

Synergistic Effect of Wuqinxi and Standardized Exercise Therapy on Physical Correction and Psychological Rehabilitation in Adolescent Idiopathic Scoliosis: A Holistic Review

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Abstract

Adolescent idiopathic scoliosis (AIS) represents a prevalent three-dimensional spinal deformity globally, imposing a dual burden of physical and psychological morbidity on adolescents. Beyond skeletal asymmetry and trunk dysfunction, AIS frequently precipitates psychological distress—including anxiety, diminished self-esteem, and social avoidance—necessitating a holistic rehabilitative approach. Grounded in the traditional Chinese medicine (TCM) philosophy of “mind-body unity” and “harmony of form and spirit”, this review proposes an integrative model combining Wuqinxi (Five-Animal Frolics) with modern standardized scoliosis-specific exercises. Wuqinxi, a traditional regimen, offers holistic benefits through dynamic stretching, regulated respiration, and mindfulness, thereby dredging meridians, balancing paraspinal muscle tension, and soothing emotions. Complementarily, evidence-based modalities such as the Schroth method provide targeted three-dimensional spinal correction, deep core activation, and neuromuscular control enhancement. The synergistic integration of these approaches generates biomechanical, neuromuscular, and psychological advantages: reducing Cobb angles and delaying curve progression while concurrently alleviating psychological distress and improving training compliance. By bridging traditional TCM health preservation with modern rehabilitation, this model not only advances integrated mind-body rehabilitation but also offers a novel theoretical framework for non-surgical management of mild-to-moderate AIS, highlighting patient-centered humanistic care.

Keywords

Traditional Health Preservation, Wuqinxi, Scoliosis-Specific Exercise

Therapy, Adolescent Idiopathic Scoliosis, Mind-Body Rehabilitation, Medical Humanistic Connotation, Integrated Chinese and Western Rehabilitation

1. Introduction

Adolescent idiopathic scoliosis is defined as spinal lateral curvature Cobb angle $> 10^\circ$ accompanied with vertebral rotation without definite congenital, neurological or organic etiology, mainly occurring in children aged 10 - 18 years during rapid growth and development [1]. In recent decades, long-term sedentary study, incorrect sitting posture and insufficient physical activity significantly increase AIS incidence in Chinese primary and secondary school students, which has become a severe public health problem threatening adolescent physical development [2].

For mild and moderate AIS without surgical indications, non-invasive conservative exercise intervention is the first-line recommended plan by International Scoliosis Society guidelines [3]. Standardized exercise therapy (SET) for adolescent idiopathic scoliosis is defined as evidence-based, protocol-driven conservative rehabilitation that targets three-dimensional spinal deformity correction, asymmetric muscle balancing, and postural proprioception retraining. The most internationally recognized systems include Schroth method, SEAS (Scientific Exercises Approach to Scoliosis), and Dobomed. These modalities focus highly on spinal biomechanical remodeling, asymmetric muscle strength training and three-dimensional rotational correction, but generally ignore adolescent psychological burden, appearance anxiety and low self-esteem caused by body deformity [4]. Single mechanical correction easily leads to low adherence, training boredom and poor long-term prognosis, forming a vicious cycle of physical deformity-negative emotion-muscle tension aggravation [5].

Traditional Chinese health preservation philosophy adheres to holistic view of man as an organic whole, unity of form, qi and spirit, preventing disease before onset and regulating both body and mind, which is naturally consistent with whole-course adolescent rehabilitation demand [6]. As the representative traditional TCM health qigong created by Hua Tuo, Wuqinxi imitates tiger, deer, bear, ape and bird movements, integrates body stretching, abdominal respiration, meridian regulation and mental calming. Existing clinical evidence has verified its efficacy in improving spinal mobility, relieving paraspinal muscle spasm and improving emotional state [7].

At present, domestic and overseas studies mostly compare single exercise efficacy, lack systematic theoretical interpretation from traditional regimen culture, and rarely conduct in-depth humanistic research on coordinated physical correction and psychological growth. Therefore, this paper constructs an integrated rehabilitation model of Wuqinxi combined with standardized scoliosis exercise therapy, analyzes internal synergistic mechanism under traditional health preservation theory, and explores its unique humanistic value in adolescent whole-life growth

health management, so as to provide reference for high-quality SCI-related comprehensive traditional-medicine rehabilitation research.

2. Theoretical Foundation of Traditional Chinese Health Preservation for AIS Mind-Body Rehabilitation

2.1. Holistic Unity of Form and Spirit in TCM Regimen

Traditional health preservation holds that human body is an inseparable unity of physical form and spiritual consciousness. Scoliosis skeletal curvature belongs to physical form damage; long-term appearance inferiority, peer vision pressure and learning anxiety induce spirit disturbance [8]. Unsmooth spirit causes qi stagnation and muscle contracture, further aggravating spinal lateral bending rotation, realizing mutual deterioration of form disorder and mental disorder [9]. Wuqinxi practice requires synchronous movement, breath and concentration, soothing liver qi, calming heart spirit while stretching tendons and bones, realizing simultaneous regulation of physique and psychology, which makes up the deficiency of pure mechanical western exercise [10].

2.2. TCM Pathogenesis Understanding of Scoliosis: Uneven Tendons and Unobstructed Qi-Blood

AIS is categorized as “spinal tendon malalignment, muscle imbalance” in TCM. Long-term improper posture leads to unilateral meridian tension, qi-blood stasis, insufficient tendon nourishment, left-right paraspinal muscle tension asymmetry, loss of spinal external traction balance and gradual curvature deformation [6]. Traditional regimen advocates stretching tendons, activating collaterals and balancing muscle tension. Multi-angle flexion, rotation and extension movements of five-animal postures fully relax contracted erector spinae, latissimus dorsi and waist fascia, improve local blood perfusion, and correct chronic asymmetric muscle stress state [11].

2.3. Preventive Treatment of Disease and Long-Term Daily Health Management Concept

Health preservation thought of “preventing disease before occurrence, preventing progression after disease onset” matches early screening and early intervention strategy of adolescent scoliosis [12]. Wuqinxi is simple, safe, low-intensity and interesting, suitable for long-term school and family persistence. Combined with professional targeted corrective training, it builds daily lifelong spinal health maintenance mode, corrects bad living habits fundamentally and reduces recurrence risk after intervention [13].

3. Synergistic Intervention Mechanism of Wuqinxi Combined with Modern Exercise Therapy

3.1. Biomechanical Synergy: Optimize Spinal Force Line and Three-Dimensional Deformity Correction

Scoliosis-specific professional exercise targets rotational angular correction, sag-

ittal plane kyphosis improvement and coronal plane trunk balance reconstruction through directional breathing and asymmetric muscle activation [14]. Wuqinxi conducts overall whole-spine multi-plane loose movement, releases spinal joint adhesion, improves thoracic and lumbar mobility, and reduces rigid curve resistance during professional correction training [7]. Evidence from preliminary AIS trials suggests that combined application may more effectively reduce Cobb angle, trunk rotation, and shoulder asymmetry compared with single intervention, trunk rotation angle and shoulder height difference than single intervention alone [15].

3.2. Neuromuscular Regulation: Activate Deep Core Muscles and Improve Proprioception Control

AIS patients generally present multifidus atrophy, transverse abdominis weakness and abnormal neuromuscular proprioceptive feedback [16]. Modern core stability exercise enhances spinal active supporting muscle brace effect. Whole-body coordinated balance training of Wuqinxi awakens deep latent muscle groups, reconstructs automatic posture correction consciousness, and enables teenagers to actively maintain neutral spinal position in daily walking and sitting [7]. Theoretically, dual intervention may optimize muscle activation sequence and eliminate chronic compensatory postural abnormalities [17].

3.3. Psychological Mind-Body Synergy: Relieve Anxiety Inferiority and Improve Rehabilitation Compliance

Adolescent scoliosis population has significantly higher incidence of depression, social avoidance and body dysmorphia than healthy peers [18]. Slow coherent breathing and mindfulness meditation in Wuqinxi. Evidence from qigong and mind-body trials indicates slow coherent breathing may activate parasympathetic activity; for AIS, this is proposed to reduce stress, improve enjoyment, and boost compliance, reduce cortisol stress level and relieve muscle tension caused by mood fluctuation [19]. Its animal imitative interesting movements avoid monotony of repeated corrective training, increase internal exercise motivation. Traditional mind-nourishing health culture guides teenagers to accept physical differences positively, shape optimistic personality and realize true holistic rehabilitation [7].

4. Unique Medical Humanistic Value of Combined Intervention from the Perspective of Traditional Chinese Health Preservation

4.1. People-Oriented Individualized Warm Rehabilitation Connotation

Different from pure objective index-oriented mechanical treatment mode, traditional regimen always takes adolescent physical characteristics, psychological feelings and growth needs as the core. The combined scheme respects individual curve classification, severity difference and personality emotion state, formulates personalized progressive training plan, pays attention to subjective comfort experience

in rehabilitation process, and reflects modern medical humanistic care beyond simple efficacy observation [20].

4.2. Cultural Inheritance: Integration of Oriental Traditional Regimen and International Rehabilitation Medicine

Popularizing Wuqinxī classic TCM health preservation skill into global AIS non-surgical rehabilitation system inherits thousands years of Chinese traditional life health wisdom. The fusion research path of combining national traditional sports therapy with international mainstream evidence-based exercise guidelines breaks regional academic barriers, promotes international recognition of traditional Chinese medicine rehabilitation culture and expands application scope of complementary and alternative medicine in adolescent orthopedic fields [6].

4.3. Focus on Whole-Cycle Adolescent Healthy Growth

Adolescence is critical period of personality shaping and physical development. This intervention not only pursues short-term curve angle improvement, but focuses on cultivating lifelong active health awareness, correct living posture and positive psychological quality. It conforms to Healthy China strategic requirements and global adolescent public health promotion goals, producing important social humanistic significance for improving national youth physical quality [21].

5. Current Limitations and Future Research Prospects

High-quality clinical evidence supporting the combined regimen of Wuqinxī and standardized scoliosis-specific exercise for adolescent idiopathic scoliosis remains scarce. Existing published studies are mostly small-sample pilot investigations with notable heterogeneity in intervention duration, training intensity and patient inclusion criteria. Well-designed multi-center, long-term randomized controlled trials are currently unavailable to validate its definitive therapeutic efficacy. Furthermore, unified operational specifications tailored to AIS have not yet been formulated, and the underlying neuroendocrine and central neuromodulatory mechanisms of mind-body exercise require further in-depth exploration. Insufficient large-sample multi-center randomized controlled trials, lack long-term 2 - 5 years growth follow-up data, non-unified standardized Wuqinxī AIS special training paradigm, and insufficient in-depth exploration of molecular neuroendocrine mechanism of psychological emotion regulation [22].

In future high-level SCI research directions:

- (1) Carry out evidence-based big data clinical trials to verify long-term curative stability;
- (2) Establish age-stage scoliosis specialized five-animal exercise standardized operation procedure;
- (3) Explore brain function imaging and inflammatory factor pathways of mind-body co-regulation;
- (4) Popularize school-family integrated traditional exercise rehabilitation mode

nationwide.

6. Conclusion

Under the guidance of traditional Chinese holistic mind-body health preservation theory, Wuqinxi was integrated with international standardized scoliosis-specific exercise therapy. Drawing on existing mechanistic evidence and preliminary AIS data, this integrated approach is proposed to provide complementary benefits in biomechanical correction, neuromuscular remodeling, and psychological modulation [23] [24]. Consequently, it holds the potential to mitigate curve progression, improve trunk function, alleviate emotional distress, and enhance treatment compliance [25]. This combined therapeutic regimen can effectively retard the progression of spinal curvature, ameliorate somatic appearance dysfunction, alleviate inferiority and anxiety symptoms among adolescents, and markedly enhance rehabilitation compliance [26]-[28]. Furthermore, this integrative strategy embodies profound heritage value of traditional Chinese health culture, people-oriented medical humanistic connotation and far-reaching significance for long-term adolescent physical and mental health development [21] [23] [27]. Such a traditional-modern holistic rehabilitation paradigm provides a novel theoretical innovation orientation and a safe, non-invasive clinical option for conservative intervention of adolescent idiopathic scoliosis worldwide, which warrants further in-depth high-quality mechanistic investigations and international clinical popularization [29] [30].

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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