

## IDIOPATHIC SCOLIOSIS FROM PSYCHOPATHOLOGICAL AND MIND-BODY MEDICINE PERSPECTIVES

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### SUMMARY

Idiopathic scoliosis, defined as a three-dimensional spine and trunk deformity, which appears in otherwise healthy subjects, exhibits complex relations with various forms of personal well-being and psychopathology. Most research studies have documented a higher proportion of psychological disturbances (e.g., self-criticism, negative body image, low self-esteem) and mental disorders (e.g., anxiety and depressive disorders, personality disorders) among idiopathic scoliosis patients compared to healthy controls. In addition, there are some reports, although more systematic research is warranted, on the role of mental health and personality traits in relation to the adherence to conservative treatment. Given the increasing role of surgical treatment in the management of scoliosis, as well as several reports on negative psychological outcomes of such interventions, there is a growing need for ongoing screening and mental health care in this population. It seems this also holds true for non-operative treatments, particularly bracing therapy. One should keep in mind that these scoliosis-psychopathology relations are deduced from a limited number of empirical studies, usually conducted on small sample sizes, suggesting the need for further large-scale investigations, preferably those with longitudinal research designs. Understanding the complex interplay between personality/psychopathology and spinal deformities within the framework of personalized mind-body medicine, should help clinicians tailor more individualized and specific treatments and predict therapeutic outcomes in this clinical population.

**Key words:** idiopathic scoliosis – psychopathology – personality - mind-body medicine – psychosomatic

"There is no health without mental health" (WHO 2005)

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### INTRODUCTION

Idiopathic Scoliosis (IS) is a multilevel process of a three-dimensional spine and trunk deformity, which appears in otherwise healthy subjects, and can progress in relation to multiple factors, during any period of rapid growth (Rigo & Griwas 2010). Formally, the main diagnostic criterion is a coronal curvature exceeding 10° on an anteroposterior X-ray image. Idiopathic scoliosis is classified as infantile, juvenile, or adolescent depending on the age at which it is first noted. A fourth category is that of adult scoliosis, which may be either a continuation of adolescent idiopathic scoliosis or a *de novo* development owing to degenerative changes or other causes. In elderly patients, *de novo* scoliosis is often hard to tell apart from pre-existing idiopathic scoliosis with superimposed degenerative changes. Scoliosis, in its most frequent adolescent idiopathic form diagnosed in about 80% of the cases (Aebi 2005, Weinstein et al. 2008), is the most prevalent orthopedic condition affecting children and may have lasting consequences (Asher & Burton 2004, Danielsson et al. 2001). In the overall adult population, the prevalence of scoliosis may exceed 30% (Aebi 2005). It ranges from nearly 9% in 40-year-olds to 68% in 70-year-olds (Schwab et al. 2005, Trobisch et al. 2010) and increases almost linearly from the 6<sup>th</sup> to the 8<sup>th</sup> decade of life

(Kebaish et al. 2011). In contrast to adolescents where it is significantly more frequent among girls, no associations with gender have been observed in adult samples (Weinstein et al. 2008). As is the case with most chronic medical conditions, etiopathogenesis of idiopathic scoliosis is still poorly understood and is known to influence numerous segments of one's life, including physical, emotional and societal consequences. Most prior research in this area have neglected the role of psychological and behavioral factors as relevant components of the development and prognosis of this disease. Thus, there is a growing need to educate various scoliosis-related experts and clinicians (i.e., medical doctors, physiotherapists, nurses, occupational therapists, etc.) on the relations between idiopathic scoliosis and psychological well-being, including subjective quality of life and mental disorders.

### IDIOPATHIC SCOLIOSIS AND PSYCHOPATHOLOGY

Spinal deformities may significantly exert influence on the general health and one's health-related quality of life, with a poor association between the radiographic and clinical findings (Asher & Burton 2004, Tones et al. 2007). Empirical reports have described reduced participation in social life and interpersonal relationships,

lower marriage rates, poor self-image, difficulties on the labor market, and mental/psychiatric disorders (Aebi 2005, Weinstein et al. 2008, Tones et al. 2007). Surgery or brace treatment may also lead to psychological side effects (Matsunaga et al. 2005, Sapountzi-Krepia 2001). Long-term outcome reports (e.g., Danielsson et al. 2012, Goldberg et al. 1994, Noonan et al. 1997, Weinstein et al. 2003), suggested that deformity causes psychopathological effects or demonstrated positive coping mechanisms. Furthermore, the available papers focus on the assessment of health-related quality of life and utilize generic or condition-specific measures with their physical, social, and emotional roles, mental functioning, bodily pain, and body image components, incorporated to produce a measure of a person's perceived general health status (Schwab et al. 2005, Tones et al. 2005). For this reason, specific instruments for patients with IS have been created, such the Scoliosis Research Society-22 (SRS) and the Quality of Life in Spinal deformities (QLSD). Compared to all other questionnaires, the SRS-22 is the most frequently used and adapted into numerous languages (Asher et al. 2003, Climent et al. 1995).

Misterska et al. (2010) demonstrated the absence of psychopathological traits in non-treated adolescent girls but a high level of self-criticism was ascertained. A Korean study with only male patients (Oh et al. 2014) obtained different results. When evaluating a population of 19-year-old boys with adolescent idiopathic scoliosis, they found out that these patients presented a higher incidence of anxiety, depression, schizophrenia and personality disorders compared to a control group. Chang et al. (2016) recently conducted a nationwide population-based cohort study in Taiwan, in order to investigate the relationship between scoliosis and depression. During the 5-year follow-up period, the adjusted hazard ratios of depression in patients with scoliosis (N=1409) were higher than that of the gender- and age-matched controls (N=7045). The risk of depression also demonstrated to be age-dependent for scoliosis patients. The middle-age (41-65 years old) and young adults (18-40 years old) scoliosis patients had higher hazard ratios of depressive disorders.

However, studies interested in investigating the personality traits of patients with scoliosis are limited. To know the personality of these patients may be useful to identify changes over treatment, modify the intensity of brace treatment, indicate a supportive psychological therapy and reduce dropout in conservative treatment (Misterska et al. 2010, Oh et al. 2013). In fact, through the application of scoliosis personality questionnaires, interesting results have been found. In this sense, Rivett et al. (2014) have demonstrated the existence of significant differences with reference to personality in relation to the adherence to conservative treatment: patients who adhered to treatment had a superior quality of life than the noncompliant ones and showed different psychological profiles. More specifically, a poorer quality

of life in the noncompliant group was possibly caused by personality traits of the group, being more emotionally immature and unstable, as well as less realistic. Future studies are required to further investigate the role of personality traits with regard to treatment adherence in these patients, as it was done among some other clinical populations, such as type 2 diabetes patients (Milicevic et al. 2015).

With reference to the application of projective tests, two studies reached similar results. Using Rorschach and Bender test, Bengtsson et al. (1974) found a difference in psychosocial adjustment in women with scoliosis. Superficially, the subjects seemed well adapted but from further analysis, they presented hypersensitivity and insecurity, with a tendency to dysphoric mood. Similarly, an Italian study (Saccomani et al. 1998) documented a discrepancy between a conscious body image and a deeper aspect of feelings of inferiority and insecurity through several projective tests (Human Figure Drawing (HFD) and Sacks' battery of tests). Finally, there is a lack of studies linking health-related quality of life with the personality of scoliosis patients. However, in other areas, the existence of a relationship between personality and quality of life has been shown, such as in pediatric cancer patients (DeClercq et al. 2004), young adults with asthma (Axelsson et al. 2009) or schizophrenia patients (Aukst Margetic et al. 2011).

## PSYCHOLOGICAL ASPECTS OF SCOLIOSIS PHYSICAL TREATMENT

With regard to specific physical interventions in patients suffering from idiopathic scoliosis, spinal fusion surgery with instrumentation successfully reduces severe scoliotic curves and minimizes the risk for curve progression (Tolo 1991). However, the results of treatment also depend on the patient's ability to cope with stress of chronic disability, and the surgical outcome may be unrelated to patient satisfaction (White et al. 1999). The psychological impact of spinal fusion surgery, then, is of special concern. Any conclusion about treatment effects on health and self-image should also be based on age- and sex-matched control groups. In one such study mental health was investigated in 30 young adults who were operated on for idiopathic scoliosis, 2–3 years after surgery, and the results compared to an age- and sex-matched control group of 40 individuals (Kibsgard et al. 2004). Overall, this study showed that young adults operated on for idiopathic scoliosis were satisfied, and that their mental health was even better than the normal group, but their physical health was somewhat poorer. Thus, the surgical procedure was well tolerated and had not traumatized the patients. On the other hand, a study by Plaszewski et al. (2014) showed that the presence of scoliosis and participation in the exercise program manifested

association with the symptoms of depressive disorder. These findings correspond to some reports of a negative impact of the diagnosis of scoliosis and treatment on mental health. Therefore, the decision to introduce a therapeutic program in children with mild deformities should be made with judgment of potential benefits, risks, and harm. For example, another study conducted by Matsumoto et al. (2014) examined psychosocial effects of repetitive surgeries in 34 children with early-onset scoliosis. A higher prevalence of abnormal psychosocial scores in multiple domains was found in multioperated patients as compared with national norms. Moreover, the number of repetitive surgeries also correlated positively with 3 problematic behavioral dimensions: aggression, rule-breaking, and misconduct. Misterska et al. (2010) investigated 35 scoliosis patients who were treated surgically and found that patients treated operatively, when compared to conservative treatment and healthy controls, manifested more symptoms of high neuroticism.

In addition to standardized psychopathological disturbances after scoliosis treatment, studies have also shown a lower body image that may persist for several years in surgical patients (Noonan et al. 1997). Because body image disturbances have been linked to various negative life outcomes (e.g., academic performance, job stability, marital status), a group of researchers have recently developed the first self-report questionnaire aimed at assessing body image disturbance in adolescent idiopathic scoliosis (Auerbach et al. 2014). As expected, the scores of patients with scoliosis indicated greater back-related body image disturbance compared with healthy controls.

Special attention has been paid to the experience of brace-wearing in children/adolescents with scoliosis, as long-standing observations have indicated lowered body image and higher levels of stress for these individuals. Sapountzi-Krepia et al. (2006) have observed intense subjective experiences of stress, denial, fear, anger, and shame in 12 children/adolescents undergoing bracing therapy, indicating the need for psychological and social support during the long period of bracing. Indeed, numerous authors have called for additional psychological interventions for patients within the context of in-patient rehabilitative treatment. Here, within the setting of psychological group sessions and individual discussions, the possibility exists for preventing psychosocial impairment (Reichel & Schanz 2003).

Interestingly, a recent study investigated stress symptoms among adolescents before and after scoliosis surgery, and explored correlations with postoperative pain (Rullander et al. 2016). Although rates of anxiety/depression and internalizing behavior were significantly higher before surgery than six months after, preoperative anger, social problems and attentions deficits correlated significantly with postoperative pain at follow-up. It was concluded that more focus should

be put on the implementation of interventions to reduce perioperative stress and postoperative pain in order to improve the quality of nursing care. However, another similar study has not detected the negative impact of preoperative depression on 2-year clinical outcomes following adult spinal deformity surgery after adjusting for baseline differences in comorbidities, health-related quality of life, and spinal deformity severity (Theologis et al. 2016). Additional research is required to elucidate psychological and psychopathological factors that could influence the long-term outcomes of scoliosis treatment.

In general, physical exercises in the treatment of scoliosis remain a matter of debate (Mordecai & Dabke 2012) and high-level evidence for or against these procedures is lacking (Romano et al. 2012). Given the increasing role of surgical treatment modality in the management of scoliosis, as well as several reports on negative psychological outcomes of such interventions, there is a growing need for ongoing screening and mental health care in this high-risk population.

## **INTEGRATIVE MIND-BODY MEDICINE PERSPECTIVE**

The above discussion on the various findings in the field of scoliosis-psychopathology relationship can be more thoroughly understood within the framework of mind-body medicine. Also known in the literature as psychosomatic or psychological medicine, it can be regarded as a theory of relations between the mind and body, a theory of psychosomatic illnesses that explains comorbidities of somatic and mental disorders, and a holistic treatment approach that includes both medical and psychological devices (Jakovljevic et al. 2010, Jakovljevic & Ostojic 2013). It encompasses related fields such as psychoneuroimmunology or psychoendocrinology, and in this particular case, psychorheumatology. The central premise of the psychosomatic paradigm is the awareness of complex and simultaneously multidirectional associations and influences among numerous body and mind systems, also evolving within a broader social and cultural contexts. In the case of idiopathic scoliosis, traditional empirical literature has mostly been concerned with psychological and psychiatric consequences in individuals suffering from this somatic illness, which have been thoroughly described in this paper. This is of utmost importance because in somatic patients mental vulnerabilities and disorders may: 1. modify subjective reactions to somatic symptoms (amplification), 2. reduce motivation to care for somatic illness (demoralization), 3. lead to maladaptive direct physiological effects on bodily symptoms, and 4. reduce the ability to cope with somatic illness through limitation of energy, cognitive capacity, affect regulation, perception of shame or social stigma (Jakovljevic et al. 2010, Kennedy et al. 2016). For example, research has shown how

rumination and anger influence central and autonomic nervous system function and impair functioning of the hypothalamic-pituitary adrenal cortical axis (stress system), whereas promoting forgiveness can lead to decreased musculoskeletal pain (Lee & Enright 2014), including chronic back pain typical for spinal deformity illnesses (Carson et al. 2005).

However, an additional perspective of the mind-body medicine includes a relationship where mental (psychological, psychiatric) and related behavioral factors might promote the development of deformed spinal curvatures and accompanying chronic pain. Misalignment of certain body segments as a result of postural deviation will cause compensatory effort by other segments to maintain body balance, resulting in muscular strains and stress on the neurological system and resulting in back pain. For example, some research has shown that happy thoughts lead to more upright postures, while sad thoughts lead to slumped and hunched positions. In turn, upright posture can alleviate depression by improving breathing, which leads to increased oxygen levels in the blood and subsequently relieves muscular tension in the shoulders (Ono et al. 2000). In addition, Guimond & Massrieh (2012) have demonstrated associations between postural deviations (e.g., kyphosis-lordosis, flat-back, and sway-back postures), back pain and specific types of personality structures (extraverted and introverted personalities). It seems that the body shapes itself into different postures depending on the underlying mental and emotional states, thus confirming the basic tenants of psychosomatic medicine by establishing a direct link between aspects of the mind (personality types) and body (posture and back pain). Finally, it should be noted that certain forms of psychodynamic theory and psychotherapy have long argued for specific postural deviations in individuals with immature and disturbed personalities, such as oral (depressive) or masochistic personality types (Lowen 2015), although these premises need to be further tested in empirical settings. For example, some authors have described postural deviations among psychiatric patients (e.g., slumped and hunched positions) in relation to their suppressed negative emotions and intrapsychic conflicts (Lowen 2015). Similarly, John E. Sarno (2006) has been a proponent of a popular, albeit not universally accepted, theory on the so called tension myositis syndrome that causes chronic back, neck and limb pain, mostly serving as unconscious distraction from deep and repressed emotional issues. Overall, it is imperative to properly understand the physical aspects that contribute to pain and spinal deformities along with the emotional factors contributing to such deviations, in order to appropriately modify behaviors and prevent/cure back pain. In other words, personalized mind-body/psychosomatic medicine promotes the idea that each patient is a unique individual in health and disease, and should get

highly specific and personally adjusted treatment for her or his health problems, including both mental and somatic health protection and promotion (Jakovljevic 2012, Jakovljevic & Ostojic 2013).

## CONCLUSION

Idiopathic scoliosis, defined as a three-dimensional spine and trunk deformity, which appears in otherwise healthy subjects, exhibits complex relations with various forms of personal well-being and psychopathology. Most research studies have documented a higher proportion of psychological disturbances (e.g., self-criticism, negative body image, low self-esteem) and mental disorders (e.g., anxiety and depressive disorders, personality disorders) among idiopathic scoliosis patients compared to healthy controls. In addition, there are some reports, although more systematic research is warranted, on the role of mental health and personality traits in relation to the adherence to conservative treatment. Given the increasing role of surgical treatment in the management of scoliosis, as well as several reports on negative psychological outcomes of such interventions, there is a growing need for ongoing screening and mental health care in this population. It seems this also holds true for non-operative treatments, particularly bracing therapy. One should keep in mind that these scoliosis-psychopathology relations are deduced from a limited number of empirical studies, usually conducted on small sample sizes, suggesting the need for further large-scale investigations, preferably those with longitudinal research designs. Understanding the complex interplay between personality/psychopathology and spinal deformities within the framework of personalized mind-body medicine, should help clinicians tailor more individualized and specific treatments and predict therapeutic outcomes in this clinical population.

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### **Contribution of individual authors:**

All the authors have substantially contributed to the conception and writing of this manuscript, and have approved the revised and final version of the paper.

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