long history of internal derangements of the TMJs, chronic TMJ pain, a history of a decrease in the frequency and severity of joint noises and presence of unilateral or bilateral crepitus.

We used history and clinical parameters to gather data about TMJ-IDs as studies indicate that there is poor agreement between the presence of TMJ pain and the magnetic resonance imaging (MRI) diagnosis of TMJ-ID[1]. Furthermore, MRI use to gather further data would not be practical considering economic costs in a large sample. Additionally, the grading system used in this study to gather data more accurately, has been encouraged by recent research suggesting that clinicians should replace the concept of an epidemic of mandibular dysfunction with the concept of various levels or gradients of adaptive and maladaptive mandibular dysfunction[17]. In other words, a grading system comparing specific internal derangements by the degree of severity and the presence of otalgia, would render more accurate data in epidemiological and/or clinical studies.

Statistical analysis: Statistical methods used in the current investigation included basic statistics (mean, standard deviation and range), the Chi-square test for independence, Chi-square statistics for trends and Fisher's exact test.

RESULTS

Frequency of otalgia in the CMD group: This group presented a frequency of 28% unilateral otalgia, 20.4% of bilateral otalgia and a total of 48.4% otalgia. The control A and the Control B groups presented frequencies of otalgia of about 3.1% and 19.4% respectively (Table II). The differences in the frequencies of otalgia between the CMD and the control A group and between the CMD and the Control B group were significant, p=0.0001 and p=0.003, respectively, indicating higher prevalences of otalgia in CMD individuals as compared to controls.

Frequencies of otalgia in the subgroups with unilateral and bilateral capsulitis: The total frequency of otalgia in the CMD group presenting unilateral/bilateral capsulitis was about 30.7% as compared to 3.1% in the control A group (p=0.004) and to 19.4% in the control B group (p=0.40. Table II).

Frequencies of otalgia in the subgroups presenting unilateral/bilateral retrodiskal pain: The total frequency of otalgia in the group presenting unilateral/bilateral retrodiskal pain was about 43.9% as compared to 3.1% in the control A group (p=0.0001) and to 19.4% the control (cervical) B group (p=0.02, Table III).

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Table II

Frequency of otalgia in the whole CMD group, unilateral capsulitis (UCAP), bilateral capsulitis (BCAP), control A group (CAG), and control B cervical pain group (CBCP)

	CMD		UCAP		GAG*		CAG*		CAG*	
	N: 221		N: 16		N: 23		N: 32		N: 31	
	n	%	n	%	n	%	n	%	n	%
Unilateral Otalgia	62	28	5	31.3	4	17.4	0	0	3	9.7
Bilateral Otalgia	45	20.4	0	0	3	13	1	3.1	3	9.7
Totals	107	48.4	5	31.3	7	30.4	1	3.1	6	19.3
Totals painful ears	152	34.4	5	15.6	10	21.7	2	3.1	9	14.5

*Fisher´s exact test to compare otalgia in the CMD and control A group, p=0.0001, a extremely significant difference.
**Fisher´s exact test comparing otalgia in the CMD and control B groups, p=0.003, considered a very significant difference.

Table III

Frequency of otalgia in the CMD group (n=221), the unilateral retrodiscal pain group (URPG=35), bilateral retrodiscal pain group (BRPG=31), control A group (CAG=32) and control B cervical pain group (CBCP=31)

	CMD		URPG		BRPG		CAG		CBCP	
	N: 221		N: 35		N: 31		N: 32		N: 31	
	n	%	n	%	n	%	n	%	n	%
Unilateral Otalgia	62	28	8	22.8	4	13	0	0	3	9.7
Bilateral Otalgia	45	20.4	5	14.3	12	38.7	1	3.1	3	9.7
Totals	107	48.4	13	37	16	51.6	1	3.1	6	19.3
Totals pain-ful ears	152	34.4	18	25.7	28	45.2	2	3.1	9	14.5

Frequencies of otalgia in the subgroup presenting disk-attachment pain: The frequency of otalgia in the group of 72 individuals presenting unilateral+bilateral disk-attachment pain was about 48.6% as compared to 3.1% in the control A group (p=0.0001) and to 19.4% in the control (cervical pain) B group (p=0.007, Table IV).

Frequency of otalgia in the subgroup presenting arthralgia-OA: The frequency of otalgia in the 40 subjects with arthralgia-OA was about 77.5% as compared to 3.1% in the control A group (p=0.0001) and to 19.4% in the control (cervical pain) B group (p=0.0001, Table V).

Frequencies of otalgia with the severity of TMJ-ID: The frequencies of otalgia in the groups presenting capsulitis, retrodiskal pain, disk-attachment pain and arthralgia – OA were about 30.7%, 43.9%, 48.6% and 77.5%, respectively. Chi-square for independence p=0.003 and Chi-square for trends p=0.0001, (Tables II-V), indicating that there is an association between the severity of TMJ-ID and higher prevalence of otalgia.

Frequency of bilateral otalgia in cases with unilateral and bilateral TMJ Pain: 4 (9%) subjects with unilateral TMJ pain and 16 (50%) with bilateral TMJ pain presented a complained of bilateral otalgia (p=0.0001, Table VI), indicating that there is an association between bilateral TMJ pain and bilateral otalgia.

Frequency of otalgia ipsilateral to TMJ Pain: The frequency of ipsilateral otalgia in the group of 20 subjects presenting right TMJ pain was 90% and the frequency of ipsilateral otalgia in 24 cases with left TMJ pain was 83.3%, (Table VI). Because the frequency of otalgia ip-

Table IV

Frequencies of otalgia in the CMD group (N=221), unilateral disk-attachment pain group (UDAP=47), bilateral disk-attachment pain group (BDAP=25), control A group (CAG=32), and control B cervical pain group (CBCP=31)

	CMD		UDAP		BDAP		CAG		CBCP	
	N: 221		N: 47		N: 25		N: 32		N: 31	
	N	%	n	%	n	%	n	%	n	%
Unilateral Otalgia	62	28	18	38.3	3	12	0	0	3	10
Bilateral Otalgia	45	20.4	5	10.6	9	36	1	3.1	3	10
Totals	107	48.4	23	48.9	12	48	1	3.1	6	19.4
Totals painful ears	152	34.4	28	29.8	21	42	2	3.1	9	14.5

silateral to pain in the right TMJ (90%) was compared with the frequency of contra-lateral otalgia in the left TMJ with pain (8.3%), and Fisher´s exact test p=0.0001, such data indicate that otalgia is much more likely to occur ipsilaterally to the TMJ with pain (Table VI).

DISCUSSION

1. Frequency of otalgia in CMD patients

When compared to the two control groups (A, B), CMD individuals presented a higher and statistically significant difference in the frequency of otalgia. One study[18], reported a frequency of 47% otalgia in CMD patients, therefore their findings are in agreement with those reported in the current investigation. Because we found frequency of 48.4% otalgia in our study, such results are further substantiated by one investigation[5] reporting that joint pain, joint noises, headache and earache are the most common sign and symptoms in TMD-IDs. Pascoal and coworkers[19], reported a frequency of 50% otalgia in TMD patients and such a result is very similar to that we report in the current investigation.

2. Frequency of otalgia by the severity of internal derangements

Because in the current investigation we found a frequency of 30.7% otalgia in patients with capsulitis, and such disorder is one of the first if we consider the sequence of stages of internal derangements, the results of this study are partially supported by one investigation[18] reporting that pain in the ear occurred more frequently in

Table V

Frequencies of otalgia in the CMD group (N=221), Unilateral arthralgia-osteoarthritis (UA-OA= 29), bilateral arthalgia-osteoarthritis (BA-OA=11), control A group (CAG=32), control B group (CBCP=31)

	CMD		UA-AO		BA-AO		CAG		CPCP	
	N: 221		N: 29		N: 11		N: 32		N: 31	
	n	%	n	%	n	%	n	%	n	%
Unilateral Otalgia	62	28	17	58.6	2	18.2	0	0	3	10
Bilateral Otalgia	45	20.4	7	24.1	5	45.5	1	3.1	3	10
Totals	107	48.4	24	82.8	7	63.6	1	3.1	6	20
Totals painful ears	152	34.4	31	53.4	12	54.5	2	3.1	9	15

Chi – square test for independence from the unilateral capsulitis group to the bilateral arthralgia-OA p=0.003, very significant.
*Chi-square trend analysis to assess an increase in the frequency of otalgia from the unilateral capsulitis group to the bilateral arthralgia-OA group (p=0.0001) considered extremely significant, indicating that otalgia increases with the severity of TMJ-ID.

Table VI

Frequencies of otalgia in the unilateral TMJ pain (UTMJ), bilateral TMJ pain (BTMJ), bilateral TMJ pain more severe in one side (BTMJS) and in the controls (CMD, CAG, CPCP) subgroups. Frequencies of otalgia in the right TMJ with pain, the left TMJ with pain and in the cases of bilateral TMJ pain

	UTMJ		BTMJ		BTMJS		CMD		RIGHT		LEFT		BILATERAL	
	N: 44		N: 32		N: 41		N: 221		N: 20		N: 24		N: 32	
	N	%	n	%	n	%	n	%	n	%	n	%	n	%
Unilateral Otalgia	40	91	1	3.1	8	19.5	62	28						
Bilateral Otalgia	4	9	16	50	15	36.6	45	20.4						
Totals	44	100	17	53	23	56	107	48.4						
Painful ears (Totals)	48	54.5	33	52	38	46.3	152	34.4						
Ipsilateral otalgia**									18	90	20	83.3	0	0
Contralateral Otalgia									0	0	2	8.3	0	0
Unilateral Otalgia									0	0	0	0	1	3
Bilateral Otalgia									2	10	2	8.3	16	50
Totals									20	100	24	100	17	53

*Fisher´s exact test comparing unilateral otalgia in the BTMJ and BTMJS groups p=0.06.
**Fisher´s exact test p=0.0001

the arthrographically normal and meniscus displacement without reduction groups suggesting that otalgia may occur in both mild and severe forms of TMJ-IDs. It may be that in the presence of capsulitis without other more advanced internal derangements, inflammation and disk disorders, are limited, less severe, and thus lead to a lower prevalence of otalgia. Following this line of reasoning, one research[20], contends that an internal TMJ derangement is a progressive disorder in which the early stage is characterized by simple disk displacement without morphologic changes of the disk or secondary osseous changes. Such prevalence of otalgia in the CMD group with capsulitis, suggests that otalgia may occur in milder forms of internal TMJ derangement.

Because the frequency of otalgia increased from the capsulitis group to those presenting disk-attachment pain, unilateral arthralgia-OA and bilateral arthralgia-OA, the results of the current investigation are partially supported by one study[18], indicating that the frequency of otalgia increased from 32% in the meniscus displacements with reduction group to 54% in the meniscus displacement without reduction group. In this regard, we must take into account that a higher frequency of meniscus displacement without reduction, severer inflammation and pain are expected to be found in patients presenting disk attachment pain, arthralgia and OA. Following this line of reasoning, one MRI investigation[1], in CMD patients reported that it is more likely that more severe pain and inflammation is present in patients with OA. Thus, patients with OA are also more likely to report otalgia.

The higher prevalence of otalgia with more severe TMJ-ID reported in the current study may also be explained by the fact that as the severity and duration of internal joint derangement increase, many other concurrent disorders/mechanisms do play a role, thus increasing the likelihood for the development of pain, inflammation and otalgia. Following this line of evidence, one study[21], reported that the clinical diagnosis of TMDs presenting with severer pain and dysfunction is not mutually exclusive and many joints present with more than one pathological diagnosis. For instance, cases of artralgia and OA may present with capsulitis, retrodiskal pain and even disk displacement, thus increasing the sources for the development of TMJ pain, headache and otalgia.

Because local TM pain and inflammation are closely related, more severe inflammation and pain occur in more advanced stages of TMJ-ID, and a higher frequency of otalgia was observed in patients presenting disk attachment pain, arthralgia and TMJ osteoarthritis, one is led to believe that otalgia and more severe inflammation are closely related. This line of reasoning is strongly supported by one investigation[8], in painful TMJs, indicating that earache is commonly observed in patients with inflammatory arthropathy of the TMJ. In cases of severe TMJ-IDs, estravasated erythrocytes and fibrin deposits in the posterior disk attachment can be observed in joint with displaced disk indicating an ongoing reaction of the vessels. Tissue ischemia, retention of lactic acid and decrease in pH is a plausible explanation for the pain[8].

Patients presenting arthralgia and TMJ-OA are those with more chronic forms of internal derangements including chronic longstanding pain and disk displacement without reduction in whom otalgia is more likely to occur. Following this line of reasoning, one investigation[12], used radiography and histology to evaluate changes associated with longstanding severe pain in 20 temporomandibular joints in 15 patients. Researchers reported that the severe pain in the TMJs is likely to originate from the innervated posterior disk attachment or capsule and may also be triggered by a vascular reaction. They also reported that the extirpated post disk attachment from the patients material appeared grossly intensely red and concluded that disc displacement may be associated with advanced degenerative and adaptive reactions of the TMJ.

3. The frequency of otalgia decreased in the bilateral artralgia-osteoarthritis group

In the current investigation we report a total frequency of 82.8% of otalgia in the group presenting with unilateral arthralgia-osteoarthritis. Such frequency decreased to 63.6% in the group presenting bilateral arthralgia-OA but the difference was not statistically significant. One plausible explanation for such unexpected finding may be that bilateral arthralgia-OA is more a degenerative than inflammatory process as compared to unilateral arthralgia-OA. As the process continues and becomes more bilateral, arthralgia-OA becomes more degenerative than inflammatory and therefore, the frequency of otalgia decreases. Otalgia in patients with unilateral arthralgia-OA is associated with more severe inflammation and pain. Supporting this point of view, one study[22] reported a higher frequency of severe TMJ pain in the group of patients with otalgia than in the group without. Therefore, severity of pain, irritation and inflammation seem to be important factors modulating the frequency of otalgia. Indirect support for this assumption comes from one study[17], reporting that pain in the ear occurred in 61% of the cases of normal meniscus position and in 54% of patients presenting disk displacement without reduction. This difference is very likely to be explained by more degenerative changes occurring in the group presenting disk displacement without reduction.

Because, disk displacement without reduction and less severe joint pain are more likely to occur in cases of bilateral arthralgia-OA, the frequency of otalgia is also more likely to decrease. Additional and partial support for this line of evidence comes from one study[23] in 20 TMD patients in need of surgical treatment. Patients presented with resorption, bone sclerosis and persistent/severe TMJ pain. Signs of inflammation were seen in a few cases as most of them presented degenerative features.

The results previously discussed when comparing frequency of otalgia in unilateral and bilateral arthralgia-OA, should be viewed with caution as there were only 11 cases in the group presenting with bilateral arthralgia-OA.

4. Frequency of otalgia in patients with unilateral, bilateral TMJ pain of the same intensity and bilateral TMJ pain more severe in one side

The frequencies of unilateral otalgia in the unilateral TMJ pain, bilateral otalgia in the bilateral same intensity TMJ pain group and unilateral and bilateral otalgia in the group presenting bilateral TMJ pain more severe in one side, were about 91%, 50% 19.5% and 36.6% respectively. Such data indicate that when the TMJ pain was unilateral, otalgia was more likely to be unilateral, when TMJ pain was bilateral with the same intensity, otalgia was again more likely to be bilateral and the frequency of unilateral otalgia was only 3.1%. However, when TMJ pain was described as bilateral but more severe in one side, the frequency of bilateral otalgia was still high (36.6%), but the frequency of unilateral otalgia increased from 3.1% (group with bilateral TMJ pain of the same severity) to 19.5% in the group with bilateral TMJ pain more severe in one side. Another Chi-square test comparing unilateral otalgia in the bilateral TMJ pain group and in the bilateral TMJ pain but more severe in one side, yielded a p value of 0.06 indicating that the difference almost reached significance.

Taken together, such set of data strongly indicate that TMJ pain both in location and intensity and otalgia are closely interrelated, indicating that inflammation is a major mechanism.

The results of the current investigation are supported at least in part by one investigation[8] carried out in patients presenting unilateral TMJ pain or bilateral TMJ pain more severe in one side. Using MRI to gather data, inflammation was observed in 88/100 joints, indicating that inflammation was the cause of the TMJ pain and otalgia in most of the cases. One investigation[24], studied tinnitus in patients with internal derangements of the TMJ and reported that disk displacement was found to be present in the ipsilateral joint with ID in all 53 patients who had tinnitus. Because tinnitus occurred more frequently ipsilaterally to the joint with ID, it may be that because of inflammatory fluid diffusion, a convergence nociceptive mechanism, or irritation of nerve endings, otalgia is more likely to also occur ipsilaterally to the deranged temporomandibular joint.

5. Frequency of otalgia in patients presenting with right, left and bilateral TMJ pain

In the current study, the frequency of otalgia ipsilaterally to the right or left TMJ with pain was much higher as compared to ear pain occurring contralateraly to the TMJ with pain (p=0.0001). Such data strongly indicate that otalgia is much more likely to occur ipsilaterally to the TMJ with pain pain. Findings in this study are supported by one research[8] indicating that one of the most common symptoms in cases of unilateral deranged temporomandibular joint is pain localized to the ipsilateral ear. Additional support for the findings in the current investigation comes from one research in cases of TMJ-IDs and OA[1], reporting that the side affected with TMJ symptoms may be associated with high MRI related prevalences of TMJ-IDs. Therefore, the affected TMJ side may present with higher prevalences of both TMJ pain and otalgia. When patients present with bilateral TMJ arthritis and pain[25] and when the concentration of 5-HT in the synovial fluid is assessed, TMJ pain during mandibular movements is significantly correlated with the presence of 5-HT in the synovial fluid. Thus if 5-HT mediates TMJ pain and inflammation, such substance and other vaso-active amines may also contribute mediating otalgia.

Limitations of this study

Even though the grading system and the large sample we evaluated increase the confidence of the results, the findings in the current investigation have to be interpreted with cautions as this was a cross sectional study which strongly limits cause and effect relationships.

CONCLUSIONS

Based on the results of this study and backed by the literature on the subject, the following conclusions can be drawn from the current investigation:

1.The frequency of otalgia in CMD patients is high.

2.The frequency of otalgia increased with the severity of internal joint derangement.

3.Inflammation is very likely to be associated as a mechanism in the development of otalgia.

4.Higher frequencies of otalgia are to be found in patients presenting arthralgia and osteoarthritis. A decrease in the frequency of otalgia from the unilateral arthralgia-osteoarthritis group is likely to be associated with degenerative changes in the TMJs.

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