



# The Effect of Psychological Factors on Sleep Disturbances in Young Adults

Hye Sook Park

Department of Dental Technology, Shingu College, Seongnam, Korea

Received February 11, 2020  
Revised March 15, 2020  
Accepted March 16, 2020

**Correspondence to:**  
Hye Sook Park  
Department of Dental Technology of  
Shingu College, 377 Gwangmyeong-ro,  
Seongnam13174, Korea  
Tel: +82-31-740-1575  
Fax: +82-31-740-1589  
E-mail: [hspark@shingu.ac.kr](mailto:hspark@shingu.ac.kr)  
<https://orcid.org/0000-0002-2981-3908>

This study was supported by a grant from Shingu College.

**Purpose:** The purpose of this study was to assess influences of psychological factors on sleep disturbances in young adults through the revised version of the Minnesota Multiphasic Personality Inventory (MMPI-2).

**Methods:** Two hundred and ninety nine college students in Gyeonggi-do completed the MMPI-2 and a questionnaire related to sleep disturbances and collected data were analyzed by logistic regression.

**Results:** The odds of tooth grinding increased significantly with the increase of T-score of hysteria (Hy) scale. The increase of T-score of hypomania (Ma) and social introversion (Si) scale significantly contributed to the risk of insomnia. The occurrence of insomnia increased significantly as T-score of somatic complaints (RC1) and psychoticism (PSYC) scale increased. The odds of tooth grinding increased significantly as T-score of anxiety (ANX) and family problems (FAM) scale increased. The occurrence of insomnia decreased significantly with the increase of T-score of type A behavior (TPA) scale. The increase of T-score of dominance (Do) scale significantly contributed to the risk of tooth clenching. The odds of tooth grinding decreased significantly as T-score of MacAndrew alcoholism-revised (MAC-R) scale increased, whereas it increased significantly as T-score of addiction potential scale (APS) increased. No scale of MMPI-2 significantly affected the occurrence of snoring.

**Conclusions:** T-scores of Hy, ANX, FAM, Do, MAC-R, and APS scales on MMPI-2 affected the risk of bruxism. T-scores of Ma, Si, RC1, PSYC, and TPA scales on MMPI-2 influenced the occurrence of insomnia. The psychometric instrument such as MMPI-2 is helpful in understanding and managing bruxism and insomnia.

**Key Words:** Bruxism; Insomnia; Minnesota Multiphasic Personality Inventory-2; Sleep disturbances

## INTRODUCTION

As a person's life style becomes more complicated, the occurrence of sleep disturbances is increasing [1]. The most common sleep disturbances comprise bruxism, snoring and insomnia. Bruxism includes both tooth clenching which is a continuously static position of maximum intercuspation and tooth grinding indicating a forceful movement of the jaw from side to side [2]. Snoring can be associated

with obstructive sleep apnea characterized by intermittent collapse of the upper airway during sleep. The prevalence rate of snoring was reported 25.7% in young adults [3]. Insomnia usually shows the delay of sleep onset, difficulty staying asleep, or awakening too early, which may contribute to initiating or perpetuating orofacial pain [4].

There have been reports on the association of psychological status with sleep disturbances [5-7]. Kang et al. [1] showed the close relation between sleep quality and

psychogenic condition using the Symptom Checklist-90-Revised (SCL-90-R) and Pittsburgh Sleep Quality Index. Manfredini et al. [8] supported an association between bruxism and certain psychopathological symptoms by means of self-report version of the Structured Clinical Interview for Panic-Agoraphobic Spectrum. Restrepo et al. [9] found a strong correlation among bruxism, the high anxiety level and the high tension personality trait using the Children's Personality Questionnaire and the Conners' Parents Rating Scales. Enright et al. [10] reported that observed apneas during sleep were associated with depression in elderly women through the modified Center for Epidemiologic Studies Depression. Buysse et al. [11] confirmed the increased risk of subsequent depression among individuals with insomnia by means of SCL-90-R.

The revised version of the Minnesota Multiphasic Personality Inventory (MMPI-2) is one of the most widely used psychometric instruments. Higher scores in MMPI-2 indicating maladaptive personality traits predicted incident chronic insomnia [12]. The psychological characteristics of the patients with bruxism were assessed by the Minnesota Multiphasic Personality Inventory (MMPI) [13]. The associations between polysomnographic variables in obstructive sleep apnea and a variety of psychological responses including depressive symptoms were evaluated by MMPI [14]. Though these studies have been performed for various age groups, the study in young adults is rare. Hence, the aim of current study is to assess influences of psychological factors on sleep disturbances through MMPI-2 in young adults.

## MATERIALS AND METHODS

This study is approved by the Institutional Review Board of Shingu College (IRB-2019-101).

### 1. Subjects

Data were collected from two hundred and ninety nine college students in Gyeonggi-do, including seventy six men and two hundred and twenty three women. Mean age of the subjects was  $19.2 \pm 2.7$  years (Table 1).

Data were obtained from October to December of 2019. Visiting a classroom, an examiner explained each item of the questionnaire (Appendix 1) related to sleep disturbances

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.

### 2. Psychological Evaluation

The MMPI-2 scales consist of the clinical scales, re-structured clinical (RC) and personality psychopathology five (PSY-5) scales, the content scales, and supplementary 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). A set of RC scales are less intercorrelated and have greater discriminant validity than the original clinical scales: demoralization (RCd), somatic complaints (RC1), low positive emotions (RC2), cynicism (RC3), antisocial behavior (RC4), ideas of persecution (RC6), dysfunctional negative emotions (RC7), aberrant experiences (RC8), hypomanic activation (RC9). The PSY-5 scales were constructed to assess personality traits relevant to both normal functioning and clinical problems: aggressiveness (AGGR), psychoticism (PSYC), disconstraint (DISC), negative emotionality/neuroticism (NEGE), introversion/low positive emotionality (INTR). The content scales represent well the content dimensions of the original MMPI: anxiety (ANX), fears (FRS), obsessiveness (OBS), depression (DEP), health concerns (HEA), bizarre mentation (BIZ), anger (ANG), cynicism (CYN), antisocial practices (ASP), type A behavior (TPA), low self-esteem (LSE), social discomfort (SOD), family problems (FAM), work interference (WRK), negative treatment indicators (TRT). The supplementary scales are judged to be a very helpful supplementary source of information in interpreting the clinical scales: anxiety (A), repression (R), ego strength (Es), dominance (Do), social responsibility (Re), college maladjustment (Mt), post-traumatic stress

**Table 1.** Demographics of the subjects

Gender	Subject	Age (y)
Men	76 (25.4)	$20.1 \pm 3.9$
Women	223 (74.6)	$18.9 \pm 2.1$
Total	299 (100.0)	$19.2 \pm 2.7$

Values are presented as number (%) or mean  $\pm$  standard deviation.

**Table 2.** Logistic regression analysis of clinical scales on sleep disturbances (n=299)

Clinical scales	$\beta$	SE	p-value	OR	95% CI	
					Lower limit	Upper limit
<b>Hs</b>						
Tooth clenching	0.002	0.036	0.959	1.002	0.933	1.075
Tooth grinding	-0.057	0.039	0.151	0.945	0.875	1.021
Snoring	0.038	0.031	0.216	1.039	0.978	1.105
Insomnia	0.065	0.034	0.052	1.068	0.999	1.140
<b>D</b>						
Tooth clenching	-0.011	0.025	0.663	0.989	0.942	1.039
Tooth grinding	0.005	0.025	0.849	1.005	0.956	1.056
Snoring	-0.017	0.021	0.425	0.983	0.943	1.025
Insomnia	0.028	0.022	0.215	1.028	0.984	1.075
<b>Hy</b>						
Tooth clenching	0.044	0.036	0.224	1.045	0.973	1.122
Tooth grinding	0.095	0.039	0.016*	1.099	1.018	1.187
Snoring	-0.026	0.032	0.416	0.975	0.916	1.037
Insomnia	-0.020	0.033	0.537	0.980	0.918	1.045
<b>Pd</b>						
Tooth clenching	-0.036	0.025	0.150	0.965	0.919	1.013
Tooth grinding	-0.046	0.026	0.074	0.955	0.908	1.005
Snoring	-0.003	0.020	0.885	0.997	0.958	1.037
Insomnia	0.009	0.021	0.670	1.009	0.968	1.052
<b>Mf</b>						
Tooth clenching	-0.005	0.014	0.742	0.995	0.968	1.023
Tooth grinding	0	0.015	0.999	1	0.971	1.030
Snoring	0.010	0.012	0.377	1.011	0.987	1.034
Insomnia	0.003	0.012	0.813	1.003	0.979	1.027
<b>Pa</b>						
Tooth clenching	-0.003	0.023	0.900	0.997	0.953	1.044
Tooth grinding	0.039	0.025	0.122	1.040	0.990	1.093
Snoring	0.016	0.020	0.418	1.016	0.977	1.056
Insomnia	0.028	0.021	0.188	1.029	0.986	1.073
<b>Pt</b>						
Tooth clenching	0.024	0.026	0.354	1.024	0.973	1.078
Tooth grinding	0.008	0.027	0.756	1.008	0.956	1.064
Snoring	0.006	0.022	0.790	1.006	0.963	1.050
Insomnia	-0.028	0.023	0.224	0.972	0.929	1.018
<b>Sc</b>						
Tooth clenching	-0.011	0.033	0.729	0.989	0.926	1.055
Tooth grinding	0.028	0.042	0.508	1.028	0.947	1.116
Snoring	-0.003	0.028	0.925	0.997	0.944	1.054
Insomnia	-0.005	0.030	0.869	0.995	0.938	1.056
<b>Ma</b>						
Tooth clenching	-0.006	0.020	0.772	0.994	0.956	1.034
Tooth grinding	0.018	0.021	0.408	1.018	0.976	1.062
Snoring	0.001	0.016	0.969	1.001	0.969	1.034
Insomnia	0.047	0.018	0.008**	1.048	1.012	1.086
<b>Si</b>						
Tooth clenching	0.009	0.019	0.616	1.009	0.973	1.047
Tooth grinding	0.015	0.023	0.523	1.015	0.970	1.062
Snoring	0.020	0.016	0.214	1.020	0.989	1.053
Insomnia	0.034	0.017	0.045*	1.034	1.001	1.069

SE, standard error; OR, odds ratio; CI, confidence interval; Hs, hypochondriasis; D, depression; Hy, hysteria; Pd, psychopathic deviation; Mf, masculinity-femininity; Pa, paranoia; Pt, psychasthenia; Sc, schizophrenia; Ma, hypomania; Si, social introversion.

Number (%): tooth clenching, 66 (22.1); tooth grinding, 65 (21.7); snoring, 119 (39.8); insomnia, 148 (49.5).

\* $p < 0.05$ , \*\* $p < 0.01$ .

**Table 3.** Logistic regression analysis of RC scales on sleep disturbances (n=299)

RC scales	$\beta$	SE	p-value	OR	95% CI	
					Lower limit	Upper limit
RCd						
Tooth clenching	-0.035	0.022	0.117	0.966	0.924	1.009
Tooth grinding	-0.013	0.022	0.536	0.987	0.946	1.030
Snoring	0.009	0.019	0.627	1.009	0.972	1.048
Insomnia	0.023	0.020	0.257	1.023	0.984	1.064
RC1						
Tooth clenching	0.010	0.019	0.584	1.010	0.974	1.049
Tooth grinding	-0.004	0.019	0.817	0.996	0.958	1.034
Snoring	-0.002	0.017	0.906	0.998	0.966	1.031
Insomnia	0.040	0.018	0.029*	1.040	1.004	1.078
RC2						
Tooth clenching	0.040	0.021	0.063	1.040	0.998	1.085
Tooth grinding	0.029	0.021	0.180	1.029	0.987	1.073
Snoring	0.007	0.019	0.695	1.007	0.971	1.046
Insomnia	0.013	0.020	0.527	1.013	0.974	1.054
RC3						
Tooth clenching	0.002	0.021	0.910	1.002	0.962	1.044
Tooth grinding	-0.007	0.021	0.736	0.993	0.953	1.035
Snoring	-0.011	0.018	0.560	0.989	0.955	1.025
Insomnia	-0.005	0.019	0.773	0.995	0.959	1.032
RC4						
Tooth clenching	-0.007	0.023	0.775	0.993	0.950	1.039
Tooth grinding	-0.010	0.023	0.656	0.990	0.946	1.036
Snoring	0.038	0.020	0.059	1.038	0.999	1.080
Insomnia	0.033	0.021	0.113	1.034	0.992	1.078
RC6						
Tooth clenching	0.001	0.021	0.947	1.001	0.961	1.043
Tooth grinding	0.003	0.021	0.901	1.003	0.962	1.045
Snoring	-0.005	0.018	0.772	0.995	0.960	1.031
Insomnia	0.005	0.020	0.821	1.005	0.965	1.045
RC7						
Tooth clenching	0.029	0.026	0.272	1.029	0.978	1.084
Tooth grinding	0.043	0.027	0.106	1.044	0.991	1.100
Snoring	0.008	0.023	0.730	1.008	0.964	1.054
Insomnia	-0.004	0.024	0.865	0.996	0.950	1.044
RC8						
Tooth clenching	0.001	0.021	0.948	1.001	0.960	1.044
Tooth grinding	0.007	0.021	0.742	1.007	0.966	1.050
Snoring	-0.013	0.019	0.493	0.987	0.952	1.024
Insomnia	0.019	0.020	0.345	1.019	0.980	1.060
RC9						
Tooth clenching	0.018	0.028	0.508	1.018	0.965	1.075
Tooth grinding	0.011	0.028	0.679	1.012	0.958	1.068
Snoring	0.024	0.024	0.313	1.025	0.977	1.074
Insomnia	-0.009	0.025	0.721	0.991	0.943	1.041

RC, restructured clinical; SE, standard error; OR, odds ratio; CI, confidence interval; RCd, demoralization; RC1, somatic complaints; RC2, low positive emotions; RC3, cynicism; RC4, antisocial behavior; RC6, ideas of persecution; RC7, dysfunctional negative emotions; RC8, aberrant experiences; RC9, hypomanic activation.

Number (%): tooth clenching, 66 (22.1); tooth grinding, 65 (21.7); snoring, 119 (39.8); insomnia, 148 (49.5).

\*p<0.05.

disorder (PK), marital distress scale (MDS), hostility (Ho), overcontrolled-hostility (O-H), MacAndrew alcoholism-revised (MAC-R), addiction admission scale (AAS), addiction potential scale (APS), masculine gender role (GM), feminine gender role (GF) [15].

### 3. Statistical Analysis

Collected response data were recorded in an Excel file. All the statistical analyses were performed by IBM SPSS Statistics for Windows, Version 25.0 (IBM Co., Armonk, NY, USA). Logistic regression analyses were conducted to evaluate impacts of MMPI-2 scales on sleep disturbances. The significance level was set to 5% ( $p < 0.05$ ).

## RESULTS

The odds of tooth grinding increased significantly with

the increase of T-score of Hy scale ( $\beta = 0.095$ ,  $p = 0.016$ ). The risk of insomnia increased significantly as T-score of Ma ( $\beta = 0.047$ ,  $p = 0.008$ ) and Si scale ( $\beta = 0.034$ ,  $p = 0.045$ ) increased (Table 2). The occurrence of insomnia increased significantly as T-score of RC1 ( $\beta = 0.040$ ,  $p = 0.029$ ) and PSYC scale ( $\beta = 0.046$ ,  $p = 0.008$ ) increased (Tables 3, 4). The odds of tooth grinding increased significantly as T-score of ANX ( $\beta = 0.049$ ,  $p = 0.046$ ) and FAM scale ( $\beta = 0.043$ ,  $p = 0.028$ ) increased. The occurrence of insomnia decreased significantly with the increase of T-score of TPA scale ( $\beta = -0.047$ ,  $p = 0.046$ ) (Table 5). The increase of T-score of Do scale significantly contributed to the risk of tooth clenching ( $\beta = 0.046$ ,  $p = 0.041$ ). The odds of tooth grinding decreased significantly as T-score of MAC-R scale ( $\beta = -0.071$ ,  $p = 0.003$ ) increased, whereas it increased significantly as T-score of APS ( $\beta = 0.045$ ,  $p = 0.020$ ) increased (Table 6). No scale of MMPI-2 significantly affected the occurrence of snoring.

**Table 4.** Logistic regression analysis of PSY-5 scales on sleep disturbances (n=299)

PSY-5 scales	$\beta$	SE	p-value	OR	95% CI	
					Lower limit	Upper limit
<b>AGGR</b>						
Tooth clenching	0.021	0.020	0.282	1.022	0.983	1.062
Tooth grinding	-0.008	0.020	0.690	0.992	0.954	1.032
Snoring	0	0.017	0.993	1	0.967	1.033
Insomnia	-0.007	0.017	0.705	0.993	0.961	1.028
<b>PSYC</b>						
Tooth clenching	0.008	0.019	0.659	1.008	0.972	1.046
Tooth grinding	0	0.019	0.982	1	0.962	1.038
Snoring	0.005	0.016	0.744	1.005	0.974	1.038
Insomnia	0.046	0.018	0.008**	1.047	1.012	1.084
<b>DISC</b>						
Tooth clenching	-0.019	0.019	0.326	0.981	0.944	1.019
Tooth grinding	0.006	0.019	0.731	1.007	0.970	1.044
Snoring	0.026	0.016	0.100	1.027	0.995	1.060
Insomnia	0.012	0.016	0.451	1.012	0.981	1.045
<b>NEGE</b>						
Tooth clenching	-0.001	0.014	0.931	0.999	0.971	1.027
Tooth grinding	0.018	0.014	0.198	1.018	0.991	1.047
Snoring	0.013	0.012	0.274	1.014	0.989	1.038
Insomnia	0.019	0.013	0.132	1.019	0.994	1.045
<b>INTR</b>						
Tooth clenching	0.017	0.016	0.299	1.017	0.985	1.050
Tooth grinding	0.017	0.016	0.288	1.017	0.986	1.050
Snoring	0.010	0.014	0.481	1.010	0.982	1.039
Insomnia	0.015	0.015	0.307	1.016	0.986	1.046

PSY-5, personality psychopathology five; SE, standard error; OR, odds ratio; CI, confidence interval; AGGR, aggressiveness; PSYC, psychoticism; DISC, disinconstraint; NEGE, negative emotionality/neuroticism; INTR, introversion/low positive emotionality.

Number (%): tooth clenching, 66 (22.1); tooth grinding, 65 (21.7); snoring, 119 (39.8); insomnia, 148 (49.5).

\*\* $p < 0.01$ .

**Table 5.** Logistic regression analysis of content scales on sleep disturbances (n=299)

Content scales	$\beta$	SE	p-value	OR	95% CI	
					Lower limit	Upper limit
ANX						
Tooth clenching	0.017	0.025	0.492	1.017	0.969	1.067
Tooth grinding	0.049	0.024	0.046*	1.050	1.001	1.101
Snoring	-0.010	0.022	0.634	0.990	0.949	1.032
Insomnia	0.038	0.023	0.101	1.039	0.993	1.087
FRS						
Tooth clenching	0.002	0.016	0.887	1.002	0.971	1.035
Tooth grinding	-0.007	0.017	0.666	0.993	0.960	1.027
Snoring	-0.009	0.014	0.541	0.991	0.964	1.019
Insomnia	-0.005	0.015	0.732	0.995	0.967	1.024
OBS						
Tooth clenching	-0.006	0.023	0.785	0.994	0.949	1.040
Tooth grinding	0.032	0.023	0.172	1.032	0.986	1.081
Snoring	0.010	0.021	0.630	1.010	0.970	1.051
Insomnia	0.013	0.021	0.537	1.013	0.972	1.056
DEP						
Tooth clenching	-0.046	0.028	0.108	0.955	0.903	1.010
Tooth grinding	0.009	0.027	0.736	1.009	0.957	1.064
Snoring	0.015	0.024	0.540	1.015	0.968	1.063
Insomnia	0.003	0.025	0.910	1.003	0.955	1.052
HEA						
Tooth clenching	0.011	0.022	0.601	1.011	0.969	1.056
Tooth grinding	-0.013	0.022	0.550	0.987	0.945	1.031
Snoring	0.016	0.019	0.398	1.016	0.979	1.055
Insomnia	0.033	0.020	0.102	1.034	0.993	1.076
BIZ						
Tooth clenching	0.015	0.022	0.502	1.015	0.972	1.060
Tooth grinding	0.007	0.023	0.760	1.007	0.963	1.053
Snoring	-0.002	0.020	0.917	0.998	0.960	1.037
Insomnia	0.008	0.020	0.690	1.008	0.969	1.049
ANG						
Tooth clenching	0.043	0.025	0.084	1.044	0.994	1.097
Tooth grinding	-0.005	0.026	0.848	0.995	0.945	1.047
Snoring	0.022	0.022	0.317	1.023	0.979	1.068
Insomnia	0.030	0.024	0.205	1.031	0.984	1.080
CYN						
Tooth clenching	-0.026	0.032	0.417	0.975	0.916	1.037
Tooth grinding	-0.018	0.032	0.558	0.982	0.923	1.044
Snoring	-0.038	0.027	0.153	0.962	0.913	1.014
Insomnia	0.004	0.027	0.879	1.004	0.952	1.059
ASP						
Tooth clenching	-0.013	0.029	0.638	0.987	0.933	1.044
Tooth grinding	-0.004	0.028	0.875	0.996	0.942	1.052
Snoring	0.006	0.024	0.813	1.006	0.959	1.055
Insomnia	-0.003	0.026	0.894	0.997	0.948	1.048
TPA						
Tooth clenching	-0.013	0.025	0.597	0.987	0.939	1.037
Tooth grinding	-0.027	0.028	0.321	0.973	0.922	1.027
Snoring	0.009	0.022	0.677	1.009	0.966	1.055
Insomnia	-0.047	0.024	0.046*	0.954	0.911	0.999
LSE						
Tooth clenching	-0.013	0.028	0.637	0.987	0.935	1.042
Tooth grinding	0.005	0.027	0.854	1.005	0.953	1.059
Snoring	0.023	0.024	0.335	1.023	0.977	1.072
Insomnia	-0.006	0.025	0.798	0.994	0.947	1.043

Table 5. Continued

Content scales	$\beta$	SE	p-value	OR	95% CI	
					Lower limit	Upper limit
SOD						
Tooth clenching	0.007	0.013	0.579	1.007	0.983	1.032
Tooth grinding	0.003	0.013	0.815	1.003	0.978	1.029
Snoring	0.009	0.011	0.414	1.009	0.988	1.030
Insomnia	0.002	0.011	0.860	1.002	0.980	1.024
FAM						
Tooth clenching	0.010	0.019	0.621	1.010	0.972	1.049
Tooth grinding	0.043	0.020	0.028*	1.044	1.005	1.086
Snoring	0.024	0.017	0.168	1.024	0.990	1.060
Insomnia	0.022	0.018	0.220	1.022	0.987	1.059
WRK						
Tooth clenching	0.036	0.033	0.277	1.037	0.971	1.107
Tooth grinding	-0.025	0.034	0.455	0.975	0.913	1.042
Snoring	-0.047	0.029	0.108	0.954	0.900	1.010
Insomnia	-0.008	0.030	0.799	0.992	0.935	1.053
TRT						
Tooth clenching	-0.003	0.032	0.928	0.997	0.937	1.061
Tooth grinding	-0.037	0.032	0.249	0.964	0.905	1.026
Snoring	0.021	0.027	0.445	1.021	0.968	1.077
Insomnia	0.003	0.028	0.912	1.003	0.949	1.060

SE, standard error; OR, odds ratio; CI, confidence interval; ANX, anxiety; FRS, fears; OBS, obsessiveness; DEP, depression; HEA, health concerns; BIZ, bizarre mentation; ANG, anger; CYN, cynicism; ASP, antisocial practices; TPA, type A behavior; LSE, low self-esteem; SOD, social discomfort; FAM, family problems; WRK, work interference; TRT, negative treatment indicators.

Number (%): tooth clenching, 66 (22.1); tooth grinding, 65 (21.7); snoring, 119 (39.8); insomnia, 148 (49.5).

\* $p < 0.05$ .

## DISCUSSION

The importance of sleep in maintaining health is now becoming increasingly recognised in young adults, particularly due to our 24-hour culture of connectivity and media consumption [16,17]. The prevalence of bruxism depends on the development of civilization and the modern lifestyle [18]. The prevalence of bruxism, with either grinding or clenching was documented by 6% to 20% of adults according to epidemiologic surveys in USA student population [19]. In the current study 22.1% of subjects clenched teeth during sleep and 21.7% ground teeth during sleep. While about one third of the United Kingdom population aged 18 and above snored at night [20], 39.8% of subjects in the present study reported snoring. The prevalence rate of insomnia in this study was 49.5% which was higher than that noted in previous investigation in which insomnia was reported by 22.8% of the general Korean adult population [21].

There has been an increasing interest in the relationship between sleep problems and mental health. Bruxing

behavior was observed in those with higher Hy scores of MMPI, indicating that there was a close relationship between Hy and bruxing behavior [22]. The mean anxiety scores of the Hospital Anxiety Depression Scales and the Hamilton Anxiety Rating Scale were statistically significant higher in patients with bruxism compared with those without bruxism, suggesting that there may be an association between bruxism and higher levels of anxiety [23]. Problems such as discord in the family are often revealed during taking the bruxer's medical history [18]. Sleep bruxism was associated positively with alcohol, caffeine, and tobacco [24]. These studies support the current result that the odds of tooth grinding increased significantly with the increase of T-score of Hy, ANX, FAM, and APS scale on MMPI-2. The present result that odds of tooth grinding decreased significantly with the increase of T-score of MAC-R scale was contrary to my expectation. This result reflects the fact that high scores on MAC-R scale may indicate persons who are socially extroverted less vulnerable to stress although high scores of MAC-R scale suggest the possibility



**Table 6.** Logistic regression analysis of supplementary scales on sleep disturbances (n=299)

Supplementary scales	$\beta$	SE	p-value	OR	95% CI	
					Lower limit	Upper limit
<b>A</b>						
Tooth clenching	0.016	0.041	0.695	1.016	0.938	1.100
Tooth grinding	-0.020	0.041	0.628	0.980	0.904	1.063
Snoring	0.027	0.035	0.436	1.028	0.960	1.101
Insomnia	-0.034	0.035	0.342	0.967	0.902	1.036
<b>R</b>						
Tooth clenching	-0.029	0.023	0.218	0.972	0.928	1.017
Tooth grinding	-0.047	0.024	0.053	0.954	0.910	1.001
Snoring	-0.036	0.020	0.073	0.964	0.927	1.003
Insomnia	-0.022	0.021	0.297	0.979	0.939	1.019
<b>Es</b>						
Tooth clenching	-0.012	0.027	0.665	0.988	0.937	1.043
Tooth grinding	-0.014	0.028	0.620	0.986	0.933	1.042
Snoring	0.010	0.024	0.673	1.010	0.964	1.058
Insomnia	-0.006	0.025	0.793	0.994	0.947	1.043
<b>Do</b>						
Tooth clenching	0.046	0.023	0.041*	1.048	1.002	1.095
Tooth grinding	0.006	0.023	0.804	1.006	0.961	1.052
Snoring	-0.011	0.019	0.577	0.989	0.953	1.027
Insomnia	0.010	0.019	0.592	1.010	0.973	1.049
<b>Re</b>						
Tooth clenching	-0.015	0.025	0.550	0.985	0.939	1.034
Tooth grinding	-0.001	0.025	0.953	0.999	0.950	1.049
Snoring	0.006	0.021	0.774	1.006	0.966	1.048
Insomnia	-0.003	0.021	0.902	0.997	0.957	1.039
<b>Mt</b>						
Tooth clenching	0.014	0.035	0.682	1.014	0.947	1.087
Tooth grinding	-0.042	0.037	0.261	0.959	0.892	1.031
Snoring	0.012	0.030	0.691	1.012	0.954	1.074
Insomnia	0.057	0.031	0.066	1.058	0.996	1.124
<b>PK</b>						
Tooth clenching	-0.012	0.039	0.763	0.988	0.916	1.067
Tooth grinding	0.048	0.040	0.236	1.049	0.969	1.135
Snoring	-0.015	0.033	0.658	0.986	0.924	1.051
Insomnia	0.031	0.033	0.348	1.032	0.966	1.102
<b>MDS</b>						
Tooth clenching	0.011	0.024	0.648	1.011	0.965	1.058
Tooth grinding	0.040	0.025	0.108	1.041	0.991	1.092
Snoring	0.024	0.021	0.242	1.025	0.984	1.067
Insomnia	0.007	0.021	0.730	1.007	0.966	1.050
<b>Ho</b>						
Tooth clenching	0.005	0.031	0.876	1.005	0.946	1.068
Tooth grinding	-0.009	0.033	0.782	0.991	0.929	1.057
Snoring	-0.047	0.027	0.084	0.954	0.904	1.006
Insomnia	-0.009	0.027	0.744	0.991	0.940	1.046
<b>O-H</b>						
Tooth clenching	0.013	0.019	0.493	1.013	0.976	1.052
Tooth grinding	-0.012	0.020	0.545	0.988	0.951	1.027
Snoring	-0.025	0.016	0.126	0.975	0.945	1.007
Insomnia	0.002	0.017	0.915	1.002	0.970	1.035
<b>MAC-R</b>						
Tooth clenching	-0.016	0.022	0.485	0.985	0.942	1.029
Tooth grinding	-0.071	0.024	0.003**	0.931	0.888	0.977
Snoring	0.007	0.019	0.711	1.007	0.970	1.046
Insomnia	0.010	0.019	0.605	1.010	0.972	1.049



Table 6. Continued

Supplementary scales	$\beta$	SE	p-value	OR	95% CI	
					Lower limit	Upper limit
AAS						
Tooth clenching	-0.021	0.023	0.352	0.979	0.936	1.024
Tooth grinding	-0.001	0.023	0.974	0.999	0.956	1.045
Snoring	-0.001	0.019	0.944	0.999	0.962	1.037
Insomnia	-0.011	0.020	0.589	0.989	0.951	1.029
APS						
Tooth clenching	-0.003	0.019	0.878	0.997	0.961	1.034
Tooth grinding	0.045	0.019	0.020*	1.046	1.007	1.087
Snoring	0.005	0.016	0.742	1.005	0.975	1.036
Insomnia	-0.008	0.016	0.613	0.992	0.962	1.023
GM						
Tooth clenching	-0.020	0.023	0.383	0.980	0.937	1.025
Tooth grinding	-0.006	0.024	0.790	0.994	0.949	1.041
Snoring	-0.001	0.020	0.977	0.999	0.961	1.039
Insomnia	-0.017	0.020	0.402	0.983	0.945	1.023
GF						
Tooth clenching	0.013	0.022	0.548	1.014	0.970	1.059
Tooth grinding	0.014	0.023	0.535	1.014	0.970	1.061
Snoring	-0.033	0.019	0.081	0.968	0.933	1.004
Insomnia	-0.012	0.019	0.513	0.988	0.951	1.025

SE, standard error; OR, odds ratio; CI, confidence interval; A, anxiety; R, repression; Es, ego strength; Do, dominance; Re, social responsibility; Mt, college maladjustment; PK, post-traumatic stress disorder; MDS, marital distress scale; Ho, hostility; O-H, overcontrolled-hostility; MAC-R, MacAndrew alcoholism-revised; AAS, addiction admission scale; APS, addiction potential scale; GM, masculine gender role; GF, feminine gender role.

Number (%): tooth clenching, 66 (22.1); tooth grinding, 65 (21.7); snoring, 119 (39.8); insomnia, 148 (49.5).

\* $p < 0.05$ , \*\* $p < 0.01$ .

of alcohol or other substance abuse problems [15]. While high scorers on Do scale appear stronger in face-to-face personal situations and self-confident, high scorers on Si scale are insecure in social situations and lack self-confidence [15]. The current result that the risk of tooth clenching increased significantly with the increase of T-score of Do scale seems contradictory to the previous study [13] that the group of clenching type had higher score on Si scale.

Certain personality traits may constitute important predisposing and perpetuating factors for insomnia [25]. Mendelson et al. [26] revealed that insomniacs had higher scores on Si scale of MMPI than control subjects. Schneider-Helmert [27] concluded that patients with insomnia were somatizing and more introverted when compared to normal sleepers. Insomniacs had significantly higher MMPI scores than did normal sleepers on Hy and Sc scales, appearing to be more neurotic, anxious, and worried than their normal counterparts [28]. Shealy et al. [29] found that insomniacs who failed in treatment generally had higher scores on Ma

and Sc scales of MMPI. These findings explain the present result that the odds of insomnia increased significantly with the increase of T-score of Ma, Si, RC1, and PSYC scale on MMPI-2. Against the expectation, the odds of insomnia decreased significantly with the increase of T-score of TPA scale in the current result, since high scorers on TPA scale are hard-driving, frequently hostile, irritable and easily annoyed [15]. Lee JS et al. suggested that there was no significant difference in T-score of TPA scale on MMPI-2 between the elderly insomniacs and noninsomniacs [30].

This study was subject to limitations comprising subjects of narrow age range, simple items of the questionnaire, and no use of polysomnography. However, It investigated all scales on MMPI-2 in contrast to previous studies focusing on clinical scales.

Conclusively, T-scores of Hy, ANX, FAM, Do, MAC-R, and APS scales on MMPI-2 affected the risk of bruxism. T-scores of Ma, Si, RC1, PSYC, and TPA scales on MMPI-2 influenced the occurrence of insomnia. The psychometric

instrument such as MMPI-2 is helpful in understanding and managing bruxism and insomnia.

## CONFLICT OF INTEREST

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

## ORCID

Hye Sook Park

<https://orcid.org/0000-0002-2981-3908>

## REFERENCES

- Kang JK, Lim HD, Lee YM. Association between sleep quality and psychologic factors among university students in Korea. *Korean J Oral Med* 2008;33:257-267.
- Jang SM, Jeon HM, Kim KH, et al. Application of botulinum toxin on masticatory muscle of patients with bruxism. *J Oral Med Pain* 2014;39:55-62.
- Hui DS, Chan JK, Ho AS, Choy DK, Lai CK, Leung RC. Prevalence of snoring and sleep-disordered breathing in a student population. *Chest* 1999;116:1530-1536.
- Kim KS. Factors contributing to temporomandibular disorders. *J Korean Dent Assoc* 1991;29:354-358.
- Ahlberg J, Lobbezoo F, Ahlberg K, et al. Self-reported bruxism mirrors anxiety and stress in adults. *Med Oral Patol Oral Cir Bucal* 2013;18:e7-e11.
- Li AM, Au CT, So HK, Lau J, Ng PC, Wing YK. Prevalence and risk factors of habitual snoring in primary school children. *Chest* 2010;138:519-527.
- Vgontzas AN, Vgontzas. The diagnosis and treatment of chronic insomnia in adults. *Sleep* 2005;28:1047-1048.
- Manfredini D, Landi N, Fantoni F, Segù M, Bosco M. Anxiety symptoms in clinically diagnosed bruxers. *J Oral Rehabil* 2005;32:584-588.
- Restrepo CC, Vásquez LM, Alvarez M, Valencia I. Personality traits and temporomandibular disorders in a group of children with bruxing behaviour. *J Oral Rehabil* 2008;35:585-593.
- Enright PL, Newman AB, Wahl PW, Manolio TA, Haponik EF, Boyle PJ. Prevalence and correlates of snoring and observed apneas in 5,201 older adults. *Sleep* 1996;19:531-538.
- Buysse DJ, Angst J, Gamma A, Ajdacic V, Eich D, Rössler W. Prevalence, course, and comorbidity of insomnia and depression in young adults. *Sleep* 2008;31:473-480.
- Singareddy R, Vgontzas AN, Fernandez-Mendoza J, et al. Risk factors for incident chronic insomnia: a general population prospective study. *Sleep* 2012;13:346-353.
- Park BO, Lee HC, Jang MJ, Shim JC. MMPI profiles of the patients with bruxism. *J Korean Neuropsychiatr Assoc* 1999;38:523-529.
- Aikens JE, Caruana-Montaldo B, Vanable PA, Tadimeti L, Mendelson WB. MMPI correlates of sleep and respiratory disturbance in obstructive sleep apnea. *Sleep* 1999;22:362-369.
- Graham JR. *MMPI-2: assessing personality and psychopathology*. 5th ed. New York: Oxford University Press; 2011. pp. 63-221.
- Cain N, Gradisar M. Electronic media use and sleep in school-aged children and adolescents: a review. *Sleep Med* 2010;11:735-742.
- Lemola S, Perkinson-Gloor N, Brand S, Dewald-Kaufmann JF, Grob A. Adolescents' electronic media use at night, sleep disturbance, and depressive symptoms in the smartphone age. *J Youth Adolesc* 2015;44:405-418.
- Wieckiewicz M, Paradowska-Stolarz A, Wieckiewicz W. Psychosocial aspects of bruxism: the most paramount factor influencing teeth grinding. *Biomed Res Int* 2014;2014: 469187.
- Glaros AG. Incidence of diurnal and nocturnal bruxism. *J Prosthet Dent* 1981;45:545-549.
- Lechner M, Breeze CE, Ohayon MM, Kotecha B. Snoring and breathing pauses during sleep: interview survey of a United Kingdom population sample reveals a significant increase in the rates of sleep apnoea and obesity over the last 20 years - data from the UK sleep survey. *Sleep Med* 2019;54:250-256.
- Cho YW, Shin WC, Yun CH, Hong SB, Kim J, Earley CJ. Epidemiology of insomnia in Korean adults: prevalence and associated factors. *J Clin Neurol* 2009;5:20-23.
- Molina OF, Peixoto MGS, Santos ZC, Penoni JDS, Aquilino RN, Peixoto MAS. Bruxism as mechanism subserving hysteria: a new theory. *Rev Neurocienc* 2008;16:262-268.
- Gungormus Z, Erciyas K. Evaluation of the relationship between anxiety and depression and bruxism. *J Int Med Res* 2009;37:547-550.
- Bertazzo-Silveira E, Kruger CM, Porto De Toledo I, et al. Association between sleep bruxism and alcohol, caffeine, tobacco, and drug abuse: a systematic review. *J Am Dent Assoc* 2016;147:859-866.
- van de Laar M, Verbeek I, Pevernagie D, Aldenkamp A, Overeem S. The role of personality traits in insomnia. *Sleep Med Rev* 2010;14:61-68.
- Mendelson WB, Garnett D, Gillin JC, Weingartner H. The experience of insomnia and daytime and nighttime functioning. *Psychiatry Res* 1984;12:235-250.
- Schneider-Helmert D. Twenty-four-hour sleep-wake function and personality patterns in chronic insomniacs and healthy controls. *Sleep* 1987;10:452-462.
- Freedman RR, Sattler HL. Physiological and psychological factors in sleep-onset insomnia. *J Abnorm Psychol* 1982;91:380-389.
- Shealy RC, Lowe JD, Ritzler BA. Sleep onset insomnia: personality characteristics and treatment outcome. *J Consult Clin Psychol* 1980;48: 659-661.
- Lee JS, Yoo RY, Nam HJ, et al. Clinical characteristics of elderly patients aged over 65 years with insomnia symptoms. *J Korean Sleep Res Soc* 2013;10:25-30.

**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 clenched your teeth during sleep or awaked with your teeth clenched?

- 1) Yes                      2) No

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

- 1) Yes                      2) No

3. Have you ever snored during sleep or heard that you were a snorer?

- 1) Yes                      2) No

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

- 1) Yes                      2) No

Thank you for your cooperation.