

EVALUATION OF DEPRESSIVE SYMPTOMS AND QUALITY OF LIFE IN INDIVIDUALS WITH TINNITUS AND TEMPOROMANDIBULAR DISORDERS

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ABSTRACT: Various etiologies are attributed to the development of subjective tinnitus, but their inter-relationship with the presence of temporomandibular disorders and depression is still poorly understood. To assess the presence of depressive symptoms in individuals with TMD and subjective tinnitus, assessing the impact on their quality of life. This is a cross-sectional observational descriptive study. We evaluated 44 patients in a public University. For TMD diagnosis as well as assessment of depressive symptoms, the RDC/TMD questionnaire was used. Otolaryngological assessment was conducted by means of pure tone, speech, and immitance audiometry. The “Tinnitus Handicap Inventory” questionnaire was also administered. 84% of the individuals with tinnitus had myofascial pain, with the masseter muscle being the most prevalent area of pain, and 16% exclusively had painful and/or degenerative TMJ changes. Among the patients with myofascial pain, 86,5% had depressive symptoms, while among those without myofascial pain, only 42,8% presented these symptoms. Eleven (11) patients (25%) reported slight impact of tinnitus on quality of life, 15 (34%) mild impact, 7 (16%) moderate, 7 (16%) severe, and 4 (9%) catastrophic impact. There was a positive association between the presence of myofascial pain and depressive symptoms ($p=0,02$), as the intensity of tinnitus increases and the severity of depressive symptoms ($p<0,01$).

KEY WORDS: Tinnitus; Temporomandibular joint disorders; Depression; Quality of life.

AVALIAÇÃO DA PRESENÇA DE SINTOMAS DEPRESSIVOS E QUALIDADE DE VIDA DE INDIVÍDUOS PORTADORES DE ZUMBIDO E DESORDENS TEMPOROMANDIBULARES

RESUMO: Diversas etiologias são atribuídas ao desenvolvimento do zumbido subjetivo, contudo sua inter-relação com a presença das desordens temporomandibulares e depressão é ainda pouco compreendida. Avaliar a presença de sintomas depressivos em indivíduos portadores de DTM e zumbido subjetivo, avaliando o impacto da presença do zumbido na qualidade de vida dos mesmos. Tipo de estudo: trata-se de um estudo descritivo observacional transversal. Foram avaliados 44 pacientes do Serviço ATM da Faculdade de Odontologia da Universidade Federal de Juiz de Fora. Para diagnóstico das DTM assim como avaliação dos sintomas depressivos, foi utilizado o questionário do RDC/TMD. Foi realizada avaliação otorrinolaringológica, sendo feitas a audiometria tonal, vocal e imitanciometria. Também foi aplicado o questionário “Tinnitus Handicap Inventory”. Dos 84% indivíduos com zumbido apresentaram dor miofascial, sendo o músculo masseter a região mais prevalente de dor, e 16% possuíram exclusivamente alterações algicas

e/ou degenerativas da ATM. Dentre os portadores de dor miofascial, 86,5% apresentaram sintomas depressivos, enquanto naqueles sem dor miofascial a presença destes sintomas estava presente em apenas 42,8%. 11 indivíduos (25%) relataram impacto do zumbido na qualidade de vida desprezível, 15 (34%) impacto leve, 7 (16%) moderado, 7 (16%) severo e 4 (9%) impacto catastrófico. Houve associação positiva entre a presença de sintomas depressivos e dor miofascial ($p=0,02$), assim como relação direta entre o aumento da intensidade do zumbido e a severidade dos sintomas depressivos ($p<0,01$).

PALAVRAS-CHAVE: Zumbido; Transtornos da articulação temporomandibular; Depressão; Qualidade de Vida.

INTRODUCTION

Temporomandibular disorders (TMD) are currently considered the third most common stomatological disease, characterized by its widespread chronicity and prevalence in the overall population. The disorders occur in over 10% of all individuals, restricting their ability to perform everyday functions at home and at work (FERENDIUK; ZAJDEL; PIHUT, 2002). TMD patients often report the presence of tinnitus as an associated symptom, and the comorbidity relationship between these changes is poorly understood (CHERIAN et al., 2013; FERNANDES et al., 2014; LEE et al., 2015). However, due to the high prevalence of such otological complaints in individuals with masticatory muscle disorders, it is speculated that there is a close relationship between tinnitus and this kind of TMD (BUERGERS et al., 2014).

In 1934, Costen mentioned the syndrome of ear and sinus symptoms in patients with TMD - Costen's Syndrome (COSTEN, 2014) - which included subjective hearing loss, ear pain, ear fullness, tinnitus, vertigo, and disorders of the temporomandibular joints (TMJ), associated with occlusal changes and missing teeth (DURHAM, 2008). Currently, there is a credible relationship between sensitization of the central and peripheral nervous system and tinnitus in patients with muscle disorders of the masticatory and adjacent areas (JAEGER, 2012; CHERIAN et al., 2013). According to this theory, descending modulatory pathways in pain processing exist that contribute to pain relief. In individuals with chronic muscle pain localized in the

head and neck area (SALVINELLI et al., 2003; LEVINE, 2004), the continuous production of somatosensory impulses could cause alterations in these descending modulatory pathways, resulting in increased neural somatosensory system impulses to the cochlear nuclei, leading, in turn to plastic changes in the auditory system, thus contributing to the onset of tinnitus (SALVINELLI et al., 2003). Corroborating this theory, tinnitus is often associated with the presence of myofascial trigger points, located mainly in the masseteric region, with tinnitus often being modulated after masticatory movements (ROCHA; SANCHEZ, 2007; BUERGERS et al., 2014).

It is noteworthy that although the close relationship between the experience of myofascial pain and depression is accepted and reported in the scientific literature (DOHRENWEND et al., 2007), this association is still commonly disregarded in the clinical routine (FERNANDES et al., 2013). It is understood that the presence of depressive symptoms can contribute to the chronicity of TMD (VELLY et al., 2011), mainly muscular, resulting indirectly in the plastic auditory changes that would be expressed by tinnitus, as a result of the interfering somatosensory impulses in the descending modulatory pathways (SALVINELLI et al., 2003). Even so, tinnitus is directly influenced by changes in the cortical networks and the neurotransmitter system, both compromised in depression cases (LANGGUTH et al., 2011), which results in considerable clinical comorbidity existing between tinnitus and depression.

Thus, it is assumed that the pathological interrelationship: tinnitus-TMD-depression, promotes the formation of a cycle, explained by the perpetuation of chronic orofacial muscle pain by depression, which in turn, directly or indirectly promotes the onset of tinnitus.

The aim of this study was to assess the presence of depressive symptoms in individuals with TMD and subjective tinnitus, evaluating the impact of the presence of tinnitus on their quality of life.

2 METHOD

This is a cross-sectional observational descriptive study, approved on December 1, 2014, by the Research Ethics Committee of Federal University of Juiz de Fora, under opinion number 907.335. The patients'

participation consent forms were duly signed before conducting the research.

The composition of the sample included the participation of volunteers coming from the Diagnostic and Advisory Service for patients with Temporomandibular Disorders (TMJ service). Those who could participate in the study included individuals of both genders, with ages between 18 and 65 years, TMD patients with subjective tinnitus present for at least 3 months (the American Academy of Otolaryngology (TUNKEL et al., 2014) recommends considering the presence of tinnitus after at least 6 months; however, given that we were dealing with individuals waiting for treatment, the 3-month timeframe was given consideration, since the majority of individuals waiting longer were already in medical or dental treatment). Among the patients excluded were those who: had done some kind of treatment for TMD or for tinnitus; had suffered some type of craniofacial trauma; had presented objective tinnitus or pulsatile tinnitus, with a vascular etiology or another etiology already diagnosed; had presented risk factors for the development of tinnitus, such as unknown otological syndromes or changes, neurological or cancerous disorders, use of ototoxic drugs, those exposed to constant noise, who used hearing aids, and individuals diagnosed with profound hearing loss.

The study methodology was divided into four steps:

Step 1 - Clinical diagnosis of TMD

Using the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) - Axis I (DWORKIN; LERESCHE, 1992; PEREIRA JÚNIOR et al., 2004), the gold standard for TMD diagnosis, enabled us to verify whether patients had some type of TMD, and classify them according to their type: 1) muscular changes; 2) articular disc position changes, and 3) painful and degenerative conditions of the TMJ. The questionnaire was administered to all participants by a single trained examiner.

Step 2 - Otolaryngological Assessment

All individuals underwent an otolaryngological assessment. At this stage, the doctor evaluated the presence of subjective tinnitus (ICD-10 – H93.1), and prior medical history in order to verify the presence

of other risk factors for the development of tinnitus, such as: unknown otological syndromes or changes, neurological disorders or malignancies, ototoxic drugs, constant exposure to noise, and profound hearing loss. We used the Heine otoscope (*Diagnostik-Otoskope K 100*), and the otoscopic findings were classified as: no change, when the tympanic membrane was observed without changes via otoscopy (whole, translucent, and mobile in response to pressure); and with changes, when there was a presence of fluid in the middle ear, opacification, retraction, perforation, and immobility of tympanic membrane in response to pressure. The pure tone, speech, and immitance audiometry test was also conducted. Individuals were considered to have hearing loss when their hearing threshold was above 25 dB according to the following classification: 25dB to 40dB, mild loss; 40dB to 60dB, moderate loss; 60 to 80dB, severe loss; and above 80dB, profound loss (BENTO; MARTINS; PINNA, 2013).

Step 3 - Assessment of depressive symptoms

To assess the presence of symptoms suggestive of depression, the patients completed Axis II of the “Research Diagnostic Criteria” (RDC) (DWORKIN; LERESCHE, 1992). This questionnaire consists of 31 questions, divided into four dimensions, among them the degree of depression. For this study, we used the version translated into Portuguese by Pereira Júnior et al. (2004). Individuals were classified as normal (result lower than 0.535), presence of moderate depression (result greater than 0.535 and less than 1.105), and severe depression (result greater than 1.105), according to the recommendation of Dworkin and Leresche (1992). It should be noted that the depression dimension, used for the data survey, consists of 20 sub-items from question 20 of this questionnaire.

Step 4 - Assessment of the impact of tinnitus on quality of life

The “Tinnitus Handicap Inventory” Questionnaire (NEWMAN; GARY; SPITZER, 1996; SCHMIDT et al., 2006), cross-culturally adapted and validated for the Portuguese language (SCHMIDT et al., 2006), was used. This instrument has excellent validity and high internal consistency, in addition to quick and easy administration. It is composed of twenty five questions. There are three

response options for each question, scored as 0, 2, or 4 points. The resulting sum of points for all questions ranges from 0, when tinnitus does not interfere with the patient's life, to 100, when the degree of interference is maximum, being categorized into five groups or levels of severity: slight (0-16%), mild (18-36%), moderate (38-56%), severe (58-76%), or catastrophic (78-100%) tinnitus (MONDELLI; ROCHA, 2011).

The sample size was calculated, arriving at a minimum of 40 subjects. A conservative estimate for the prevalence of tinnitus in patients with TMD (20%) was used (SILVEIRA et al., 2007), with a 95% confidence interval. The absolute and relative frequencies of observed changes were presented, and the relationship was confirmed between the presence of myofascial pain, depressive symptoms, and impact of tinnitus on quality of life, using Fisher's exact test. A significance level of 5% ($p \leq 0.05$) and a 95% confidence interval were adopted. To verify the association between the impact of tinnitus and depressive symptoms, Spearman's test was used. The calculations were performed using SPSS for Windows 14.0.

3 RESULTS

Initially, 54 individuals were included in the study. However, ten participants could not continue due to failure to meet the inclusion criteria (five had already done treatment for TMD and five had used ototoxic drugs). Thus, the final sample consisted of 44 members, 37 female and 7 male. The average age of the sample was 52.3 ± 9.3 .

Through the analysis of the RDC/TMD, it was found that among the individuals with tinnitus, 37 (84%) had myofascial pain (possibly associated with another type of TMD, or not) and seven individuals (16%) had painful and/or degenerative TMJ changes exclusively, characterized mainly by joint crepitation. It is noted that all the participants had chronic pain (present for more than six months), with a mean duration of 2.3 ± 0.4 years. The prevalence and pain intensity of muscle palpation evaluated via the RDC/TMD are specified in Table 1. The presence of pain was more frequent on both sides in the medial masseter region.

According to the index of depressive symptoms,

Table 1. Prevalence and intensity of palpation muscle pain assessed by the RDC/TMD

	Right side		Left side	
	Frequency	Pain intensity (0 to 3)	Frequency	Pain intensity (0 to 3)
Posterior Temporal	15 (34)	1.66 ± 0.61	16 (36.3)	2 ± 0.7
Medial Temporal	18 (40)	1.61 ± 0.6	21 (47.7)	1.7 ± 0.7
Anterior Temporal	21 (47.7)	1.85 ± 0.7	20 (45.4)	1.8 ± 0.8
Superior Masseter	30 (68.1)	1.9 ± 0.6	22 (50)	1.7 ± 0.8
Medial Masseter	34 (77.2)	2 ± 0.8	34 (77.2)	2 ± 0.7
Inferior Masseter	21 (47.7)	2 ± 0.8	21 (47.7)	1.8 ± 0.8
Posterior mandibular region	25 (56.8)	1.88 ± 0.8	23 (52.2)	2 ± 0.7
Submandibular region	18 (40.9)	1.9 ± 0.7	21 (47.7)	1.7 ± 0.7
Area of the lateral pterygoid	8 (18.1)	2.1 ± 0.8	11 (25)	2.2 ± 0.7
Temporal tendon	9 (20.4)	2.2 ± 0.8	12 (27.2)	2.3 ± 0.7

of the 37 individuals with myofascial pain, 86.5% had depressive symptoms, while for those without myofascial pain these symptoms were present in only 42.8% of the individuals assessed, and these individuals had moderate

depression levels. Fisher's exact test demonstrated a positive relationship between the presence of myofascial pain and depressive symptoms ($p=0.02$) (Table 2).
Assessing the impact on quality of life in relation

Table 2. Relationship between the presence of myofascial pain and depressive symptoms measured by the RDC/TMD

Type of TMD	Depressive Symptoms			p-value	OR
	With depressive symptoms 35 (79.5)	Without depressive symptoms 9 (20.5)			
With myofascial pain (37)	32 (86.5)	5 (13.5)		0.02	8.53 (1.12-73.9)
Without myofascial pain (7)	3 (42.8)	4 (57.2)			

to tinnitus, 11 individuals (25%) reported slight impact, 15 (34%) mild impact, 7 (16%) moderate, 7 (16%) severe, and 4 (9%) catastrophic impact from this otological complaint. Tinnitus was present for an average of 2.3 ± 0.7 years (Table 3). Of the individuals with myofascial pain, 7 had slight impact, 14 mild, 6 moderate, 7 severe, and 4 had catastrophic impact.

observed that when the intensity of tinnitus increases, so does the severity of depressive symptoms ($\rho = 0.482$, $p < 0.01$).

From analysis of the audiometric examination, 40 (91%) individuals did not have hearing loss, and 4 (9%) had mild hearing loss.

Using the Spearman correlation test, it could be

A flowchart detailing the methodology and the

Table 3. Prevalence of the impact of tinnitus on quality of life and depressive symptoms assessed by the RDC/TMD

Impact of tinnitus	Depressive Symptoms		
	Normal	Moderate	Severe
Slight (11)	5 (45.4)	2 (18.1)	4 (36.3)
Mild (15)	2 (13.4)	6 (40)	7 (46.6)
Moderate (7)	0 (0)	2 (28.5)	5 (71.5)
Severe (7)	0 (0)	1 (14.2)	6 (85.7)
Catastrophic (4)	0 (0)	0 (0)	4 (100)

tests applied are presented in Figure 1.

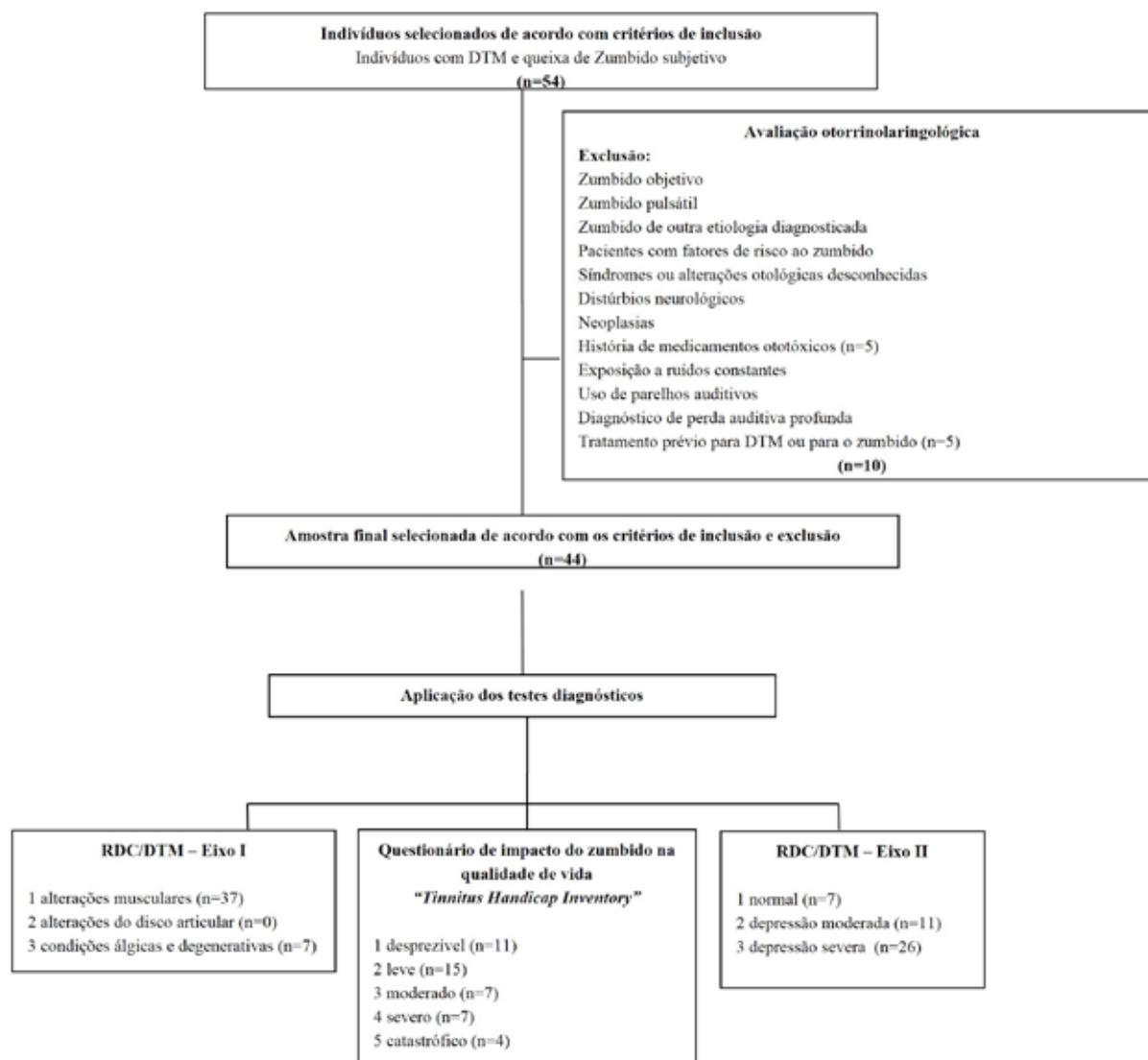


Figure 1. Sample selection and tests applied

4 DISCUSSION

Tinnitus is an otological symptom defined as the perception of sound in the ears or the head, in the absence of an external sound source, and is often reported by individuals with temporomandibular disorders (KANJJI; KHOSA-SHANGASE, 2013). It can be divided into objective and subjective, the first being audible for someone other than the patient (PINTO et al., 2014). Various studies have separately explored the association between high levels of depression and tinnitus (LANGGUTH et al., 2011), and elevated depression and TMD levels (DOHRENWEND et al., 1999; FERNANDES et al., 2013). However, there is a lack of research investigating such variables jointly,

given that tinnitus, depression, and TMD are highly prevalent (FERNANDES et al., 2014) and have great impact on the lives of individuals (FERNANDES et al., 2013). In a study conducted in 2013 by Fernandes et al., of the individuals who had painful TMD (myalgia, arthralgia, or osteoarthritis of the TMJ) and tinnitus, 85% had moderate or severe depression levels. Similarly, the results of the present study demonstrate that of the 44 participants with tinnitus and TMD, 35 (79.5%) had depressive symptoms. Around 33 (75%) reported that the presence of tinnitus has a direct impact on their quality of life. These data demonstrate the association between the variables: tinnitus, TMD, and depression. However, this is a cross-sectional study, and it is not possible to analyze

which of the factors developed first; additionally, those selected were patients seeking care for TMD, which was a prerequisite for participation in the study.

It is stressed that the prevalence of psychiatric disorders, mainly anxiety and depression, is elevated in individuals with tinnitus (LANGGUTH et al., 2011). The review of 153 articles, done by Pinto (2014) demonstrated a high prevalence of psychiatric disorders in patients affected by tinnitus, reported in fifteen articles. Nine studies showed high correlation between the presence of psychiatric disorders, negative impact on quality of life, and the severity of this otological change. Corroborating this statement, among the individuals evaluated in the present study, those who considered the impact of tinnitus on quality of life to be catastrophic, 100% had severe depressive symptoms, unlike those who considered the impact of tinnitus to be slight, where only 36.3% had severe depressive symptoms. Among those who reported mild, moderate, or severe impact, the prevalence of severe depressive symptoms was gradual, with values of 46.6%, 71.5%, and 85.7% respectively. Again, in relation to the abovementioned study, using the Spearman association test, a positive association was found between the presence of depressive symptoms and the impact of tinnitus on quality of life, the severity of depression increasing according to the increase in the intensity of tinnitus.

One must consider, however, that tinnitus and chronic TMD are commonly present in patients with a similar psychological profile, characterized by the presence of significant distress and impairment (HILGENBERG et al., 2012), and with a high prevalence in females (DUBROVSKY et al., 2014), the observed intensity of discomfort from tinnitus being significantly higher in women (COELHO; SANCHEZ; BENTO, 2004). Of the 44 individuals evaluated in this study, 37 (84%) were women, with a mean age of 43.2 ± 2.1 years. However, a possible bias occurred in the present study, since the prevalence of TMD in women is high, turning the prevalence of tinnitus in this gender high as well, in the sample being studied.

Depression can be directly influenced by the presence of chronic pain (present for at least 6 months) (FERNANDES et al., 2013), amplifying psychological

changes, and altering the severity, the perception, and the intensity of TMD (HILGENBERG et al., 2012). In the presence of trigger points, characteristic of myofascial pain, depression, as well as poor posture, psychological stress, and lack of sleep, can perpetuate the existence of such points, and consequently of pain (JAEGER, 2012). In this study, of the individuals with chronic pain, 84% had myofascial pain according to the RDC/TMD, and of these, 86.5% had depressive symptoms. Statistical significance was found between depression and myofascial pain, with $p=0.02$.

Another limitation of this study is that the diagnosis was considered myofascial pain when the reported presence of myalgia was associated with pain from the palpation examination (DWORKIN; LERESCHE, 1992). However, the trigger point responsible for the complaint was not found, nor even its indicated pain area, despite the unanimous characterization of chronic pain by the patients.

It is known that tinnitus is often associated with the presence of myofascial trigger points, especially in the masseteric region (JAEGER, 2012). In this study's sample, the masseter was the palpated muscle that elicited pain more often (77.3% of the individuals complained of myalgia on both sides), and its middle portion the most affected, suggesting the possible presence of trigger points in this muscle.

It is noted that tinnitus can often be related to cases of hearing loss. In our study, through the audiometric examination⁴, it was observed that 40 individuals had normal hearing and only 4 had mild hearing loss, highlighting a strong association between tinnitus and TMD. Thus, it is suggested that a detailed anamnesis be carried out, investigating all possible factors related to the development of tinnitus, as well as the multidisciplinary approach, aimed at precise diagnosis and treatment.

5 CONCLUSION

There was a positive association between the presence of depressive symptoms, temporomandibular disorder, and subjective tinnitus, as well as between the increase in the intensity of tinnitus and decrease in quality of life.

6 CONFLICT OF INTEREST

We certify that we do not have any commercial or associate interest that represents a conflict of interest in this study.

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