

Clinical Article

The Psychopathological Influence of Adolescent Idiopathic Scoliosis in Korean Male : An Analysis of Multiphasic Personal Inventory Test Results

Chang Hyun Oh, M.D.,¹ Yu Shik Shim, M.D.,² Seung Hwan Yoon, M.D., Ph.D.,² Hyeong-chun Park, M.D.,² Chong Oon Park, M.D.,² Myoung Seok Lee, M.D.³

Department of Neurosurgery,¹ Guro Teun Teun Hospital, Seoul, Korea

Department of Neurosurgery,² Inha University Hospital, College of Medicine, Inha University, Incheon, Korea

Department of Radiology,³ Seoul Regional Military Manpower Administration, Seoul, Korea

Objective : There are few published studies which have documented psychopathological abnormalities in patients with of adolescent idiopathic scoliosis (AIS) The aim of this study was to evaluate the psychopathological influence of AIS in Korean 19-year-old males.

Methods : The authors compared the Korean military multiphasic personal inventory (KMPI) military profiles of 105 AIS cases (more than 10 degrees of Cobb's angle without surgical treatment) with the KMPI profiles of 108 normal controls. The AIS group was split depending on Cobb's angle to further evaluate this relation by the severity of AIS.

Results : A significantly decreased result on the faking-good response scale and an significantly increased result on the faking-bad response were observed in the AIS group compared to the control ($p < 0.012$). The neurosis scale results, including anxiety, depression and somatization symptoms, were significantly increased in the AIS group compared to the control ($p < 0.010$). The severity level of personality disorder and schizophrenia were also significantly increased in the AIS group ($p < 0.010$). Differences in KMPI scale scores were not related to the severity of AIS.

Conclusion : Young males with AIS tend to have abnormal results on the multiphasic personal inventory test compared to normal volunteers, suggesting that AIS may be related to psychopathology in the young male group in Korea. Although these psychopathology in AIS were differently observed compared to normal controls, but not interfered with military life. Clinicians are recommended to pay attention the psychopathological traits of patients with AIS.

Key Words : Adolescent idiopathic scoliosis · Multiphasic personal inventory · Psychopathology · Korea · Conscription.

INTRODUCTION

Patients with idiopathic scoliosis are nervous about the deformed trunk of the patient on a regular basis, and experience strong anxiety that the patient may lead their life with a deformed trunk in the future^{1,2,8,18}. The multiphasic personal inventory test is widely used to investigate personality structure and psychopathology in various disciplines, but it is not commonly used in the field of spinal deformity disease. Additionally, there are few published studies which have documented psychopathological abnormalities in patients with adolescent idiopathic scoliosis (AIS). This study, therefore, using tests re-

sults from the Korean conscription system, reviews multiphasic personal inventory test scores to examine the psychological influence of AIS in Korean male adolescents.

MATERIALS AND METHODS

Korea has a conscription system, meaning that all males are examined for conscription by the Military Manpower Administration. In the course of this examination, examinees are administered the Korean military multiphasic personality inventory test (KMPI) from April to November 2011. By using these results, we collected the data of normal healthy volunteers and

• Received : July 12, 2012 • Revised : October 15, 2012 • Accepted : January 15, 2013

• Address for reprints : Seung Hwan Yoon, M.D., Ph.D.

Department of Neurosurgery, Inha University Hospital, College of Medicine, Inha University, 27 Inhang-ro, Jung-gu, Incheon 400-711, Korea
Tel : +82-32-890-2370, Fax : +82-32-890-2374, E-mail : nsyoon@gmail.com

• This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/3.0>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

examinees with AIS. All examinees in this study were 19-year-old males tested at the Seoul regional Military Manpower Administration.

The normal group subjects (n=108) were interviewed by one physician and had no medical history, including that of spinal conditions, and no history of psychological problems. The examinees with AIS (105 cases) had their condition confirmed by thoraco-lumbar standing radiographs (TLRS) during the conscription process. The Cobb angle was the crossed angle on the perpendicular line from each end vertebrae that are the vertebrae at the upper and lower limits of the curve which tilted most severely toward the concavity of the curve^{4,5}. We considered normal spinal curvature to be a Cobb angle of less than 10 degrees. Cobb angles in TLRS were recorded by a radiologist, an orthopedic surgeon and a neurosurgeon separated from each other. If the checked Cobb angle was differently checked by different physician, the Cobb angle was rechecked, and the median angle was selected in the situation of inter-observer variability. In this study, to examine psychopathological effects by the severity of AIS, cases with AIS was categorized by Cobb's angle according to the guideline issued by the Korean military directorate; 1) mild group with more than 10 degrees and lesser than 25 degrees of Cobb angle, 2) moderate group with more than 25 degrees and lesser than 40 degrees of Cobb angle, and 3) severe group with more than 40 degrees of Cobb angle using TLRS. In Korea conscription, cases with normal to mild scoliosis were judged as military service, cases with moderate scoliosis were decided as public service workers, and severe AIS cases were exempted from military service. Each AIS groups were compared in terms of KMPI results.

The KMPI is a conventional type of the Minnesota multiphasic personality inventory test (MMPI) adjusted for Korean conscription¹⁶. The KMPI was created in five stages. First, several military-associated questions were added to the pre-existing MMPI. A pre-test (575 questions) was administered to normal soldiers, normal university students, military prisoners, military hospital psychiatric patients and private hospital psychiatric patients. After this, three scales (validity scale, clinical scale and content scale) were established and divided by several profiles, similar to the MMPI. For the final examination, score standardization and a yield of distinct function were performed. The KMPI is similar to the MMPI in its overall aspects¹⁶. The KMPI also sets scores for each scale, which are transformed into a standardized T-score. Therefore, by comparing the T-scores of

each group, we can easily measure trends in personality and psychopathology.

Several item groups are analyzed by the KMPI, such as the Response Set, Neurosis Set, Psychopathy Set, Accident Set, Prediction Set of accidents, and the Special Set. If results on any one of these scales exceeded the normal range, this data was automatically categorized as an abnormal result. In this study, the results were divided into three types; Response Set (faking-good response, faking-bad response, and infrequency scale), the Neurosis Set (anxiety, depression, and somatization), and the Psychopathy Set (schizophrenia, personality disorder, and paranoia). Evaluation of the statistical significance of differences was carried out using student t-tests. Tests were considered significant at *p*-values of less than 0.05. Statistical comparisons were analyzed using SPSS 12.0 (SPSS Inc., Chicago, IL, USA).

RESULTS

In this study, all 213 examinees were 19-year-old males who lived in Seoul. In both groups, examinees with psychological problems (depression, anxiety disorder, schizophrenia, etc.) were excluded. Table 1 shows the types of AIS participants had according to the severity of Cobb angle in this study. Mild group (more than 10 degrees and lesser than 25 degrees of Cobb angle) was 49 cases, moderate group (more than 25 degrees and lesser than 40 degrees of Cobb angle) was 50 cases, and severe group (more than 40 degrees of Cobb angle) was 6 cases. The severe cases were so few, so we conducted the AIS group categorize to mild group and moderate to severe group. The operated cases were 2, and these cases were not included in the KMPI profiles to avoid the interference of scoliosis surgical correction.

Table 2, Fig. 1 and 2 summarize the KMPI results for the normal group and the AIS group. The proportion of abnormal results, the Response Set, the Neurosis Set, and the Psychopathy Set of KMPI were compared between the two groups. There were significantly differently increased abnormal results in the AIS group (22.9%) than in the normal group (9.3%, *p*=0.007) (Fig. 1). In the KMPI results, the faking-good and bad response scale, the Neurosis Set (anxiety, depression, and somatization scale), and the Psychopathy Set (schizophrenia and personality disorder scale) were all significantly different between the two groups. The faking-good response scale showed significantly decreased results in the AIS group compared to the normal volunteer group (*p*=0.012). The faking-bad response was, by contrast, significantly increased in the AIS group (*p*=0.011). The infrequency scale was not differed by group (*p*=0.280). In the Neurosis Set, all the scales of anxiety, depression, and somatization were significantly increased in the AIS group (*p*=0.010, 0.003 and 0.002, respectively). In the Psychopathy Set, the schizophrenia and personality disorder scales

Table 1. Types of adolescent idiopathic scoliosis according to the severity of Cobb angle

Type of adolescent idiopathic scoliosis	Cobb angle	No. of cases
Mild group		49
Mild adolescent idiopathic scoliosis	10-25	49
Moderate to severe group	-	56
Moderate adolescent idiopathic scoliosis	25-40	50
Severe adolescent idiopathic scoliosis	>40	6
Total	-	105

Table 2. Korean military multiphasic inventory test results in the normal volunteer group and the adolescent idiopathic scoliosis group

Korean military multiphasic inventory test	Normal volunteer group (n=108)	Adolescent idiopathic scoliosis group (n=105)	p
Abnormal result (n, %)	10 (9.3)	24 (22.9)	0.007
Response Set (mean±SD)			
Faking-good response	52.03±8.54	48.48±11.74	0.012
Faking-bad response	47.28±9.05	50.77±10.88	0.011
Infrequency scale	48.93±9.51	50.31±9.19	0.280
Neurosis Set (mean±SD)			
Anxiety	47.44±9.00	51.26±12.28	0.010
Depression	47.87±9.55	52.66±13.61	0.003
Somatization	48.58±9.74	53.35±12.82	0.002
Psychopathy Set (mean±SD)			
Schizophrenia	47.43±7.98	50.79±10.64	0.010
Personality disorder	46.28±8.85	51.07±12.04	0.001
Paranoid	48.34±9.36	50.20±10.74	0.180

showed a significantly increase in the AIS group ($p=0.010$ and 0.001), with no other differences present.

We separated AIS subjects by the severity of Cobb angle. Mild group and moderate to severe group cases were 49 and 56 cases. Fig. 2 and Table 3 show the KMPI results by these two subgroups. There were no differences between groups in all KMPI profiles.

DISCUSSION

The multiphasic personality inventory is designed to assist in identifying personality structures and psychopathology²². The MMPI is one of the most frequently used personality tests in the mental health field^{19,21}. It also has wider applicability and use; for example, it is used in law to identify malingering claims. However, this test is not commonly applied in the field of spinal deformity disease, and there are a few published studies about psychopathological abnormality in patients with AIS. Because the spinal deformity disease is a main concern of neurosurgical field, meticulous care about its psychopathological influence is required by neurosurgeons.

In the MMPI, there are ten types of clinical scales : hypochondriasis (concern with bodily symptoms); depression (depressive symptoms); hysteria (fixation on problems and vulnerabilities); psychopathic deviate (conflict, struggle, anger, respect for society's rules); masculinity/femininity (stereotypical masculine or feminine interests/behavior); paranoia (level of trust, suspiciousness, sensitivity); psychasthenia (worry, anxiety, tension, doubts, obsessiveness); schizophrenia (odd thinking and social alienation); hypomania (level of excitability), and social introversion (people orientation)¹⁷. MMPI analysis focuses on the relative elevation of profiles, with these being compared to profiles of various normal groups. Raw scores are transformed into standardized metric scores, T-scores, in order to facilitate clinical interpretation.

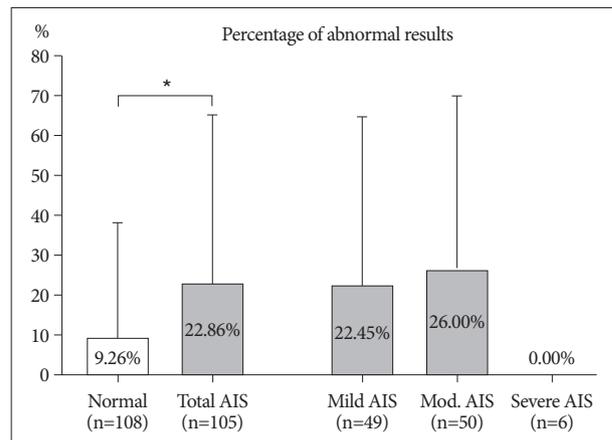


Fig. 1. Abnormal result percentages of Korean military multiphasic personality inventory test in the normal curves and adolescent idiopathic scoliosis (AIS) according to the severity of Cobb angle. *Statistically significant different.

In this study, the KMPI was applied, which is an adjusted form of the MMPI. In this study, only three sets of the KMPI were used. Of these, the Response Set comprised faking-good response, faking-bad response, and infrequent response scale. People fake good responses (faking-good response) when they feel it will serve their interests to skew their answers so as to put them in what they perceive to be a good light. The opposite of this is faking-bad. The infrequent response scale detects infrequent responding among psychopathological populations. Second, the Neurosis Set comprises anxiety, depression, and somatization scales, presenting the respondent's tendency toward these neurotic statuses. Third, the Psychopathy Set comprises schizophrenia, personality disorder, and paranoia subscales, which also capture tendencies toward these conditions.

As shown in Fig. 1 and Table 2, young males with AIS tended to have more abnormal results on the multiphasic personal inventory test compared to normal volunteers. Decreased results

on the faking-good response scale and increased results on the faking-bad response scale were observed in the AIS group, compared with the normal group. The Neurosis Set responses

were also markedly increased in the AIS group. The schizophrenia and personality disorder scores were also elevated in the AIS group. Therefore it can be suggested that AIS conditions have a

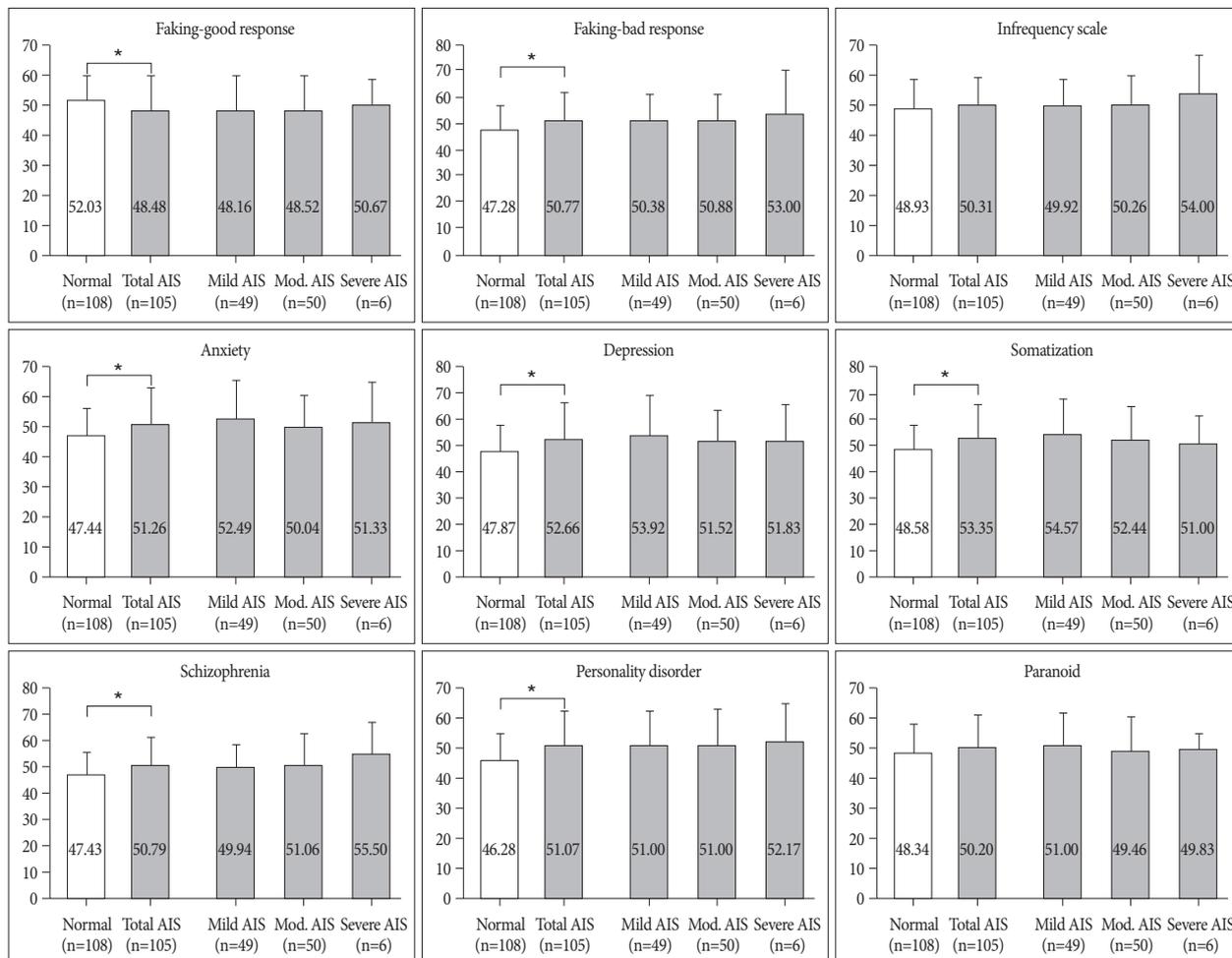


Fig. 2. Diagrams of Korean military multiphasic personality inventory test results in the normal curves and adolescent idiopathic scoliosis (AIS) according to the severity of Cobb angle. *Statistically significant different.

Table 3. KMPI results in the adolescent idiopathic scoliosis according to the severity of Cobb angle

Korean military multiphasic inventory test	Mild scoliosis group (n=49)	Moderate to severe scoliosis group (n=56)	<i>P</i>
Abnormal result (n, %)	11 (22.5)	13 (22.9)	0.927
Response Set (mean±SD)			
Faking-good response	48.16±12.20	48.75±11.43	0.800
Faking-bad response	50.39±10.62	51.11±11.18	0.737
Infrequency scale	49.92±8.35	50.66±9.92	0.682
Neurosis Set (mean±SD)			
Anxiety	52.49±13.84	50.18±10.75	0.338
Depression	53.92±15.30	51.55±11.97	0.377
Somatization	54.57±13.18	52.29±12.52	0.365
Psychopathy Set (mean±SD)			
Schizophrenia	49.94±8.99	51.54±11.93	0.446
Personality disorder	51.00±12.02	51.13±12.17	0.958
Paranoid	51.00±10.98	49.50±10.57	0.488

KMPI : Korean military multiphasic personality inventory test

significant effect on the psychological state of adolescents.

In previous literature, the multiphasic personal inventory test in the AIS was not usually used. Maudsley personality test¹⁰⁻¹³, Erich Mittenecker and Walter Toman personality test¹⁴, Psychological General Well-being Index^{5,7}, Short Form-36^{4,5}, Oswestry Disability Back Pain Questionnaire^{5,7}, Scoliosis Research Society Patient Questionnaire^{3,4}, and Frankfurt Self-concept Scales²⁰ were used to prevent patients stopping brace use or to assess the quality of life in AIS. Most of these studies indicated that AIS subjects had poorer psychological and quality of life outcomes than normal controls, which is similar to this study's results. Kasai et al.¹¹ reported patients with scoliosis have frequently a slight introversion and mild neurotic tendency. Misterska et al.¹⁴ reported that patients with scoliosis self report having more self-criticism expression than their healthy peers. Noonan et al.¹⁵ also concluded that transient psychological effects are often present during treatment of scoliosis. Another study by Matsunaga et al.¹³ concluded that the measuring personality type is useful to reduce the psychological effect by offering counseling or permitting part-time brace wearing.

However, some reports that do not support those hypotheses and have reported lower levels of psychological distress, or no difference in AIS groups compared with controls. A study by Danielsson et al.⁵ about the quality of life of patients with AIS indicated little effect on the psychological and social aspects of quality of life. Imanzadeh et al.⁹ also concluded there was no significant relationship between evidence of scoliosis, depression and anxiety in athletic and non athlete subjects. These studies found some evidence that AIS subjects may even have psychological and quality of life outcomes that are similar with those for normal populations.

Although there are conflicting opinions about the psychological influence of AIS, it is nevertheless important to provide psychological support to AIS children and psychological advice to parents. This is because the common denominators for poor physical and psychological quality of life in patients with AIS were primarily personality traits, psychological distress levels and family support.

Because the personal inventory test results were significantly different between the AIS and normal volunteer groups in this study, it was hypothesized that the severity of AIS could be a trigger of abnormal personality or psychopathology. However, these scales were not correlated with the severity of AIS (Table 3). No previous studies have considered the psychopathological influence of the severity of AIS, so further research is needed to assess this issue.

This study has some limitations. First of all, the KMPI has not been widely documented or analyzed in the literature because its purpose was designed in the unique context of military conscription⁶. However, the KMPI is officially approved by the Korean government, as with the MMPI¹⁶. Secondly, only males were included in this study because the data was sourced from the military conscription examinations. Indeed, this result only

showed the tendency of psychopathological influence of AIS, and it is not indicate for changing the criteria of conscription although the data was derived from the conscription. Although abnormal results were more increased in AIS, nobody met the criteria of psychopathological ground for exemption. Despite these limitations, however, the multiphasic personal inventory test may remain a useful tool for identifying personality changes or psychopathologies in AIS patients.

CONCLUSION

Young males with AIS may be more likely to display abnormal results on the multiphasic personal inventory test compared with normal volunteers, particularly in the scales for faking-good response, faking-bad response, anxiety, depression, somatization, schizophrenia and personality disorder, irrespective of the severity of Cobb's angle. This result suggests that AIS may influence psychopathology in the young male group in Korea, although it was not interfered with military life. Therefore, clinicians are recommended to pay attention the psychopathological aspects of patients with AIS.

• Acknowledgements

This work was supported by an Inha University Research Grant.

References

1. Bridwell KH, Shufflebarger HL, Lenke LG, Lowe TG, Betz RR, Bassett GS : Parents' and patients' preferences and concerns in idiopathic adolescent scoliosis : a cross-sectional preoperative analysis. *Spine (Phila Pa 1976)* 25 : 2392-2399, 2000
2. Bunch WH, Chapman RG : Patient preferences in surgery for scoliosis. *J Bone Joint Surg Am* 67 : 794-799, 1985
3. Bunge EM, Juttman RE, de Kleuver M, van Biezen FC, de Koning HJ : Health-related quality of life in patients with adolescent idiopathic scoliosis after treatment : short-term effects after brace or surgical treatment. *Eur Spine J* 16 : 83-89, 2007
4. Danielsson AJ, Hasselius R, Ohlin A, Nachemson AL : Health-related quality of life in untreated versus brace-treated patients with adolescent idiopathic scoliosis : a long-term follow-up. *Spine (Phila Pa 1976)* 35 : 199-205, 2010
5. Danielsson AJ, Wiklund I, Pehrsson K, Nachemson AL : Health-related quality of life in patients with adolescent idiopathic scoliosis : a matched follow-up at least 20 years after treatment with brace or surgery. *Eur Spine J* 10 : 278-288, 2001
6. Fiedler ER, Oltmanns TF, Turkheimer E : Traits associated with personality disorders and adjustment to military life : predictive validity of self and peer reports. *Mil Med* 169 : 207-211, 2004
7. Haefeli M, Elfering A, Kilian R, Min K, Boos N : Nonoperative treatment for adolescent idiopathic scoliosis : a 10- to 60-year follow-up with special reference to health-related quality of life. *Spine (Phila Pa 1976)* 31 : 355-366; discussion 367, 2006
8. Maher TR, Merola A, Zipnick RI, Gorup J, Mannor D, Orchowski J : Meta-analysis of surgical outcome in adolescent idiopathic scoliosis. A 35-year English literature review of 11,000 patients. *Spine (Phila Pa 1976)* 20 : 1575-1584, 1995
9. Imanzadeh M, Asghari A, Malaei M, Jalili M : Relationship between scoliosis and depression anxiety in athlete and non athlete male students in selected universities of Tehran. *Aust J Basic Appl Sci* 5 : 307-311,

- 2011
10. Kasai Y, Morishita K, Kawakita E, Kondo T, Uchida A : Pre-and postoperative psychological characteristics in mothers of patients with idiopathic scoliosis. *Eur Spine J* 15 : 1103-1107, 2006
 11. Kasai Y, Takegami K, Uchida A : A study of patients with spinal disease using Maudsley Personality Inventory. *Int Orthop* 28 : 56-59, 2004
 12. Matsunaga S, Hayashi K, Naruo T, Nozoe S, Komiya S : Psychologic management of brace therapy for patients with idiopathic scoliosis. *Spine (Phila Pa 1976)* 30 : 547-550, 2005
 13. Matsunaga S, Sakou T, Nozoe S : Psychological effects of brace therapy on patients with idiopathic scoliosis. *J Orthop Sci* 2 : 391-395, 1997
 14. Misterska E, Glowacki M, Harasymczuk J : Personality characteristics of females with adolescent idiopathic scoliosis after brace or surgical treatment compared to healthy controls. *Med Sci Monit* 16 : CR606-CR615, 2010
 15. Noonan KJ, Dolan LA, Jacobson WC, Weinstein SL : Long-term psychosocial characteristics of patients treated for idiopathic scoliosis. *J Pediatr Orthop* 17 : 712-717, 1997
 16. Paik HK, Oh CH, Choi K, Kim CE, Yoon SH, Chung J : Influence of history of brain disease or brain trauma on psychopathological abnormality in young male in Korea : analysis of multiphasic personal inventory test. *J Korean Neurosurg Soc* 50 : 114-118, 2011
 17. Reitan RM, Wolfson D : Emotional disturbances and their interaction with neuropsychological deficits. *Neuropsychol Rev* 7 : 3-19, 1997
 18. Rinella A, Lenke L, Peelle M, Edwards C, Bridwell KH, Sides B : Comparison of SRS questionnaire results submitted by both parents and patients in the operative treatment of idiopathic scoliosis. *Spine (Phila Pa 1976)* 29 : 303-310, 2004
 19. van Balen HG, de Mey HR, van Limbeek J : A neurocorrective approach for MMPI-2 use with brain-damaged patients. *Int J Rehabil Res* 22 : 249-259, 1999
 20. Weiss HR, Cherdron J : [Effects of Schroth's rehabilitation program on the self concept of scoliosis patients]. *Rehabilitation (Stuttg)* 33 : 31-34, 1994
 21. Wetzel RD, Guze SB, Cloninger CR, Martin RL, Clayton PJ : Briquet's syndrome (hysteria) is both a somatoform and a "psychoform" illness : a Minnesota Multiphasic Personality Inventory study. *Psychosom Med* 56 : 564-569, 1994
 22. Wolf EJ, Miller MW, Orazem RJ, Weierich MR, Castillo DT, Milford J, et al. : The MMPI-2 restructured clinical scales in the assessment of posttraumatic stress disorder and comorbid disorders. *Psychol Assess* 20 : 327-340, 2008