The Revised Version of the Minnesota Multiphasic Personality Inventory in Korean College Students with Symptoms of Temporomandibular Disorders

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Purpose: The purpose of this study was to assess the association of personality characteristics with temporomandibular disorders (TMDs).

Methods: Four hundred and fifty one college students in Gyeonggi-do completed the revised version of the Minnesota Multiphasic Personality Inventory (MMPI-2) and a questionnaire and collected data were analyzed by IBM SPSS Statistics ver. 25.0 software (IBM Co., Armonk, NY, USA).

Results: Mean values of the number of positive answers of TMD symptoms were significantly higher in higher scorers on hypochondriasis (Hs), depression (D), paranoia (Pa) (Hs>60, D>64, Pa>59) (p<0.01). Higher scorers on Hs, hysteria (Hy), schizophrenia (Sc), Pa, psychasthenia (Pt) (Hy>64, Sc>64, Pt>64) exhibited significantly higher mean values of the number of positive answers of contributing factors for TMD (p<0.01, p<0.001). Low scorers on social introversion (Si≤44) exhibited significantly lower mean value of the number of positive answers of contributing factors for TMD than high or moderate scorers on Si (Si>64, 45-64) (p<0.01, p<0.05). The percentage of subjects who responded that they had at least one TMD symptom was significantly higher in higher scorers on Hs, Pt, D (p<0.05, p<0.01). The significantly higher percentage of higher scorers on D, Pa reported at least one contributing factor for TMD (p<0.05). The percentage of subjects who responded that they had at least one TMD symptom or one contributing factor for TMD was significantly different among three groups divided by T-score on Si (p<0.01, p<0.05). T-scores of Hs, D, Hy, Pt and Sc showed significant correlation with the numbers of TMD symptoms and contributing factors for TMD, respectively (p<0.001). A correlation was found between T-score of Pd and the number of TMD symptoms (p<0.001). T-score of Si correlated to the number of contributing factors for TMD (p<0.001).

Conclusions: Most clinical scales of MMPI-2 were found to be related to TMD. Psychological assessment including MMPI-2 may play a role in predicting treatment outcome and planning treatment of TMD.

Key Words: Contributing factor for temporomandibular disorder; Minnesota Multiphasic Personality Inventory-2; Personality; Temporomandibular disorder symptom

INTRODUCTION

Temporomandibular disorders (TMDs) exhibit various symptoms encompassing pain of temporomandibular joint (TMJ) and muscles of head and neck, joint sound during mandibular movement, limitation of mandibular movement [1,2]. Although TMD symptoms spread throughout in all ages, they occur mostly in the 20 to 40 years old population

[3-5].

TMD have been associated with major etiologic factors, such as occlusal condition, trauma, parafunctional activities, deep pain input and emotional stress [6]. Parafunctional activities and factors that contribute to the initiation and progress of TMD symptoms are as follows: teeth clenching, teeth grinding, a habit of biting lips, cheeks, nails or pencils, a habit of resting the cheek on one hand, unilateral chewing, gum chewing, and insomnia, etc [7].

Psychological profiles have been largely evaluated to assess the multifactorial nature of TMD [8]. Although studies have indicated that patients with TMD demonstrate increased somatization, stress, anxiety, and depression relative to healthy controls, conflicting evidence still exists [9-11]. Several psychometric instruments, such as the Minnesota Multiphasic Personality Inventory (MMPI), the Symptom Checklist-90-Revised (SCL-90-R) and the Social Readjustment Rating Scale have been used to assess the psychological status of patients with TMD. MMPI in its revised form (MMPI-2) is one of the most widely used self-report inventories [12]. Michelotti et al. [8] analysed psychological profiles of fifty chronic TMD patients by means of MMPI test. The comparison of the personality profile between chronic migraine and chronic tension-type headache was made using MMPI-2 [13]. Fishbain et al. [14] showed that some elevated MMPI scale scores reduced after successful treatments in patients with headache and craniofacial pain.

Hence, current study has been performed aiming to analyze results of MMPI-2 of college students with TMD symptoms and to assess the association of personality characteristics with TMD.

MATERIALS AND METHODS

This study is approved by the Institutional Review Board of Shingu College (IRB no. 2018-101) and informed consent was obtained.

1. Subjects

Data were collected from four hundred and fifty one college students in Gyeonggi-do, including eighty three men and three hundred and sixty eight women. Mean age of the

subjects was 19.98±3.51 years (Table 1).

2. Psychological Evaluation

The Korean MMPI-2 version includes 567 true/false questions with normative data calibrated with a Korean reference population. It has three validity scales (L=lie, F=infrequency, K=correction) and ten clinical scales. Every clinical scale concerns a particular psychological aspect: hypochondriasis (Hs), depression (D), hysteria (Hy), psychopathic deviation (Pd), masculinity-femininity (Mf), paranoia (Pa), psychasthenia (Pt), schizophrenia (Sc), hypomania (Ma), social introversion (Si) [8,12].

3. Data Collection

Data were obtained from May to December of 2018. A questionnaire (Appendix 1) consisted of 18 items, among which 10 items (from item number 1 to item number 10) indicated TMD symptoms and 8 items (from item number 11 to item number 18) related to contributing factors for TMD. It was formed referring to a questionnaire [15] recommended by the American Academy of Orofacial Pain and a method devised by Nilner [16]. Visiting a classroom, an examiner explained each item of the questionnaire and asked the students to answer it by self-evaluation and retrieved the completed answers at their classroom. Moreover, a psychologist administered MMPI-2 to the students and calculated T-scores. Collected response data were recorded in an Excel file.

4. Statistical Analyses

All the statistical analyses were performed by IBM SPSS Statistics ver. 25.0 software (IBM Co., Armonk, NY, USA). Student's t-test was performed to compare mean values of the number of positive answers of TMD symptoms and contributing factors for TMD according to the range of T-scores on Hs, D, Hy, Pd, Pa, Pt, Sc and Ma clinical scales. One way

Table 1. Demographics of the subjects

Gender	Subject	Age (y)
Men	83 (18.4)	22.48±4.11
Women	368 (81.6)	19.42±3.09
Total	451 (100.0)	19.98±3.51

Values are presented as number (%) or mean±standard deviation.

Table 2. Prevalence and mean values of positive answers of TMD symptoms and contributing factors for TMD according to the range of T-score on ten clinical scales of MMPI-2 (n=451)

Groups divided by clinical scale scores of MMPI-2	Mean values of positive answer		Subject	
	TMD symptoms 2.37±2.53	Contributing factors for TMD 2.47±1.58	TMD symptoms 317 (70.3)	Contributing factors for TMD 394 (87.4)
Hs				
>60				
31 (6.9)	3.71±2.55	3.29±1.83	28 (90.3)	30 (96.8)
≤60				
420 (93.1)	2.28±2.50	2.41±1.54	289 (68.8)	364 (86.7)
p-value	0.002**	0.003**	0.011*	0.102
D				
>64				
29 (6.4)	3.90±2.41	3.00±1.46	28 (96.6)	29 (100.0)
≤64				
422 (93.6)	2.27±2.50	2.43±1.58	289 (68.5)	365 (86.5)
p-value	0.001**	0.060	0.001**	0.034*
Hy				
>64				
15 (3.3)	3.2±2.65	3.60±1.50	13 (86.7)	14 (93.3)
≤64				
436 (96.7)	2.35±2.52	2.43±1.57	304 (69.7)	380 (87.2)
p-value	0.199	0.005**	0.158	0.479
Pd				
>64				
8 (1.8)	2.50±2.07	3.25±1.58	7 (87.5)	7 (87.5)
≤64				
443 (98.2)	2.37±2.54	2.45±1.58	310 (70.0)	387 (87.4)
p-value	0.888	0.157	0.282	0.991
Mf				
>64				
27 (6.0)	2.41±2.47	2.44±1.31	19 (70.4)	24 (88.9)
45–64				
216 (47.9)	2.40±2.58	2.45±1.63	152 (70.4)	188 (87.0)
≤44				
208 (46.1)	2.35±2.49	2.49±1.56	146 (70.2)	182 (87.5)
p-value	0.976	0.976	0.999	0.960
Pa				
>59				
51 (11.3)	3.37±2.88	3.55±1.53	39 (76.5)	50 (98.0)
≤59				
400 (88.7)	2.25±2.45	2.33±1.53	278 (69.5)	344 (86.0)
p-value	0.003**	0.000***	0.305	0.015*
Pt				
>64				
42 (9.3)	3.02±2.32	3.40±1.80	36 (85.7)	39 (92.9)
≤64				
409 (90.7)	2.31±2.54	2.37±1.52	281 (68.7)	355 (86.8)
p-value	0.080	0.000***	0.022*	0.260
Sc				
>64				
19 (4.2)	2.84±2.71	3.68±1.46	15 (78.9)	18 (94.7)
≤64				
432 (95.8)	2.35±2.52	2.41±1.56	302 (69.9)	376 (87.0)
p-value	0.411	0.001**	0.399	0.323

Table 2. Continued

Groups divided by clinical scale scores of MMPI-2	Mean values of positive answer		Subject	
	TMD symptoms 2.37±2.53	Contributing factors for TMD 2.47±1.58	TMD symptoms 317 (70.3)	Contributing factors for TMD 394 (87.4)
Ma				
>64				
16 (3.5)	1.88±2.39	2.88±1.63	9 (56.3)	13 (81.3)
≤64				
435 (96.5)	2.39±2.53	2.45±1.58	308 (70.8)	381 (87.6)
p-value	0.421	0.294	0.211	0.454
Si				
>64				
49 (10.9)	3.04±2.18	3.00±1.56	44 (89.8)	48 (98.0)
45-64				
253 (56.1)	2.36±2.55	2.56±1.60	177 (70.0)	221 (87.4)
≤44				
149 (33.0)	2.19±2.58	2.14±1.48	96 (64.4)	125 (83.9)
p-value	0.120	0.002**	0.003**	0.037*

TMD, temporomandibular disorder; MMPI-2, the revised version of the Minnesota Multiphasic Personality Inventory; Hs, hypochondriasis; D, depression; Hy, hysteria; Pd, psychopathic deviation; Mf, masculinity-femininity; Pa, paranoia; Pt, psychasthenia; Sc, schizophrenia; Ma, hypomania; Si, social introversion.
Values are presented as number (%) or mean±standard deviation.
The p-values were completed by chi-square test for prevalence. The p-values were completed by Student's t-test for mean values on Hs, D, Hy, Pd, Pa, Pt, Sc, and Ma clinical scales. The p-values were completed by one way ANOVA for mean values on Mf and Si clinical scales.
*$p<0.05$, **$p<0.01$, ***$p<0.001$.

ANOVA and Tukey post hoc analysis were implemented to compare mean values of the number of positive answers of TMD symptoms and contributing factors for TMD according to the range of T-scores on Mf and Si clinical scales. The Pearson's Chi-square test was applied to compare self-reporting prevalence rate of TMD symptoms and contributing factors for TMD according to the range of T-scores on ten clinical scales of MMPI-2. Pearson's correlations were employed to evaluate the relation between T-scores on ten clinical scales of MMPI-2 and the numbers of TMD symptoms and contributing factors for TMD, The significance level was set to 5% ($p<0.05$).

RESULTS

The mean value of the number of symptoms to which subjects answered positively among 10 items (from item number 1 to item number 10) indicating TMD symptoms on the questionnaire (Appendix 1) was 2.37±2.53. The mean value of the number of factors to which subjects responded positively among 8 items (from item number 11 to item number 18) related to contributing factors for TMD

was 2.47±1.58. Mean values of the number of positive answers of TMD symptoms were significantly higher in the group with high T-score on Hs, D and Pa scales (Hs>60, D>64, Pa>59) than in the group with low T-score on Hs, D and Pa scales (Hs≤60, D≤64, Pa≤59) ($p<0.01$). Subjects with high T-score on Hs, Hy, Sc, Pa and Pt scales (Hy>64, Sc>64, Pt>64) exhibited significantly higher mean values of the number of positive answers of contributing factors for TMD than subjects with low T-score on Hs, Hy, Sc, Pa and Pt scales (Hy≤64, Sc≤64, Pt≤64) ($p<0.01$, $p<0.001$) (Table 2). Subjects with low T-score on Si scale (Si≤44) exhibited significantly lower mean value of the number of positive answers of contributing factors for TMD than subjects with high or moderate T-score on Si scale (Si>64, 45-64) ($p<0.01$, $p<0.05$) (Table 3).

Three hundred and seventeen subjects (317, 70.3%) in this study showed at least one of TMD symptoms and three hundred and ninety four subjects (394, 87.4%) had at least one of contributing factors for TMD. The percentage of subjects who responded that they had at least one TMD symptom was significantly higher in the group with high T-score than with low T-score on Hs, Pt and D scales

Table 3. Tukey post hoc analysis on mean values of positive answers of contributing factors for TMD among three groups divided by T-score on Si scale (n=451)

I	J	Difference (I-J)	STD	p-value	95% CI	
					Upper limit	Lower limit
Si						
>64	45-64	0.443	0.243	0.164	−0.13	1.01
	≤44	0.859*	0.257	0.003**	0.26	1.46
45-64	>64	−0.443	0.243	0.164	−1.01	0.13
	≤44	0.416*	0.161	0.027*	0.04	0.79
≤44	>64	−0.859*	0.257	0.003**	−1.46	−0.26
	45-64	−0.416*	0.161	0.027*	−0.79	−0.04

TMD, temporomandibular disorder; Si, social introversion; STD, standard deviation; CI, confidence interval.
The p-values were completed by Tukey post hoc test.
*p<0.05, **p<0.01.

Table 4. Correlation between ten clinical scales of MMPI-2 and TMD symptoms and contributing factors for TMD (n=451)

Clinical scales	TMD symptoms	p-value	Contributing factors for TMD	p-value
Hs	0.243	0.000***	0.213	0.000***
D	0.148	0.000***	0.165	0.000***
Hy	0.222	0.000***	0.173	0.000***
Pd	0.138	0.000***	0.090	0.060
Mf	−0.024	0.620	−0.006	0.900
Pa	0.060	0.240	0.080	0.110
Pt	0.185	0.000***	0.188	0.000***
Sc	0.184	0.000***	0.222	0.000***
Ma	0.040	0.460	0.010	0.770
Si	0.090	0.070	0.189	0.000***

MMPI-2, the revised version of the Minnesota Multiphasic Personality Inventory; TMD, temporomandibular disorder; Hs, hypochondriasis; D, depression; Hy, hysteria; Pd, psychopathic deviation; Mf, masculinity-femininity; Pa, paranoia; Pt, psychasthenia; Sc, schizophrenia; Ma, hypomania; Si, social introversion.
The p-values were completed by Pearson's correlation analysis.
***p<0.001.

(p<0.05, p<0.01) (Table 2). The significantly higher percentage of subjects in the group with high T-score than with low T-score on D and Pa scales reported at least one contributing factor for TMD (p<0.05) (Table 2). The percentage of subjects who responded that they had at least one TMD symptom or one contributing factor for TMD was significantly different among three groups divided by T-score on Si scale (p<0.01, p<0.05) (Table 2).

Pearson's correlation coefficients for ten clinical scales of MMPI-2 are given in Table 4. T-scores of Hs, D, Hy, Pt and Sc scales showed significant correlation with the numbers of TMD symptoms and contributing factors for TMD, respectively (p<0.001). A correlation was found between T-score of Pd scale and the number of TMD symptoms (p<0.001). T-score of Si scale correlated to the number of

contributing factors for TMD (p<0.001).

DISCUSSION

The relationship between TMD and personality characteristics is controversial. Mongini et al. [17] showed that patients with TMJ intracapsular disorders had a normal personality profile by means of MMPI data. The personality profile did not differ between the group of myofascial pain and the group of TMJ articular disorders in MMPI scales [8]. On the contrary, TMD patients scored significantly higher on Hs and Hy among MMPI scales when compared with the controls [18]. Patients with TMJ dysfunction had significantly higher T-scores on Hs, D, Hy, Pt and Sc among MMPI scales than control group [19]. This report

is consistent with the present result that T-scores on Hs, D, Hy, Pt and Sc showed significant correlation with the numbers of TMD symptoms and contributing factors for TMD.

Using Eysenck Personality Questionnaire (EPQ), Southwell et al. [20] demonstrated that TMJ patients scored significantly higher on neuroticism scale when compared with controls. Elevated values of the neurotic triad scales (Hs, D, and Hy) in MMPI have been reported for TMD [21,22]. Similarly, in current study, mean values of the number of positive answers of TMD symptoms were significantly higher in high scorers than low scorers on Hs and D scales. High scorers than low scorers on Hs and Hy scales exhibited significantly higher mean values of the number of positive answers of contributing factors for TMD. The neurotic personality shows a higher psychic tension and a low stress tolerance [8].

Gerschman et al. [23] identified seventeen percent of TMD patients as having severe anxiety. Anxiety has been proposed as a cause of TMD through oral habits and increased muscle tension [24]. Bruxism group showed significantly higher T-scores on obsessive-compulsive (O-C) and anxiety (ANX) scales as compared with the control group using the SCL-90-R test [25]. High scorers on Pt scale in MMPI-2 tend to be anxious, tense, fearful, and apprehensive [26]. These findings explain the present result that higher scorers on Pt scale exhibited significantly higher mean values of the number of positive answers of contributing factors for TMD and that the percentage of subjects who responded that they had at least one TMD symptom was significantly higher in higher scorers on Pt scale.

Chung et al. [27] reported that 45.3% of 203 patients with TMJ dysfunction thought their own character sensitive. Forty three TMD patients showed significantly higher scores on hostility (HOS) scale as compared to the controls by means of the SCL-90-R [18]. High scorers on Pa scale in MMPI-2 tend to be excessively sensitive and commonly exhibit HOS [26]. These studies are supportive of the result that mean values of the number of positive answers of TMD symptoms and contributing factors for TMD were significantly higher in higher scorers on Pa scale and that the significantly higher percentage of higher scorers on Pa scale reported at least one contributing factor for TMD.

Administering the SCL-90-R to 138 TMJ patients, Ko et

al. [28] suggested that they scored significantly higher on psychoticism (PSY) scale than healthy individuals. Women patients with facial pain disorders showed high tendency to PSY in MMPI-2 [29]. High scorers on Sc scale in MMPI-2 may have a psychotic disorder and feel insecure, inferior and dissatisfied [26]. These findings are similar with the result that higher scorers on Sc scale exhibited significantly higher number of positive answers of contributing factors for TMD.

It was reported that contributing factors for TMD including teeth clenching occurred more frequently in introverts than extroverts [30]. TMJ patients were significantly more introverted than conrtols in EPQ [20]. High scorers on Si scale in MMPI-2 are socially introverted and tend to worry, to be irritable, and to feel anxious [26]. These reports are in accord with the current result that lower scorers on Si scale exhibited significantly lower number of positive answers of contributing factors for TMD and that the percentage of subjects who responded that they had at least one TMD symptom or one contributing factor for TMD was significantly different according to the range of T-score on Si scale.

In conclusion, most clinical scales of MMPI-2 were found to be related to TMD, Psychological assessment including MMPI-2 may play a role in predicting treatment outcome and planning treatment of TMD.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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Appendix 1. Form and contents of questionnaire.

QUESTIONNAIRE

Name of College :   Name of Department :   Grade :

Name :   Gender :

Please answer the following questions by checking the one answer which describes you.

1. Have you ever had pain in your jaw joint when you opened your mouth wide?
   1) Yes   2) No

2. Has your jaw ever been caught or locked during certain jaw movements?
   1) Yes   2) No

3. Have you ever felt pain or discomfort in your jaw during speech or chewing?
   1) Yes   2) No

4. Do you hear sound in your jaw joint when you open or close your mouth?
   1) Yes   2) No

5. Do you frequently feel stiffness or fatigue in your jaw?
   1) Yes   2) No

6. Do you have pain in your ear, temple or cheek?
   1) Yes   2) No

7. Do you suffer from frequent headache?
   1) Yes   2) No

8. Has your jaw ever been stiff or painful when you woke up in the morning?
   1) Yes   2) No

9. Do you find it uncomfortable to bite your teeth hard together?
   1) Yes   2) No

10. Have you ever been treated for jaw problem?
    1) Yes   2) No

11. Have you ever experienced trauma in head, neck or jaw?
    1) Yes   2) No

12. Do you habitually clench your teeth ?

   1) Yes   2) No

13. Have you ever ground your teeth during sleep or heard that you were a bruxer?

   1) Yes   2) No

14. Do you usually chew food only on one side?

   1) Yes   2) No

15. Do you use chewing gum frequently?

   1) Yes   2) No

16. Do you habitually rest the cheek on your hand?

   1) Yes   2) No

17. Are you in the habit of biting lips, cheeks, nails or pencils?

   1) Yes   2) No

18. Have you difficulty initiating or maintaining sleep at night or nonrestorative sleep?

   1) Yes   2) No

Thank you for your cooperation.