

ORIGINAL ARTICLE



Association of temporomandibular disorder and high frequency of suicide ideation in Korean adolescents: a cross-sectional survey

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ABSTRACT

Background: This study investigated the association between psychological factors and temporomandibular disorder (TMD) in a representative sample using data from the Korean nationwide survey.

Methods: The study included 1337 adolescents. Participants provided demographic, socio-economic and behavioural information, and responses to questionnaires assessing their mental health status including perceived stress, depressed mood and suicidal ideation in the presence of TMD. In univariate analysis, *t*-test was used to test the association between TMD and risk factors by gender in a complex sampling design. Multivariate logistic regression analyses were used to examine the association between TMD and psychological factors.

Results: Male adolescents with TMD were highly engaged with depressed mood and suicidal ideation ($p = .0006$, $p = .0223$), however, no psychological factors were significant in female adolescents ($p < .05$). Male adolescents with both depressed mood and suicidal ideation had significantly high rates of TMD ($p = .0024$). The risks for experiencing depressed mood (OR: 3.07) and suicidal ideation (OR: 2.564) were significantly associated with TMD in male adolescents after adjusting confounders.

Conclusions: The results provide evidence that the depressed mood and suicidal ideation were associated with TMD in male adolescents. This study has important implications for enhanced screening and evaluation of mental health among patients with TMD according to gender.

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Introduction

Temporomandibular disorder (TMD) is a collective terminology that embraces alterations of the temporomandibular joint (TMJ), the masticatory muscles and associated head and neck musculoskeletal structures. It shows a highly varied prevalence of symptoms and clinical signs such as discomfort, pain in TMJ during function, tenderness on palpation, incoordination in jaw movements and sounds in joints. TMD is represented as the most widespread oral and facial pain condition [1,2].

The incidence of TMD is positively associated with age. Prevalence in children is low, increasing among adolescents, peaking in the young adult period and declining after the fifth decade of life. A prospective cohort study informed that initial-onset TMD developed in 3.9% of individuals annually [3,4]. According to epidemiological studies, females have a slightly higher incidence of TMD pain than males among adults and prevalence rates of 2–6% are reported in children and adolescents, with more girls than boys [5].

The etiology of TMD is regarded as multifactorial; it is caused locally by disorders in masticatory structures, parafunctions and systemic disorders in pain regulation process [6]. The most common physiologic characteristics of TMD are pathologies in muscles (myofascial pain) and/or joints (internal derangement and osteoarthritis). Apparently, psychological factors also affect the various stages of TMD such

as its predisposition, initiation and perpetuation. Psychological factors such as high incidental experience to demanding life events, high anxiety levels, and somatic symptoms related to stress have been found in TMD patients [7–9].

In the stage of adolescence, children's stress and anxieties are increasing and deteriorating their mental health [5], and adolescents have been the object of many studies of TMD symptoms [1,7,10,11]. To better understand TMD in adolescents, it is essential to investigate the association between psychological factors and TMD by surveying a large representative population in a cross-sectional study.

In addition, adolescence is a period where different gender characteristics such as personality, attitude and behaviours caused by secondary sexual characteristics become evident [12]. Due to existing differences in traditional gender role, the association of TMD with psychological factors needs to be analysed in accordance to different gender, taking developmental characteristics into account. Nevertheless, only few studies focused on this gender difference in adolescents, making it difficult to understand the effect of developmental characteristics [4,10,13]. Thus, this study explores whether the association between psychological factors related to mental health and TMD varies between male and female adolescents within a representative sample of Koreans.

Materials and methods

Data source

This study is a secondary analysis of data collected by Korea Centers for Disease Control and Prevention, which is a nationally representative, cross-sectional survey based on population [14]. The present study used the data collected during from 2010 to 2012 by KNHANES. The KNHANES methodology has been described previously in many articles [15,16].

Study population

Analyses were conducted on data collected from 1337 participants aged 12–18 years who completed the TMD questionnaire and agreed to the clinical interview and oral examinations. Before the survey, all participants signed informed-consent form, to which they all agreed on. This study also acquired approval from the Institutional Review Board Committee.

Temporomandibular disorder symptoms assessment

Trained dentists performed clinical interviews and oral examinations while participants sat in dental chairs. Participants were evaluated for TMD symptoms such as tenderness on palpation of the TMJ and the masticatory muscles, clicking of one or both TMJ, and reduced jaw mobility within the last year [15]. The questionnaires about TMD symptoms were 'Have you ever had a pain around TMJ area?', 'Have you ever had a joint noise (clicking, popping or crepitus)?' and 'Have you ever had a limited range of movement and pain during mouth opening?' Response options were 'yes' and 'no'.

Psychological factors measurement

Three measurements were determined within the domains of mental health, namely perceived stress, depressed mood and suicidal ideation. To evaluate stress, participants were asked about their stress experience and how they perceived it, comparing to normal days. The question on depressed mood was 'Have you ever had in the previous 12 months, a sense of melancholy or hopelessness to an extent that you need to stop your daily activities for at least two weeks?' To measure suicidal ideation, the participants were questioned, 'Have you ever sincerely thought about committing suicide in the past year?' The answer 'yes' or 'no' was analysed as a dependent variable.

Correlates

The correlates in this study included socio-demographic factors, lifestyle habits and oral health status. Socio-demographic factors including age, gender, body mass index (BMI), waist circumference (WC), income, region of inhabitation, current smoking, drinking habit and moderate physical activity were collected through a self-reported questionnaire.

Toothache history and use of oral health services were determined from an oral health interview. Toothache history was defined as an experience of a dull and aching tooth, throbbing tooth pain, or pain in the teeth when consuming foods or drinks during last year. Also use of oral health services during the previous year was assessed.

Statistical analysis

This study used the SAS survey procedure (SAS Institute, Cary, NC) to provide statistical analysis. Such procedure was taken in order to incorporate KNHANES' intricate sampling design and sampling weights, while supplying nationally representative prevalence estimates.

In the univariate analysis, *t*-test (PROC SURVEYREG) was applied to experiment the relationship between TMD and risk factors in a complex sampling design. To describe the participants' traits according to gender, means and standard errors were used for continuous variables. For categorical variables, percentages (standard errors) were used.

Multivariate logistic regression analyses (PROC SURVEYLOGISTIC) were used to examine the connection between the mental health measurements and TMD. After potential confounders including age, BMI, income and physical activity (intermediate) were adjusted, odds ratios (ORs) and 95% confidence intervals (CIs) were evaluated. The two-tailed *p* values were used, and when *p* values were smaller than .05, it was considered significant.

Results

TMD according to participant's characteristics by gender

The number of participants that experienced TMD in the last 12 months was 150 (11.2%). Those with TMD were more commonly female adolescents (5.0% vs. 6.2%, $p = .0236$) as shown in Table 1 and TMD incidence increased with age for both male and female adolescents ($p < .0001$ and $p < .0004$, respectively).

Male adolescents with TMD were more likely to show high BMI, and had a history of smoking and drinking. Participants with TMD had higher proportions of self-reported toothache history for male adolescents (Table 1).

Associations between TMD and psychological factors

Figure 1 shows the relationship between the mental health variables and participants with or without TMD for each gender. In male adolescents, depressed mood and suicidal ideation were significantly associated with TMD ($p = .0006$ and $p = .0223$, respectively). However, in female adolescents, although perceived stress, depressed mood and suicidal ideation were prevalent in participants who had TMD, no psychological factors were statistically significant.

Table 2 shows the prevalence of TMD according to the combination of two significant variables – depressed mood and suicidal ideation. In male adolescents, participants with both factors showed significantly higher rates of TMD

Table 1. Analysis of factors potentially associated with TMD ($n = 1337$).

Parameter	Male			Female		
	No ($n = 650$)	Yes ($n = 67$)	p value	No ($n = 537$)	Yes ($n = 83$)	p value
TMD symptoms						
Age, years	15 $\pm$ 0.1	16.4 $\pm$ 0.2	<.0001*	15 $\pm$ 0.1	15.9 $\pm$ 0.2	.0004*
BMI, kg/m ²	21.1 $\pm$ 0.2	22.4 $\pm$ 0.7	.0487*	20.9 $\pm$ 0.2	21.1 $\pm$ 0.6	n.s.
WC, cm	72.3 $\pm$ 0.5	75.9 $\pm$ 1.7	.0368*	68.7 $\pm$ 0.5	69.9 $\pm$ 1.4	n.s.
Income (lowest quartile), %	15.9 (2)	24.4 (6.3)	n.s.	19 (2.8)	13.2 (4.6)	n.s.
Region of inhabitance (rural)	18 (3.1)	10.1 (5.1)	n.s.	20.6 (4.2)	22.6 (9)	n.s.
Smoking during previous month	23 (2.2)	41.4 (7.2)	.0067*	12.7 (1.9)	9 (3.8)	n.s.
Alcohol consumption during previous year	30.3 (2.2)	60.1 (7.1)	<.0001*	20.8 (2.7)	32.3 (6)	n.s.
Physical activity (intermediate)	8.9 (1.3)	12.2 (4.5)	n.s.	4 (0.9)	8.4 (3.4)	n.s.
Toothache history (yes), %	17.3 (2)	36.9 (7.6)	.0034*	20.4 (2.4)	23.2 (5.2)	n.s.
Use of oral health services (yes), %	36.1 (2.4)	30.8 (6.9)	n.s.	42.4 (2.9)	37.2 (7)	n.s.

BMI: body mass index; WC: waist circumference.

Values are mean $\pm$ SE or % (SE).

*Significant at $p < .05$.

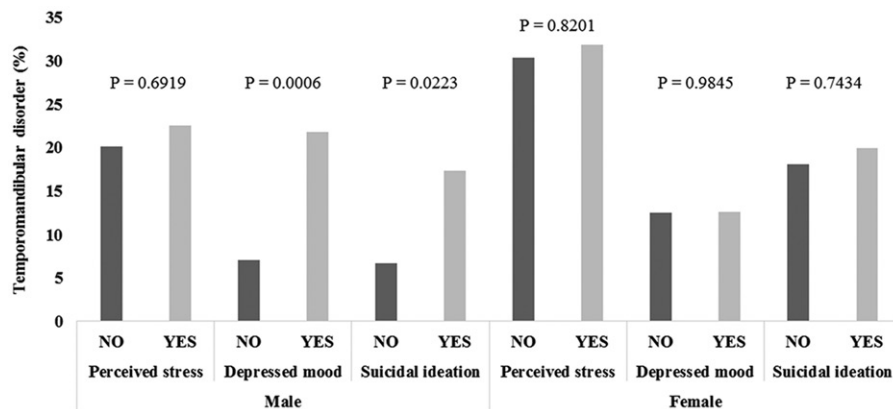


Figure 1. Prevalence of TMD according to mental health measurements in males and female adolescents. Depressed mood and suicidal ideation are significantly associated with TMD in male adolescents.

Table 2. Prevalence of TMD based on the combination of depressed mood and suicidal ideation.

TMD symptoms	Male		Female	
	No (%)	Yes (%)	No (%)	Yes (%)
No depressed mood and suicidal ideation	76.84	74.36	87.8	70.09
Depressed mood (+) and suicidal ideation (-)	10.72	13.11	5.05	8.15
Depressed mood (-) and suicidal ideation (+)	5.11	5.70	5.41	12.60
Both depressed mood and suicidal ideation	7.32	6.81	1.65	9.13
p value	.0024		n.s.	

($p = .0024$). In female adolescents, there was no statistically significant difference with the combination of the variables.

Table 3 presents the interrelation between psychological variables and TMD using logistic regression models. After accommodating factors of age, BMI, income and physical activity (moderate) in model 3, TMD was highly associated with depressed mood (OR [95% CI]: 3.07 [1.394, 6.76]) and suicidal ideation (OR [95% CI]: 2.564 [1.014, 6.484]) for male adolescents. In contrast, the OR values of psychological factors in female adolescents did not show significant correlations.

Discussion

This study examined whether the interrelation between TMD and related psychological factors varies between males and females within a representative sample of Korean adolescents. This study revealed that mood depression and suicidal ideation are closely connected to TMD in male adolescents in Korea.

The findings of the present study revealed that the prevalence of TMD symptoms in Korean adolescents is relatively high compared with the results from other epidemiological studies performed in northern European countries [17,18]. However, the prevalence rate is much lower than those reported in other countries in which the prevalence of TMD ranged between 25.5 and 36.0% [4,7,10]. There is a debate on whether TMD rate is more prevalent in underdeveloped and developing countries' adolescents compared to those in developed countries [4]. Then, the difference might be analogized by the fact that Korea has become an advanced society. Additionally, dissimilarities in methodology, diagnostic instruments and sample characteristics likely contributed to the differences. Future studies are needed to clarify whether or not these differences in socio-economic state played a part in prevalence rate in Korea.

The present study also found a female predominance of TMD symptoms, which is in accordance with other reports about TMD pain in the literature. Many epidemiologic studies

Table 3. Logistic regression models of TMD for mental health.

Parameter	Stress perception		Depressed mood		Suicidal ideation	
	Male	Female	Male	Female	Male	Female
Adjusted OR (95% CI)						
Unadjusted model	1.154 (0.567–2.352)	1.069 (0.603–1.895)	3.65 (1.689–7.89)*	1.009 (0.402–2.531)	2.907 (1.109–7.619)*	1.132 (0.538–2.382)
Adjusted for age and BMI	1.023 (0.489–2.138)	0.978 (0.533–1.793)	3.335 (1.618–6.876)*	0.906 (0.363–2.262)	2.503 (1.003–6.246)*	1.06 (0.501–2.242)
Adjusted for age, BMI, income, physical activity	0.909 (0.424–1.949)	0.976 (0.527–1.809)	3.07 (1.394–6.76)*	0.888 (0.346–2.279)	2.564 (1.014–6.484)*	1.051 (0.493–2.243)

OR: odds ratio; CI: confidence interval.

*Significant at $p < .05$.

asserted that TMD's prevalence rate was meaningfully higher in female adolescents than male adolescents (12–18 year olds) [18,19]. However, differences in gender should be considered with consideration, since the disparity is minimized when examining non-patient population [20,21]. The present study was conducted on an adolescent non-patient population and also illustrated significant gender gap. In terms of pain tolerance, gender dissimilarity is well explained: males are more tolerable to agonizing stimuli, seek medical care less often, and suffer less from pains associated with joints and musculoskeletal structures [22]. It has been proposed that structural differences between males and females in the components of TMJ might be the reason for these differences. However, studies that can properly explain the gender differences that result in a higher prevalence of females having TMD are still lacking [23]. In the present study, we observed that both male and female participants with TMD were more likely to suffer from stress. Stress is widely acknowledged as an important factor contributing to TMD development [8,24–26]. Though the prevalence of stress in both male and female adolescents with TMD was relatively high, no statistical significance was found in this study. This was attributed to the fact that many participants experienced a lot of stress on a normal basis due to academic burdens as Korean adolescents. Nevertheless, this finding indicates that stress should be assessed in relation to TMD evaluation and when managing patients with TMD [8,26,27].

Another significant result that should be accentuated is the strong association between TMD and depressed mood and suicidal ideation in male adolescents, which is contrary to other comparable adolescent studies [11,18,28]. In our findings, male adolescents with TMD had a 3.07-fold greater likelihood of depressed mood than those without TMD after adjusting for confounding factors such as age, BMI, income and physical activity. No other known study supports the finding that male adolescents with TMD were more depressed than their female counterpart is not supported by any other known study. A probable explanation for this result could be different psychosocial roles according to gender. Similar to other East Asian countries, Korea's culture is deeply rooted in patriarchy and Confucianism. Due to such cultural impact, Korean parents would generally expect higher academic achievements and social success from their sons than daughters. These differences in gender roles and expectation from parents between male adolescents and female adolescents may lead to contrasting indicators of mental health status like depressed mood and suicidal ideation [29].

TMD is recognized as being related to other chronic pains, including head, neck, back and joint pain, and consequently might influence daily life activities negatively. According to population-based studies involving adolescents, those with TMD report more somatic complaints and experience greater limitations in psychosocial functioning compared with controls [30,31]. In addition, TMD might worsen suicidal thoughts and attempts, and further attention is needed in relation to suicide [15]. Though suicidal ideation is not always followed by suicidal behaviour, it is important as a dangerous predictor of suicide because it is latent in the unconscious and can be channelled into any suicide attempt and completion throughout adolescence [32,33]. In our results, suicidal ideation was more prevalent in male adolescents with TMD than in female adolescents. This is contrary to the findings of other research that TMD had a significantly greater influence on behavioural and psychosocial factors in girls than in boys [5,19]. In general, a higher incidence of depression and suicidal ideation in females is reported all over the world [34], because girls usually perceive higher pressure from psychosocial factors, though they also report better performance and support [33]. Yet, it was unexpected that the effect of TMD on suicidal ideation was stronger among male adolescents than female adolescents. This finding indicates that Korean male adolescents with TMD experience worse psychological conditions within the family, school and peer groups than their female counterparts and it is likely that they are more susceptible to higher psychological burdens that affect mental health than female adolescents [35]. This is partly supported by the fact that male adolescents are not only more likely than females to exhibit aggressive and destructive tendencies, but also their ways of managing pain are unhelpful and even detrimental [12]. It is necessary to be aware that the effects of gender in TMD are not always considered as much as they should be [9]. Nevertheless, based on the study's findings, better mental health for adolescents and more active management of TMD might help circumvent suicidal ideation in Korean adolescents.

This study has several limitations. First, this study is cross-sectional. Longitudinal research may be helpful in demonstrating a causal relationship between TMD and psychological factors in adolescents. Second, inquiries on TMD were based on retrospective self-reports, which means that it is prone to underreporting and recall bias. Third, to enhance the analysis regarding the TMD's association with

psychological factors, combining more objective indicators of the latter may help.

Conclusions

In conclusion, the results provide evidence that the depressed mood and suicidal ideation was associated with TMD in male adolescents. This study is consequential in that it calls for intensified screening and evaluation of depression, as well as suicidal ideation in patients with TMD according to gender.

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Ethical approval

This study was reviewed and approved by the Institutional Review Board (HC15EASI0092).

Disclosure statement

No potential conflict of interest was reported by the authors.

Data availability statement

Access to the data can be obtained by researchers who visit the following website and complete the application form (<https://knhanes.cdc.go.kr/knhanes/index.do>).

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