Comparison of the Effectiveness of the Core Stabilization Exercise Model and the Schroth Method in Treating Balance Disorders in Adolescents with Idiopathic Scoliosis

Renni Hidayati Zein[1A-E*], Wiwi Sartika[2B-D], Indah Permata Sari[3B-D]

[1,2] Universitas Abdurrab Pekanbaru, Pekanbaru, Indonesia
[3] Universitas Baiturrahim Jambi, Jambi, Indonesia

renni.hidayati.z@univrab.ac.id[1], wiwi.sartika@univrab.ac.id[2], indahpermata.fisio11@gmail.com[3]

ABSTRACT

Poor posture habits can cause several postural defects, one of which is idiopathic scoliosis. Scoliosis is a postural disorder caused by changes in the shape and function of muscles and bones in the vertebrae, characterized by an abnormal curvature of the spine to the left and right. This can cause poor posture, balance disorders, and functional disabilities, increasing the risk of permanent disability. The research method used was a quasi-experimental design with a pre-test and post-test with a control group design, where the subjects were divided into three groups: experimental group 1 (given core stabilization exercises), experimental group 2 (given the Schroth method), and the control group (given no intervention or only given conventional therapy). The sample used was 32 students of SMK 1 Muhammadiyah 1 Pekanbaru. The purpose of this study was to compare the effectiveness of each intervention method separately on improving postural balance in adolescents with idiopathic scoliosis. The results of this study were that the Schroth method was more effective for balance than the core stabilization exercise method.

AUTHORS' CONTRIBUTION

A. Conception and design of the study;
B. Acquisition of data;
C. Analysis and interpretation of data;
D. Manuscript preparation;
E. Obtaining funding

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INTRODUCTION

Advances in scientific knowledge and clinical practice in the health sector have had a significant positive impact, particularly in the management of postural and musculoskeletal disorders. Innovations in exercise methods and physiotherapy interventions have accelerated the development of treatment models for idiopathic scoliosis, particularly in adolescents. Advances in exercise techniques such as core stabilization and the Schroth method offer significant opportunities to improve therapy effectiveness. This presents both a challenge and an opportunity for healthcare professionals, academics, and the government to develop evidence-based interventions that are applicable and have a direct impact on the community. The development of

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renni.hidayati.z@univrab.ac.id[1*]

structured, scientifically sound, and contextual exercise models, such as those in this study, is part of an effort to improve the quality of preventive and rehabilitative healthcare services in Indonesia (Zein et al., 2020).

Incorrect posture habits, such as carrying a heavy bag on one shoulder only, can cause the shoulder to become higher on one side, causing weakness in the trunk muscles, which can lead to scoliosis (Zein & Permata, 2024). Therefore, core stabilization exercises involve the deep trunk muscles to improve postural stability and reduce postural asymmetry. Core stabilization is used in several countries to address balance disorders caused by scoliosis. The goal of this exercise is to maintain the body's postural muscles so that the exercise provides benefits in restoring abnormal postures and increasing functional activities as a preventive and rehabilitative effort for musculoskeletal injuries caused by muscle imbalances. The Schroth method is a form of physiotherapy for scoliosis (Paramento et al., 2024). This form of treatment is conservative, based on the principles of specific postural correction, correction of breathing patterns, and correction of postural perception (Qi et al., 2022). The Schroth method aims to restore muscle symmetry and postural alignment by breathing to the concave side of the body, thereby improving balance (Saputra et al., 2023).

Based on current trends, many adolescents develop poor posture due to excessive gadget use, prolonged sitting, and minimal physical activity. These habits can trigger musculoskeletal disorders, including idiopathic scoliosis (Lubis et al., 2022). Core stabilization exercises have the advantage of strengthening the deep core stabilizing muscles, effectively improving postural control and functional stability. However, these exercises emphasize neuromuscular control and require skill and regular practice to achieve optimal results. Meanwhile, the Schroth method is a three-dimensional scoliosis-specific approach that targets deformity correction through focused breathing and stretching exercises. The advantage of this method is its individualized, active postural correction, but it requires intensive guidance and the skills of a trained instructor. This study attempts to compare the effectiveness of both, particularly in relation to improving balance in adolescents with idiopathic scoliosis. Therefore, preventive and therapeutic efforts are needed in the form of effective exercise interventions to stabilize posture and improve body balance (Liu et al., 2020).

Various studies have shown that regular core stabilization exercises can improve posture and the musculoskeletal system in people with idiopathic scoliosis. This approach involves training the trunk muscles, specifically the muscles of the spine, pelvis, and abdomen. This training can improve balance and muscle function (Shahid Mohammad et al., 2023).

METHODS

The research method used was a quasi-experimental pre-test and post-test control group design. Subjects were divided into three groups: experimental group 1

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(given core stabilization exercises), experimental group 2 (given the Schroth method), and a control group (given no intervention or only conventional therapy).

This design aimed to compare the effectiveness of each intervention method separately on improving postural balance in adolescents with idiopathic scoliosis. This study was conducted at SMA 1 Muhammadiyah Pekanbaru. The population consisted of adolescents diagnosed with idiopathic scoliosis and experiencing balance disorders.

The primary data in this study were obtained through direct measurements of the research subjects using balance measuring instruments such as the Berg Balance Scale (BBS), as well as other measurements relevant to posture and stability. Measurements were taken both before and after. Each treatment was given for 8 weeks, with a training frequency of 3 times per week, and each session duration of 45–60 minutes. Experimental group 1 (core stabilization): Performed core stabilization exercises with a focus on activating the trunk muscles, especially the deep abdominal and multifidus. Each session consisted of a warm-up (5–10 minutes), main exercises (30–40 minutes), and a cool-down (5–10 minutes). The exercise program was arranged in stages from static to dynamic according to individual tolerance and ability. Meanwhile, Experimental group 2 (Schroth method): Performed Schroth exercises based on the principles of 3D corrective breathing, postural elongation, and rotational angular breathing. Each session consisted of posture education (5–10 minutes), active correction and breathing exercises (30–40 minutes), and relaxation/cool-down (5–10 minutes). Therapy is carried out under the supervision of a physiotherapist trained in the Schroth method.

Research Design

The sampling technique used was purposive sampling, selecting subjects based on specific inclusion and exclusion criteria consistent with the research objectives, such as age, degree of scoliosis, and balance status before intervention. Data collection techniques included observation, direct measurement, and recording the results of each intervention session. The measurement instruments have been validated and are reliable in previous studies and adapted to field conditions.

Population and Sample

The research population was students of Muhammadiyah 1 Pekanbaru High School, and the sample was 32 people.

Data Analysis

Data analysis was conducted through several stages, including: normality test, homogeneity test, and difference test (ANOVA or equivalent non-parametric test such as Kruskal-Wallis), followed by a post-hoc test to determine significant differences between groups. Statistical interpretation was performed to assess the effectiveness of each intervention. This research began with problem identification and formulation, determination of relevant data and subjects, data collection, analysis, drawing preliminary conclusions and verification, and writing up the research results.

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RESULTS AND DISCUSSION
Result
Normality Test

Table 1.
Normality Test Results

Variable	Statistic	Df	sig
Pre-balance	0,934	32	0, 052
Post-balance	0,953	32	0, 171

Based on the results of the Shapiro-Wilk normality test, it is known that the Pre-Equilibrium variable has a significance value of 0.052 and the Post-Equilibrium variable has a significance value of 0.171. All significance values are greater than 0.05 (p > 0.05), so it can be concluded that all research variables are normally distributed.

Homogeneity Test

Table 2.
Homogeneity Test Results

Variabel	F	Sig
Equilibrium Improvement	0,037	0, 849

From the table data above, sig 0.849 can be concluded that the population has the same variance.

Independent Sample T-Test

Table 3.
Independent Sample T-Test Results

Variable	N	Mean	Std. Deviasi
Core Stabilization	16	6,81	1,797
Metode scrotch	16	10,00	2,066

Based on the results of the independent sample T-test, the Core group (n = 16) had an average balance improvement of 6.81 (SD = 1.797), while the Schroth group (n = 16) had an average balance improvement of 10.00 (SD = 2.066).

The results of the Independent Sample T-Test showed that the difference in average balance improvement between the two groups was statistically significant at p < 0.001. The mean difference value was -3.188 with a 95% confidence interval between -4.585 and -1.790, indicating that the Schroth group had a consistently higher balance improvement than the Core group. Based on the results of the table above, it can be concluded that Schroth exercises are more effective in improving balance than core stabilization exercises.

Discussion

Exercises and treatments for scoliosis can include conservative approaches such as core stabilization exercises and the Schroth method, the use of a brace, and surgical intervention in severe cases. Core stabilization exercises aim to improve postural stability by activating the deep trunk muscles, while the Schroth method focuses on postural correction, breathing patterns, and postural perception. Core stabilization

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exercises and the Schroth method are more effective. Core stabilization can reduce back pain and improve postural stability, while the Schroth method focuses on postural correction and muscle symmetry. Both exercise methods are effective and can be applied as early intervention in adolescents with idiopathic scoliosis (Zein et al., 2025).

Exercises using the Schroth method performed at least twice a week for one hour per day, 30-45 minutes before and after exercise, can reduce scoliosis (Sari & Hadi, 2025).

CONCLUSION

Based on the research results, it can be concluded that both core stabilization exercises and the Schroth method provide benefits in improving postural stability and reducing complaints in adolescents with idiopathic scoliosis. However, compared to core stabilization, the Schroth method is more effective in improving postural balance. Therefore, the Schroth method can be recommended as a more optimal exercise intervention for adolescents with idiopathic scoliosis, particularly in the area of balance.

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