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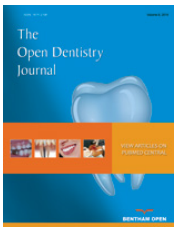

RESEARCH ARTICLE

Relationship Between Wind Instrument Playing Habits and Symptoms of Temporomandibular Disorders in Non-Professional Musicians

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Abstract:

Background:

In this study, we focused on the habits of wind instrumentalists as well as the presence of playing instruments, and investigated associations between the risk of temporomandibular disorders (TMD) and playing wind instruments in non-professional musicians.

Material and Methods:

Seventy-two non-professional players of wind instruments (instrument group) (mean(SD), 20.0(1.1) y; 42 women) and 66 non-players (control group) (22.0(2.6) y; 45 women) participated in this study. Factors were investigated using questionnaires (a screening questionnaire for TMD, instrument playing habits, years of experience, and time played per day).

Result:

The prevalence of a high risk of TMD was not significantly different between the instrument group (29.2%) and control group (21.2%). In the instrument group, the frequency of subjects who felt mouthpiece pressure in the high risk of TMD group (47.6%) was significantly greater than that in the low risk of TMD group (21.6%). Mouthpiece pressure was found to be a significant factor contributing to a high risk of TMD (odds ratio, 3.31; 95% CI, 1.12–9.79).

Conclusion:

This study suggests that pressure from the mouthpiece was one of the contributing factors related to a high risk of TMD in non-professional wind instrument players.

Keywords: Amateur instrumentalists, Embouchure, Screening questionnaire, Wind instruments.

INTRODUCTION

The term “temporomandibular disorders” (TMD) encompasses a number of clinical conditions that involve the temporomandibular joint (TMJ), masticatory muscles, or both [1]. TMD are a significant public health problem affecting approximately 5% to 12% of the population [2]. Since the 1970s, TMD have been proposed to demonstrate multifactorial etiologies in which various contributing factors are responsible for pain and dysfunction [3]. These

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factors include structural conditions, psychological morbidity, and behavioral problems such as parafunctional habits [4, 5]. It is thought that trauma and habitual behaviors that burden the TMJ and masticatory muscles influence the development of TMD. Several studies support an association between bruxism and myofascial pain or TMD [6 - 8]. Nishiyama *et al*. [9] reported that habitual behavioral factors such as sleep and awake bruxism had a stronger effect on the symptoms of TMD than psychosocial factors such as stress. Behavioral factors can include parafunctional habits, such as bruxism, nail biting, gum chewing, and playing a musical instrument.

Playing a musical instrument, such as wind instruments and string instruments that are held between the shoulder and angle of the jaw, could overload the masticatory muscles and orofacial skeletal system, thereby possibly causing TMD or worsening existing TMD [10]. However, most studies have investigated string instruments such as the violin and viola. Only a few studies have explored wind instruments in association with symptoms of TMD [11]. It is inferred that the relationship between playing wind instruments and TMD is stronger, because playing wind instruments involves facial muscles, including the masticatory muscles, even more so than string instruments.

However, Attallah *et al*. [10] reported in a review of the literature that no clear-cut conclusion could be drawn as to whether playing a musical instrument was associated with TMD, either directly or in combination with other factors.

In this study, we focused on the habits of wind instrumentalists as well as the presence of playing instruments, and investigated associations between the risk of TMD and playing wind instruments in non-professional players.

MATERIALS AND METHODOLOGY

Subjects and Data Collection

We recruited 72 wind instrumentalists (instrument group) who belonged to the orchestras of 3 universities in Tokyo, and 66 non-players (control group) who were similar to the instrument group in age and sex, enrolled at Tokyo Medical and Dental University, and had not played any musical instrument within 1 y.

This cross-sectional study was performed using an anonymous questionnaire with the approval (No. 997) of the ethics committee of the Tokyo Medical and Dental University, Japan. After the purpose and contents of the study questionnaire were explained before the study commenced, questionnaires were distributed to all subjects, and completed questionnaires were collected afterward. Written informed consent was not obtained because the identification of individuals was not required; answering the questionnaire was considered consent to participate.

Questionnaire

The administered questionnaire is shown in Table **1**. Sex, age, and responses to items 1-10 were recorded. Items 1-4 are questions related to screening for TMD (screening questionnaire for TMD: SQ-TMD) that were developed by Sugisaki *et al*. [12]. The subjects rated the 4 screening items using a 5-point numeric rating scale (0 to 4).

Table 1. Questionnaire.

Question item		**Abbreviated form**
Q1	If you open your mouth wide, can you fit 3 fingers held vertically in your mouth?	Limited mouth opening
Q2	Do you experience pain in the face, jaw, temple, or in front of the ear when you open and close your mouth?	Mouth-opening pain
Q3	Can you open your mouth without any deviation?	Mouth-opening deviation
Q4	Do you experience pain in the face, jaw, temple, or in front of the ear when you eat hard foods such as beef jerky, dried cuttlefish, or octopus?	Chewing-induced pain
Only instrument players answered the following questions		
Q5	Do you play the instrument with your head tilted forward?	Head tilted forward
Q6	Do you play the instrument with incorrect embouchure*?	Incorrect embouchure
Q7	Are you using an instrument with strong mouthpiece resistance?	Strong resistance
Q8	When you play the instrument, do you press the mouthpiece against your mouth?	Pressure from the mouthpiece
Q9	How many years have you played the instrument?	Years of experience
Q10	How many hours per day do you play the instrument?	Playing time per day

The subjects were asked to answer question items 1-8 on a 5-point numeric rating scale.

Item1,3: 0) strongly agree,1) weakly agree, 2) neither agree nor disagree, 3) weakly disagree, or 4) strongly disagree. Item 2, 4-8: 0) strongly disagree,1) weakly disagree, 2) neither agree nor disagree, 3) weakly agree, or 4) strongly agree.

* The form and function of the mouth while playing the instrument

The other 6 items were used to investigate factors related to playing wind instruments. Items 5-8 solicited information about habits while playing instruments, and the subjects were asked to rate these 4 question items using a 5-point numeric rating scale. Items 9 and 10 solicited information about years of experience and playing time per day.

Statistical Analysis

On the SQ-TMD, participants with a score ≥ 5.0 were assigned to the high risk of TMD (H-TMD) group, whereas those with a score ≤ 4.0 were assigned to the low risk of TMD (L-TMD) group.

The statistical analysis compared the instrument and control groups using Student's *t* tests and chi-squared tests. Comparisons between the H-TMD group and L-TMD group were performed in the instrument group using Student's *t* tests and chi-squared tests. For the item concerning habits while playing instruments, participants with a score ≤ 3 were assigned a value of "0 (low frequency)," whereas those with a score ≥ 4 were assigned a value of "1 (high frequency)."

In the instrument group, factors influencing the H-TMD were estimated using a logistic regression analysis with odds ratios (ORs) and 95% CIs as measures of association. The dependent variable was the result of the screening for TMD (L-TMD, 0; H-TMD, 1). Meanwhile, the independent variables were age, sex, years of experience, playing time per day, and various habits while playing instruments (low frequency, 0; high frequency, 1). The covariates were entered into the logistic regression analysis with a forward stepwise technique; $P < 0.05$ was considered statistically significant. All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) (version 21.0, IBM, Tokyo, Japan).

RESULTS

Characteristics of the instrument and control groups are shown in Table **2**. The prevalence of the H-TMD was not significantly different between the instrument and control groups ($P = 0.283$).

Table 2. Ratio of subjects with a high risk of TMD between the instrument and control groups.

	Total	Instrument group	Control group	P value
N	138	72	66	
Age: y (SD)	21.0(2.2)	20.0(1.1)	22.0(2.6)	< 0.001*[a]
Women (%)	87(63.0)	42(58.3)	45(68.2)	0.231[b]
High risk of TMD (%)	35(25.4)	21(29.2)	14(21.2)	0.283[b]

TMD, temporomandibular disorders; a, *t* test; b, chi-squared test; * $P < 0.05$

In the instrument group, the frequency of pressure from the mouthpiece in the H-TMD group was significantly greater than that in the L-TMD group ($P < 0.05$) (Table **3**). Table **4** shows the results of the logistic regression analysis. The only statistically significant independent variable ($P < 0.05$) is shown. Pressure from the mouthpiece was found to be a significant factor contributing to an H-TMD (OR, 3.31; 95% CI, 1.12-9.79).

Table 3. Comparison between the high and low risk of TMD groups in the instrument group.

	Instrument group		*P* value
	High risk of TMD (N = 21)	Low risk of TMD (N = 51)	
Women (%)	14(66.7)	28(54.9)	0.357[b]
Head tilted forward: high frequency (%)	5(23.8)	13(25.5)	0.881[b]
Incorrect embouchure: high frequency (%)	6(28.6)	9(17.6)	0.300[b]
Strong resistance: high frequency (%)	9(42.9)	18(35.3)	0.547[b]
Pressure from the mouthpiece: high frequency (%)	10(47.6)	11(21.6)	0.027*[b]
Mean years of experience: y (SD)	6.5(2.1)	6.1(2.9)	0.573[a]
Mean playing time: h (SD)	1.9(0.99)	2.0(0.89)	0.573[a]

TMD, temporomandibular disorders; a, *t* test; b, chi-squared test; * $P < 0.05$

DISCUSSION

Screening Questionnaire for TMD

The SQ-TMD used in this study was developed by Sugisaki *et al*. [12]. They extracted 4 items from a 20-item

questionnaire administered to dental patients. When the cut-off value for the total score from these 4 items was 4.5, the sensitivity, specificity, and false-positive rate derived from the screening for TMD were 0.746, 0.811, and 0.189, respectively [12]. From these results, participants with a score ≥ 5.0 were assigned to the H-TMD group, whereas those with a score ≤ 4.0 were assigned to the L-TMD group. One item related to joint noise was omitted from the screening questionnaire, as an analysis using non-parametric item response theory (a Mokken analysis) showed that the validity of the 4 included items was higher than that of the 5 items. Nishiyama *et al*. [13] showed that the true-positive rate of detecting TMD (based on the Research Diagnostic Criteria for TMD: RDC/TMD) using the SQ-TMD was very high (81.6%), and the SQ-TMD could be used to screen for TMD in patients with moderate or severe pain and difficulty completing activities of daily living.

Table 4. Results of the logistic regression analysis (the only significant factor).

	***P* value**	**Odds ratio**	**95% CI**
Pressure from the mouthpiece	0.031	3.31	1.12–9.79

Comparison Between the Instrument and Control Groups

In this study, the prevalence of the H-TMD among all subjects was 25.4%. According to the SQ-TMD survey results of a working population of 2203 subjects, the prevalence of the H-TMD was 16.4% [9]. It was reported that TMD were a significant public health problem affecting approximately 5% to 12% of the population [2], and the prevalence among those younger than 30 years was higher than in those older than 30 years [14, 15]. Our result was consistent with the results of these studies. In this study, all participants were younger than 30 years of age. The ages of the participants were considered as one of the reasons for the high incidence of TMD.

The prevalence of the H-TMD in the instrument group (29.1%) was greater than that in the control group. Hada *et al*. [14] reported that the prevalence of TMD among wind instrumentalists was 31.5%. However, there was no statistically significant difference in our study. Few studies have investigated the relationship between playing wind instruments and TMD. Rampel *et al*. [16] reported that wind musicians showed a high incidence of developing TMD. On the other hand, Gotouda *et al*. [17] showed that the contractive load on jaw-closing muscles was small when playing both medium and high tones on a wind instrument, and playing an instrument for a long duration did not induce fatigue in the jaw-closing muscles.

Instrument Group

It is thought that trauma and habitual behaviors that burden the TMJ and masticatory muscles influence the development of TMD. Behavioral factors can include parafunctional habits, such as playing a musical instrument. Especially, wind instruments could overload the masticatory muscles and orofacial skeletal system, thereby possibly causing TMD or worsening existing TMD [10].

In the instrument group, the habit of strongly pressing the mouthpiece (or lead) to the lips was found to be a significant factor contributing to the manifestation of TMD. The mandible is pushed posteriorly by pressing the mouthpiece to the lip. It was considered that the duration of this pressure caused an overload of the TMJ or masticatory muscles. There is a report stating that the contractive load on jaw-closing muscles was small when playing a wind instrument [17]. However, participants in that study were professional musicians. Because participants in this study were students and non-professional musicians, it was considered that they had not been able to acquire the appropriate embouchure. It is possible that the embouchure during wind instrument playing is different between amateur musicians, professional musicians, and students who aim to become professionals. In many cases, because amateur musicians have not learned the correct embouchure, they may strongly press the mouthpiece (or lead) against their mouth or lip. According to research using a finite element method (FEM) in an anterior disc displacement model of the TMJ, a prolonged force equivalent to 20% of the maximum muscle contraction caused sustained displacement of the condyle, and large stresses were observed in the posterior part of the disc [18]. Because an extension in the duration that a mouthpiece (or lead) presses strongly on the mouth or lip increases the load on the TMJ while playing wind instruments, there is the possibility that it caused TMJ pain.

Limitations of the Study

In this study, a 7% difference in the prevalence of TMD was observed between the instrument and control groups; however, the difference was not significant. The reasons were some limitations of our study. First, this was a cross-

sectional study, and the sample size was insufficient (n = 138). G*Power indicated that the ideal sample size would be 144 for an effect size of 0.3, an α-type error of 0.05, and a β-type error of 0.2. In the future, there is a need for further evaluation with improved statistical accuracy in a survey of a greater number of subjects. Second, this was not only a diagnosis made on a clinical and radiographic basis, but also based on the questionnaire analysis.

CONCLUSION

This study suggests that pressure from the mouthpiece was one of the contributing factors related to the H-TMD in non-professional wind instrument players. Therefore, wind instrumentalists should be taught by an instructor about correct embouchure and playing method when learning to play the instrument.

CONFLICT OF INTEREST

The authors confirm that this article content has no conflict of interest.

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