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Publicity and Research on Adolescent Scoliosis

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ABSTRACT

The incidence of adolescent scoliosis (AIS) in China has been increasing year by year and has become an important issue threatening the health of adolescents. This study systematically reviewed the definition, classification and pathological mechanism of adolescent scoliosis, revealing the significant influence of factors such as genetics, growth and development, and lifestyle on its occurrence. Survey data indicates that the public's awareness of diseases is insufficient, treatment costs are high, and the coverage rate of screening is low. It is urgent to strengthen health education and early screening work. Psychological intervention strategies emphasize the importance of family and social support. Building a multi-party collaborative system can enhance the prevention and treatment effect.

KEYWORDS

Adolescent scoliosis; Health; Treatment; Psychological impact; Prevention

1. INTRODUCTION

Scoliosis is a musculoskeletal disorder characterized by an abnormal lateral curvature of the spine sometimes accompanied by vertebral rotation. Scoliosis is considered clinical when the Cobb angle is greater than 10 degrees on a spine radiograph. The most prevalent subtype is Adolescent Idiopathic Scoliosis (AIS), which typically develops in the pubertal growth spurt of adolescence. Although the absolute etiology of AIS has not been identified, it is thought to be produced by a combination of biomechanical, genetic, and postural factors.

In the past decades, the occurrence of scoliosis in adolescents in China has rapidly risen with enhanced sedentary habits, abnormal TV watching, and incorrect postures as a result of learning stress and electronic device use. The latest data shows that the abnormal curvature rate of the spine among children and teenagers aged 5-17 in China is as high as 30%, and the incidence of spinal curvature exceeds 5%. It is estimated that the number of primary and secondary school students with spinal curvature in China has exceeded 5 million at present, and it is increasing at a rate of 300,000 each year. At present, spinal curvature has become the "third major killer" threatening the health of Chinese children and teenagers after obesity and myopia. [1] Although the impact is becoming increasingly significant, there are still problems of insufficient diagnosis and lack of effective treatment methods in the medical and educational fields for this disease.

Medical consequences of scoliosis appear on three interdependent levels. On the first, bodily level, the progression of curvature of the spine may cause truncal asymmetry, pelvic tilt, deviated gait pattern, long-term backache, and in severe cases, impaired cardiopulmonary functioning. On the second level, psychological effects are likewise well-documented: because adolescence is a phase of

identity development, visually apparent spinal curvature can lead to low self-esteem, social isolation, and poor school performance. Thirdly, on a community level, untreated scoliosis results in long-term healthcare costs, worker productivity loss, and public health burdens. Overall, they show that scoliosis is not just an orthopedic problem, but a public health problem of wide socio-economic importance.

Despite the condition becoming more prevalent, awareness and early detection of scoliosis in adolescents trail behind. Not many schools have screening programs or adequate prevention practices. Instructions like "sit up straight" or "exercise more," although good-natured, are too vague nowadays.

As a patient with scoliosis, I have had first-hand experience of the physical suffering, emotional anguish, and social deprivation of this condition. Not only did it make me more aware of the subject matter, but it also urged this research. Following a literature review, interview, and purpose-specific intervention design, this research aims to explore adolescents' awareness, access to screening, emotional consequences, and prevention of scoliosis. Lastly, the intention is to provide evidence-based recommendations for improving early detection, increasing awareness among the public, and integrating youth-friendly interventions into daily school practice.

2. LITERATURE REVIEW

2.1. Theoretical Basis of Adolescent Scoliosis

As the core structure of the human axial skeleton, the spine not only supports body weight and protects the spinal cord and internal organs, but also participates in movement and balance maintenance. From an anatomical perspective, a normal spine exhibits an "S" -shaped physiological curvature in the sagittal plane, including cervical lordosis, thoracic kyphosis, lumbar lordosis, and sacral kyphosis, while maintaining a straight line in the coronal plane. This complex physiological structure enables flexible movement of the spine in three-dimensional space. However, when the spine shows lateral curvature exceeding 10 in the coronal plane accompanied by vertebral rotation, it is defined as scoliosis. Based on etiological differences, scoliosis can be classified into idiopathic, congenital, and neuromuscular types. Among these, adolescent idiopathic scoliosis (AIS) is the most common type, accounting for about 85% of all scoliosis cases [3]. Although the exact pathogenesis of AIS remains unclear, its core pathological features include three-dimensional spinal deformities: coronal plane curvature, sagittal plane sequence abnormalities, and axial vertebral rotation. These structural changes may cause physical deformities in patients, and in severe cases, lead to cardiopulmonary dysfunction and even psychological disorders [2].

2.2. Research Progress

In recent years, scholars worldwide have conducted extensive and in-depth research on the etiology, screening and diagnosis, treatment strategies, and preventive measures for adolescent scoliosis. Regarding etiology, genetic factors are recognized as one of the key risk factors for adolescent idiopathic scoliosis (AIS). Multiple studies indicate that mutations or abnormal expression of specific genes may be closely associated with the development of spinal curvature [3]. Additionally, fluctuations in hormone levels during growth, asymmetrical musculoskeletal system development, and poor lifestyle habits are also considered potential contributing factors [4]. In terms of screening and diagnostic techniques, traditional physical examinations like the Adam's Forward Bend test are widely used for initial screening due to their convenience, but their high false-positive rate limits diagnostic accuracy. In contrast, X-ray examinations based on Cobb angle measurement provide more objective and precise diagnostic evidence, though the associated radiation exposure risk should not be overlooked [5]. For treatment approaches, conservative therapies mainly include bracing and exercise therapy. The former corrects spinal curvature through external mechanical force, while the latter enhances muscle strength and posture control through targeted functional training [3]. Surgical intervention remains crucial for severe scoliosis patients, with posterior spinal fusion demonstrating

significant efficacy in correcting spinal deformities [4]. Although many substantive advances have been made in domestic and foreign research, there are differences in the focus and development trend of research in different regions. For example, the United States focuses more on early screening and preventive intervention, while the research in China focuses more on the optimization of treatment technology and clinical promotion [6].

2.3. Research Gaps and Research Directions

While existing research provides crucial references for the prevention and management of adolescent scoliosis, several pressing issues remain unresolved. First, the profound psychological impacts of spinal curvature on adolescents have not received sufficient attention. Current studies predominantly focus on surface-level observations, lacking in-depth exploration of underlying mechanisms and optimization of intervention strategies [6]. Second, screening methods struggle to balance efficiency, convenience, and cost-effectiveness, which has become a major bottleneck hindering large-scale implementation [7]. Additionally, literature searches using "spinal health exercise management" as keywords yield no relevant findings, while those targeting scoliosis management models primarily return postoperative interventions or pain management trials for ankylosing spondylitis. In the context of comprehensive health initiatives, non-medical interventions for adolescent scoliosis are gaining recognition, yet research on proactive health promotion remains scarce. Clinical practice reveals that medical departments mainly address adolescents with moderate-to-severe curvature through bracing or surgery, while complementary exercise therapy and active spinal alignment remain neglected areas. For mild curvature cases, recommendations typically focus on posture correction and physical training. Although sports authorities could implement intervention programs, many practitioners lack proper qualifications, reducing credibility. As spinal health issues become a widespread societal concern, current fragmented efforts by single departments demonstrate discontinuity and insufficient coordination. From a sociological perspective, conducting research on multi-stakeholder collaborative management supported by health promotion theories has emerged as a new research hotspot. This approach offers an innovative pathway for adolescent scoliosis prevention and management [8]. Building on this foundation, Our study aims to integrate multidisciplinary resources to establish a comprehensive prevention system encompassing public education, treatment protocols, and psychological support. By investigating the specific psychological mechanisms of scoliosis in adolescents and proposing targeted interventions, we seek to provide scientific evidence and practical guidance for improving adolescent spinal health [6].

3. STUDY ON THE ETIOLOGY OF ADOLESCENT SCOLIOSIS

3.1. Genetic Factors

3.1.1. Research results of related genes

The pathogenesis of adolescent idiopathic scoliosis (AIS) remains incompletely elucidated, with genetic factors playing a significant role. Studies have shown that mutations or polymorphisms in specific genes are associated with AIS development. For instance, mutations in the CHD7 gene may disrupt normal vertebral development, thereby increasing spinal curvature risk. Additionally, abnormal expression of TBX6 gene -a crucial regulator in spinal development-is also linked to scoliosis. Current research suggests that AIS typically follows a polygenic inheritance pattern, requiring thorough family studies to explore its genetic mechanisms.

3.1.2. Family clustering study

The familial clustering of scoliosis further confirms the critical role of genetic factors. Patients with AIS show significantly higher incidence rates among first-degree relatives compared to the general population, with high concordance observed between identical twins. Research has identified that

genetic variations at specific loci (such as polymorphisms in the 6p chromosomal region) can increase susceptibility to AIS. Family studies also reveal interactions between genetic predisposition and environmental factors, providing a theoretical basis for early intervention strategies.

3.2. Growth and Development Factors

3.2.1. Rapid growth of spine in adolescents

Adolescents are particularly susceptible to scoliosis during their rapid spinal growth phase. While the spine experiences accelerated vertical elongation during this stage, the vertebral bodies and intervertebral discs remain underdeveloped, resulting in structural instability. Insufficient strength or uneven distribution of back muscles can cause coronal plane displacement of the spine. [12] Poor posture or improper weight-bearing habits may exacerbate the risk of lateral curvature, which requires close attention.

3.2.2. Hormone level effects

Abnormal fluctuations in growth hormones may contribute to the development of scoliosis, with excessive secretion potentially causing skeletal overgrowth. Sex hormones play a crucial role in regulating bone maturation, and estrogen receptor gene polymorphisms have been linked to the severity of idiopathic scoliosis (AIS) in adolescent females. The specific mechanisms of hormonal actions and their gender-and age-specific variations require further investigation to establish theoretical foundations for potential hormonal intervention strategies.

3.3. Lifestyle Factors

It's important to note that while these factors can contribute to postural fatigue and musculoskeletal pain, the evidence for them being a primary cause of true idiopathic scoliosis (a 3D rotational deformity) is weak. They are more accurately described as exacerbating factors that can worsen the symptoms and progression in a genetically predisposed individual.

4. SURVEY DESIGN

To systematically assess the epidemiological characteristics of adolescent scoliosis (including incidence, contributing factors, and current status of early screening and intervention), this study collected data from healthcare professionals, patients, and the general public through a questionnaire survey. The questionnaire was distributed via social media platforms to encourage participation. After collecting responses, standardized procedures were implemented for data organization, followed by quantitative analysis using statistical methods. This approach aims to establish a scientific understanding of the current status of adolescent scoliosis.

4.1. How the Patient Considers The Cost of Treatment

As shown in Figure 1, patients in this study generally report significant financial burdens from treatment costs. Only 2.9% consider themselves "Affordable" to the expenses, while 5.7% manage to "barely affordable." Over 91.5% of patients describe their treatment costs as "difficult to afford" with 42.9% explicitly stating they cannot afford it. These findings highlight that current medical costs are placing substantial financial strain on families, potentially affecting treatment adherence and prognosis. This underscores the urgent need to strengthen medical insurance support and optimize cost control mechanisms in healthcare decision-making.

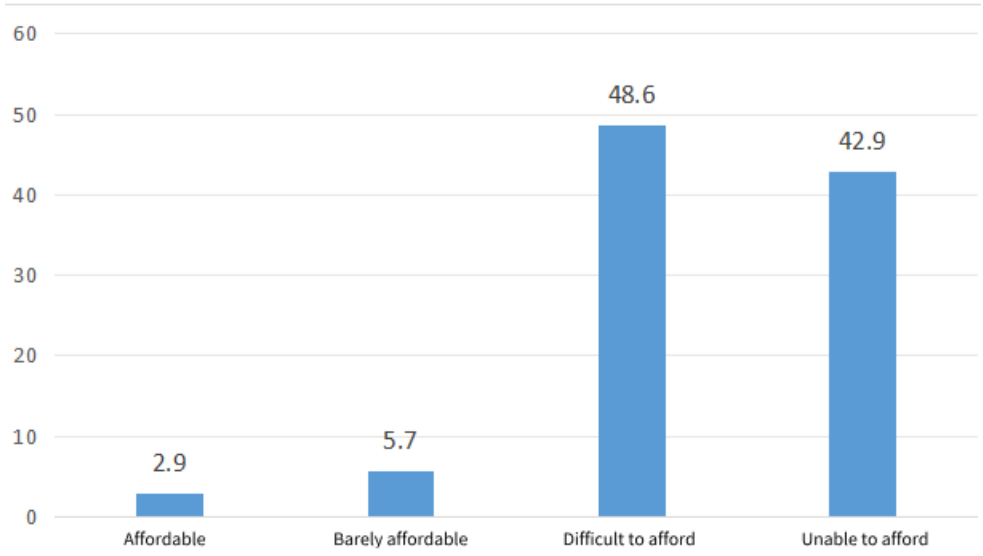

Figure 1. How patients perceive treatment costs

4.2. Whether the Patient Was Treated Differently Because of Scoliosis

As shown in Figure 2 of this study, 34.3% of patients reported experiencing discrimination due to scoliosis, while another 34.3% had no such experience, with 31.4% being "unsure." These figures indicate that approximately one-third of patients explicitly felt social stigma or unfair treatment stemming from their condition, while a significant proportion experienced ambiguous perceptions. This reveals that scoliosis not only impacts physical health but may also cause psychosocial distress, suggesting that clinical interventions should prioritize social support and psychological counseling for patients.

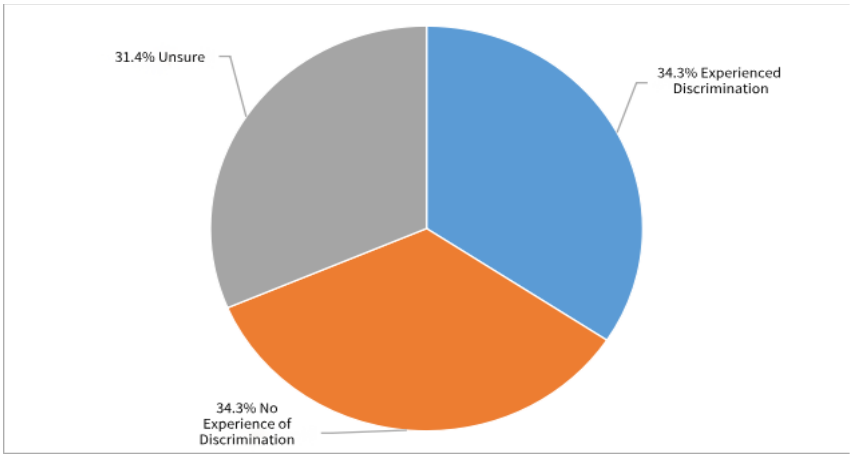

Figure 2. Whether patients were treated differently for scoliosis

4.3. Statistical Analysis of the General Population

Regarding the question <Do the general public have heard of "scoliosis"?>, survey results show that 57% of respondents said they had never heard of "scoliosis", while another 43% indicated they were "barely aware". This finding reveals widespread public ignorance about scoliosis, highlighting the urgent need to enhance disease awareness. Such lack of understanding may lead to insufficient early screening rates and delayed diagnosis/treatment, suggesting the necessity to strengthen health education campaigns on scoliosis prevention. These efforts could boost public awareness and encourage proactive medical consultation. (Figure 3)

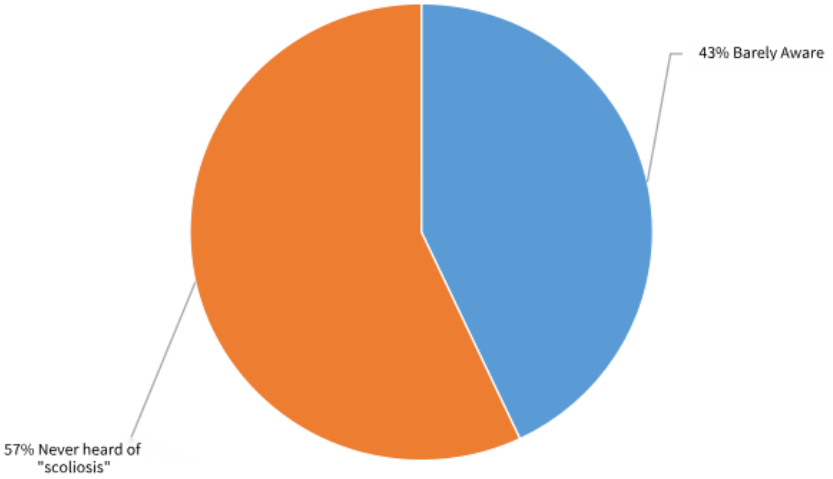

Figure 3. Do ordinary people know about scoliosis

4.4. Have Ordinary People Ever Done Spinal Related Tests?

As shown in Figure 4, the survey results indicate that only 24.6% of respondents explicitly reported having undergone spinal-related examinations, while 8.5% claimed they had done so without spinal assessment. Notably, a staggering 66.9% have never received such screenings. These findings highlight significant gaps in public awareness regarding spinal health management and demonstrate low rates of early detection and treatment for spinal issues. It is recommended to enhance public education on spinal health screenings and promote their inclusion in routine medical checkups, with particular emphasis on implementing early screening interventions among adolescents and high-risk populations.

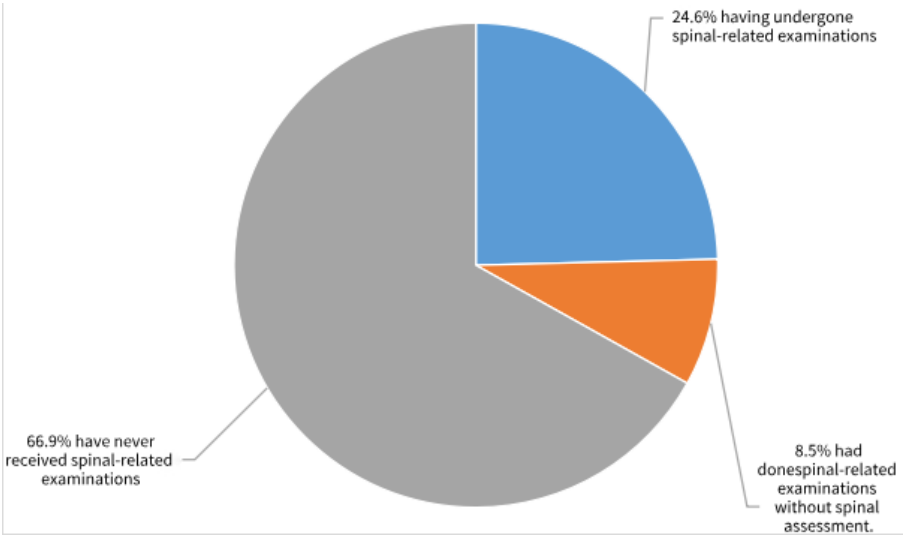

Figure 4. Whether the general population has been tested for spinal-related conditions

4.5. Do Ordinary People Think Scoliosis Is A Disease?

Survey results indicate that only 24.6% of respondents clearly recognize scoliosis as a medical condition, while 57.7% expressed uncertainty and 17.6% considered it non-pathological. This demonstrates significant knowledge gaps regarding scoliosis's medical nature among the public. Strengthening health education and promoting awareness about scoliosis is crucial for enhancing public disease recognition capabilities and facilitating early diagnosis and treatment. (Figure 5)

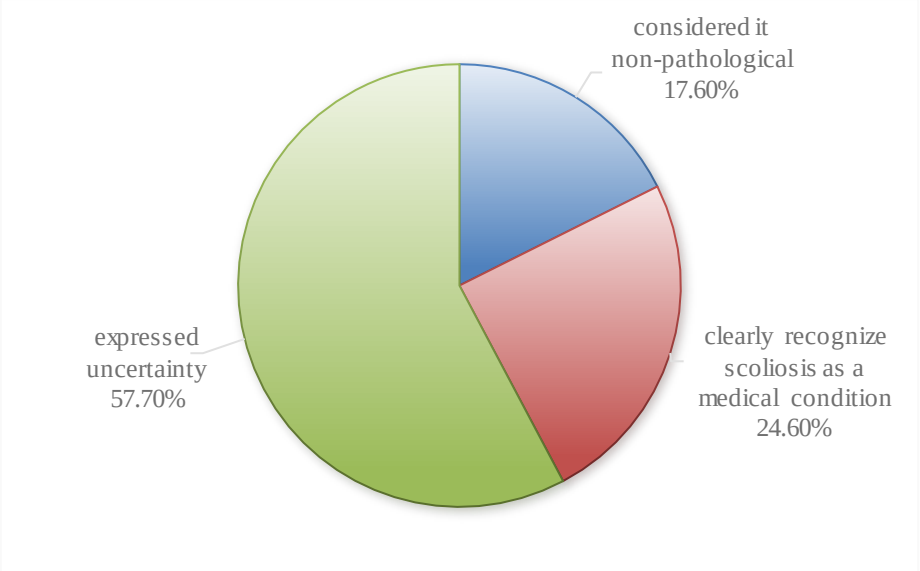

Figure 5. Do you think scoliosis is a disease

4.6. Are the general population diagnosed with scoliosis?

The survey results indicate that 24.6% of respondents had been diagnosed with scoliosis, while 75.4% reported remaining undiagnosed. This disparity suggests that despite limited public awareness, the actual prevalence of scoliosis remains significant, with many cases likely going undetected and untreated. Strengthening routine screening and early diagnosis are crucial for preventing disease progression.

4.7. Doctoral Statistical Analysis

The doctor thinks about how much science and screening is available for scoliosis Survey findings indicate that 81.8% of respondents consider spinal scoliosis education and screening "not widely dissemination", with only 3% describing it as "extremely common" and another 6.1% reporting "little awareness". These results highlight a critical gap in public health education regarding spinal scoliosis prevention and screening, revealing significant knowledge gaps among the general population. There is an urgent need to enhance health education initiatives and regular screening coverage, driving early detection and timely intervention through improved public awareness campaigns.

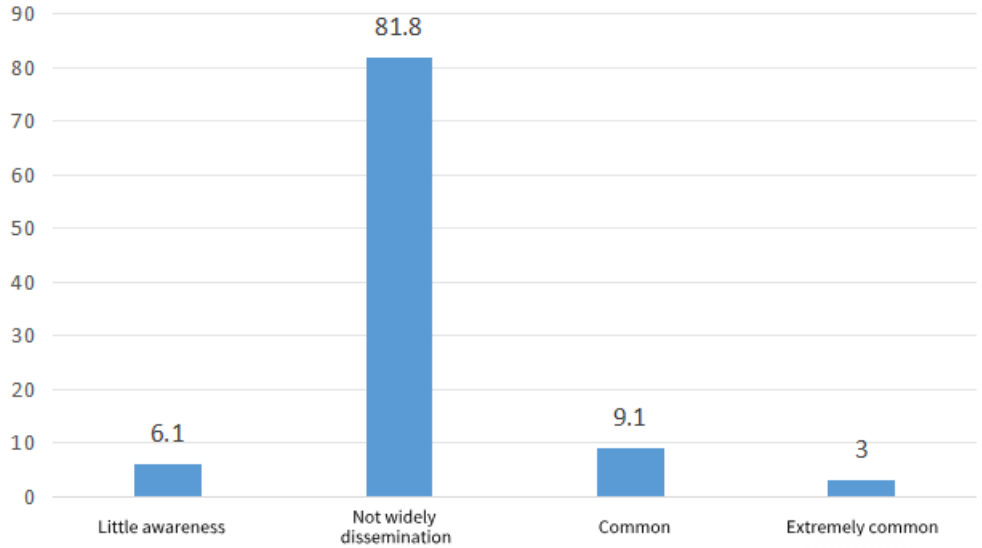

Figure 6. How doctors think the current science popularization and screening of scoliosis is

5. TREATMENT OF SCOLIOSIS IN ADOLESCENTS

5.1. Conservative Treatment

5.1.1. Orthosis treatment

Bracing therapy serves as a pivotal non-surgical intervention for adolescent scoliosis, operating through continuous biomechanical correction via external support structures to effectively inhibit progression and promote morphological recovery. As evidenced by research in [13], 3D-printed scoliosis braces utilizing computer-aided design and manufacturing (CAD/CAM) demonstrate superior precision and personalized adaptability compared to traditional orthoses, significantly improving key metrics including Cobb angle, apex vertebral displacement distance, and apex vertebral rotation degree. Furthermore, brace design must be tailored to individual clinical profiles: mild-to-moderate cases typically require flexible braces, while severe cases often necessitate rigid braces for enhanced mechanical support [14]. Treatment efficacy is comprehensively evaluated through Cobb angle measurements, pain relief levels, and functional movement scores, with integrated analysis enabling accurate quantification of brace therapy outcomes.

The characteristics of different types of orthotic devices are closely related to their target patient groups. While traditional orthotics feature complex manufacturing processes and less optimal fit, they offer higher cost-effectiveness, making them suitable for patients with limited financial resources. In contrast, 3D-printed orthotics, with their highly personalized biomechanical designs and optimized comfort, are better suited for patients demanding superior orthopedic outcomes. It is crucial to emphasize that the success of orthotic treatment significantly depends on patient compliance. Therefore, comprehensive patient education throughout the treatment process is essential to ensure proper device usage and consistent wear adherence.

5.1.2. Exercise therapy

Sports therapy corrects spinal scoliosis through targeted training that addresses strength imbalances in paraspinal muscle groups. The Schroth therapy integrates specific breathing techniques with three-dimensional exercise regimens to activate concave-side muscles while relaxing convex-side muscles, thereby resolving muscular imbalances. The protocol includes three-dimensional automatic correction, selective breathing exercises, and daily posture self-management, which significantly improves spinal morphological parameters and functional mobility [15].

The Scientific Exercise Approach for Scoliosis (SEAS) is a modern neurophysiological exercise therapy that emphasizes multidisciplinary collaboration to develop personalized treatment plans. It focuses on strengthening deep core muscles around the spine, promoting subconscious postural self-correction, and integrating training into daily activities for long-term effectiveness. The Dobomed Therapy and Functional Individualized Scoliosis Therapy (FITS) target patients with thoracic rotation deformities and pelvic alignment abnormalities, enhancing trunk stability through closed-chain exercises and foot load optimization. Exercise therapy is primarily suitable for patients with mild to moderate scoliosis, especially adolescents during their growth spurts, as their highly adaptable musculoskeletal system allows significant therapeutic outcomes.

5.1.3. Direct Current Therapy (DC)

Direct current therapy applies electrical stimulation to the muscles on both sides of the spine. By leveraging the physiological effects of electric current, it promotes the contraction and relaxation of muscles, enhances muscle strength, and improves the stability of the spine, thereby contributing to the correction of scoliosis. This therapy is primarily suitable for patients with mild to moderate scoliosis, especially those with adolescent idiopathic scoliosis. For patients with fully developed spines, the efficacy of electrical stimulation therapy may be limited. Research indicates that electrical stimulation therapy is more effective in treating mild scoliosis, as it can assist in correcting the spinal

angle and preventing the progression of scoliosis. Direct current therapy (DC) requires long - term daily treatment, and regular follow - up examinations are necessary to evaluate the treatment effect.

5.1.4. Symptomatic Drug Treatment (DO)

Drug treatment is mainly used to relieve the pain and discomfort caused by scoliosis. Commonly used drugs include non - steroidal anti - inflammatory drugs (such as ibuprofen) and muscle relaxants (such as eperisone hydrochloride). These drugs can reduce inflammation, relieve pain, and alleviate muscle spasms. Drug treatment is applicable to all scoliosis patients, particularly those who experience significant pain and discomfort due to spinal deformities. Drug treatment can effectively relieve pain and inflammation and improve the patients' quality of life, but it cannot change the angle of scoliosis. Drug treatment should be carried out under the guidance of a doctor, and long - term and excessive use should be avoided to prevent drug side effects.5.2 Surgical treatment

5.2. Technical Characteristics of Different Types of Surgery

Surgical treatment is typically indicated for patients with severe scoliosis, aiming to restore normal spinal alignment and prevent progression through surgical intervention. Posterior fusion surgery remains the most commonly used approach in clinical practice, utilizing internal fixation devices (such as pedicle screws and rods) to achieve three-dimensional spinal correction and long-term biomechanical stabilization via bone graft fusion. The standard procedure involves posterior spinal exposure, pedicle screw placement, deformity correction, and bone graft fusion. While this technique offers precise corrective outcomes and broad applicability, it carries the limitation of relatively significant surgical trauma [10].

Anterior surgery is indicated for specific thoracic scoliosis cases. The technique involves exposing the anterior spinal column through thoracoscopic or open surgical approaches, followed by direct discectomy and vertebral reconstruction. Compared to posterior surgery, anterior approach demonstrates superior correction of sagittal plane convex deformities but carries higher technical complexity and increased complication risks. Furthermore, advancements in minimally invasive techniques have enabled intraoperative navigation and robotic-assisted procedures, which enhance surgical precision, reduce tissue trauma, and shorten recovery duration.

5.3. Surgical Risk And Postoperative Rehabilitation

While surgical interventions can effectively improve the anatomical structure and physiological function of scoliosis patients, they pose significant clinical challenges due to associated risks. Neurological damage, as a major surgical complication, primarily stems from intraoperative instrument errors or improper placement of internal fixation devices. Postoperative infections are more common in elderly patients or those with compromised immune systems. Additionally, long-term complications include loosening, fracture, and pseudarthrosis formation of the internal fixation devices [8].

Postoperative systematic rehabilitation training is crucial for functional recovery, involving early bedside mobilization, progressive weight-bearing walking, and spinal stability reinforcement exercises. A standardized rehabilitation protocol not only accelerates the patient's functional recovery process but also significantly reduces complication rates. Given this, there is an urgent need to integrate multidisciplinary collaboration mechanisms and develop personalized rehabilitation plans to achieve optimal clinical outcomes.

6. PSYCHOLOGICAL EFFECTS AND COPING STRATEGIES OF ADOLESCENT SCOLIOSIS

6.1. Psychological Problem Analysis

6.1.1. Inferiority and anxiety

Adolescent scoliosis patients often experience widespread feelings of inferiority and anxiety due to physical changes such as asymmetrical shoulders, hunched back, or pelvic tilt. These negative emotions primarily manifest as excessive self-focus and heightened sensitivity to others 'evaluations, which may lead to social withdrawal and self-isolation behaviors. Research indicates that growing adolescents with scoliosis are more susceptible to ridicule or exclusion from peers due to their abnormal posture, thereby exacerbating psychological burdens. Furthermore, the treatment process for scoliosis often involves long-term brace use or surgical interventions, which further intensify patients' stress levels and increase susceptibility to anxiety and depressive disorders. Therefore, early identification and intervention of psychological issues in scoliosis patients hold significant clinical importance.

6.1.2. Social barriers

Scoliosis not only compromises adolescents 'physical health but also significantly impacts their social functioning. Due to abnormal posture and restricted mobility, patients often reduce social interactions in group activities or sports due to low self-esteem and confidence [9]. This social withdrawal may lead to loneliness and further develop into social barriers. Research indicates that individuals with scoliosis are more prone to social marginalization in school environments, characterized by shrinking social circles and declining relationship quality, which profoundly affects their mental health and social adaptability [11]. Additionally, pain and discomfort during treatment may further drive patients to avoid social situations, creating a vicious cycle. Therefore, thoroughly investigating the mechanisms by which scoliosis affects adolescents' social activities can help develop targeted intervention strategies to improve their mental health.

6.2. Response Strategies

6.2.1. Psychological intervention methods

For adolescents with scoliosis, cognitive behavioral therapy (CBT) and psychological counseling are commonly used interventions. CBT helps patients identify and correct negative thought patterns while enhancing their ability to cope with difficulties and challenges, effectively alleviating feelings of inferiority and anxiety. For instance, CBT guides patients to reassess their self-image, reduce excessive reliance on others' evaluations, and develop positive self-perception. Psychological counseling provides personalized professional guidance, offering emotional support and psychological counseling to help patients better manage stress related to scoliosis. Research shows that integrating family support and school resources in psychological interventions can significantly improve the mental health of scoliosis patients and enhance their quality of life.

6.2.2. Family and social support

Families, schools, and society all play crucial roles in providing psychological support for adolescents with scoliosis. Family members should proactively monitor patients 'mental health, create an accepting home environment through emotional support, and help them build confidence. At the school level, teachers' and classmates 'understanding and support are vital in alleviating social barriers. Schools can implement health education programs and anti-bullying campaigns to enhance students' awareness of scoliosis and reduce discriminatory behaviors. On the societal front, the media and community organizations can raise public awareness through science communication and charitable activities, fostering a more inclusive and supportive social environment. In summary, establishing a

collaborative psychological support system can effectively alleviate the psychological burden on scoliosis patients and promote their physical and mental well-being.

7. SUMMARY OF RESEARCH RESULTS

Scientific research and public education on adolescent scoliosis encompassing fundamental concepts to comprehensive prevention strategies provide evidence-based support for enhancing public awareness and improving adolescent health. This study systematically examines the definition, classification, and pathogenesis of scoliosis, demonstrating its high prevalence and rapid progression through authoritative data. Genetic predisposition, growth patterns, and lifestyle factors are identified as significant contributors to the condition's development. The research further reveals critical gaps in public understanding and underscores the urgent need for enhanced medical support, particularly regarding patient awareness, cost-sharing mechanisms, and screening accessibility. Notably, the study explores the psychological impacts of scoliosis on adolescents, proposing targeted psychological interventions that emphasize family and community support. Through multidimensional preventive measures involving schools, families, and society, this research establishes a holistic prevention and treatment framework that highlights the importance of integrating educational initiatives with practical implementation.

While this study has achieved notable progress in public education and research on adolescent scoliosis, several limitations require further refinement. First, regarding sample scope, the analysis primarily relied on existing domestic and international literature. Due to time and budget constraints, the questionnaire survey yielded limited data volume with questionable accuracy. The absence of large-scale field investigation data may limit the generalizability of certain conclusions. Second, in terms of long-term follow-up studies, time and resource limitations prevented continuous monitoring of treatment outcomes and psychological states in scoliosis patients, making it challenging to evaluate the long-term effectiveness of interventions. Additionally, while incorporating genetic research findings, the analysis of gene-environment interactions remains insufficient. Future studies could employ multi-omics technologies to explore this area in depth. Regarding preventive strategies, although multidimensional measures involving schools, families, and society were proposed, their implementation pathways and effectiveness evaluation require further validation. Future research should emphasize interdisciplinary collaboration, integrating knowledge from biomedicine, psychology, and sociology to establish a comprehensive scoliosis prevention system that would list the ideal members of this collaborative team: Orthopedic Surgeons, Physiatrists, Orthotists, Physical Therapists (Schroth certified), Chiropractors, Psychologists, and School Nurses/Health Educators. Concurrently, with advancements in artificial intelligence, utilizing big data and machine learning algorithms for early diagnosis and personalized treatment of scoliosis will become crucial research directions.

REFERENCES

[1] Zhu Qi. Investigation on the Current Situation of Scoliosis in Students of Northwest Minzu University [D]. Lanzhou: Northwest Minzu University, 2022.

[2] Liang Ying; Xu Kaiying; Feng Zhen. Research progress on adolescent idiopathic scoliosis [J]. Practical Clinical Medicine (Jiangxi), 2021, 22(2):101-106.

[3] Yang Run; Ren Yan; Li Zhigui; Chen Kecheng; Cheng Xianghui. Research status of adolescent idiopathic scoliosis [J]. Guangming Traditional Chinese Medicine, 2022, 37(2):342-345.

[4] Lin Chuhua; Wen Hongyuan; Ge Min'en; Long Jiezhen; Zhang Yongjie; Li Jiandong. Advances in Non-surgical Therapies for Adolescent Scoliosis [J]. Chinese Journal of Ethnic Medicine, 2023, 29(4):67-69.

[5] Yin Jing, Zhao Baoli, Wang Hongdong, Yu Changsui, Bai Gang, Liu Liyong, Chi Chunli, and Zhang Xinyue. Discussion on the Treatment Principles and Methods for Adolescent Idiopathic Scoliosis Based on Traditional Chinese Medicine Spinal Correction Theory [J]. Chinese Folk Therapies, 2023, 31(18):1-4.

[6] Cai Yaping; Wu Xiangdong. Research progress on screening and conservative treatment of idiopathic scoliosis in adolescents [J]. Chinese Journal of Therapeutic Medicine, 2023, 32(11):1182-1187.

[7] Zhang Hao; Zhang Ning; Chen Xuanyin; Zhou Yang; Wang Heng; Huang Shanhu; Liu Jiaming. Current Status of Epidemiological Investigation on Adolescent Scoliosis [J]. Journal of Nanchang University (Medical Edition), 2022, 62(6):97-100.

[8] Yao Xiaona. Research on the Construction and Implementation Path of Adolescent Scoliosis Exercise Health Promotion Model under the Perspective of Sports and Health Integration [D]. Shandong: Shandong Sport University, 2023

[9] He Miao and Wang Qi. Attention to adolescent scoliosis! [J]. Adolescent Health, 2023, 21(12):14-15.

[10] Lin Chuhua; Wen Hongyuan; Ge Min'en; Long Jiezhen; Zhang Yongjie; Li Jiandong. Advances in Non-surgical Therapies for Adolescent Scoliosis [J]. Journal of Chinese Ethnic Medicine, 2023, 29(4):67-69.

[11] Permit. Is your body "crooked"? [J]. Science 24 Hours, 2023, (7):74-77.

[12] Wang Aiyin; Ji Zhonglei; Chen Haipeng; Yang Qing; Yang Qi. Influencing Factors and Clinical Research Progress of Adolescent Scoliosis [J]. International Journal of Medical and Health Herald, 2023, 29(22):3176-3180.

[13] Zhang Hongsheng; Huang Hanwei; Wang Jinwu; Zheng Junwei; Liu Rixin; Liao Zijie; Wang Peng; Xu Yuanjing; Wang Zanbo; Wan Keming. Evaluation of a Multi-criteria Decision Model for 3D Printing Spinal Curvature Orthosis in Adolescent Scoliosis Treatment [J]. Chinese Journal of Tissue Engineering, 2024, 28(30):4806-4811.

[14] Zhu Peikun; Bai Jinzhu. Classification comparison of orthotic devices for adolescent idiopathic scoliosis and application progress of digital intelligence technology [J]. Chinese Journal of Tissue Engineering, 2024, 28(21):3418-3423.

[15] Li Xinyi and Liu Haiyan. Effects of different rehabilitation methods on progression of adolescent scoliosis [J]. Contemporary Sports Science and Technology, 2021, 11(30):19-21.