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Analysis of the sagittal plane in standing and sitting position in girls with left lumbar idiopathic scoliosis



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ABSTRACT

Introduction: Current development of civilization and technology makes a sitting position dominant in everyday life. This applies also to patients with spinal deformities.

Aim: The aim of this study was to analyze the size of physiological spinal curvatures in standing and sitting posture in girls with left lumbar scoliosis and evaluate usefulness of Zebris CMS-10 System in the assessment of physiological curvatures in both positions.

Material and methods: A group of 30 girls aged 11–17 years with left lumbar idiopathic scoliosis, with a Cobb angle in the range of 10°–21°, was examined. Control group consisted of 30 healthy girls aged 10–17 years. Studies were conducted with the use of ZEBRIS CMS-10 System (Zebris Medical, Germany) in a standardized standing (P1) and sitting (P2) position. Mean kyphosis and lordosis angle and differences between kyphosis and lordosis angle dependent upon positional changes were analyzed in each of the groups.

Results and discussion: Mean kyphosis angle in both positions showed no statistically significant differences between the study group and control group. Mean lordosis angle in P1 position in the study group was statistically significantly higher than in control group. Differences between mean kyphosis angle in P1 and P2 position in the study group in comparison with control group were not statistically significant. Differences between mean lordosis angle in P1 and P2 position in comparison with control group showed a statistical significance.

Conclusions: The presence of low degree lumbar scoliosis can result in deepening of lumbar lordosis in the standing posture, but it does not significantly affect kyphosis angle measured in standing and sitting position. Zebris CMS 10 System is a useful tool for the assessment of physiological spinal curvatures in standing and sitting position.

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1. Introduction

Idiopathic scoliosis (IS) is defined as multi-dimensional deformity of the spine, where buckling of the spine in frontal plane is accompanied by abnormal curvature of the sagittal and transverse alignment of the spine.^{1,2,4,5,8,10}

2. Aim

Analysis of physiological curvatures in standing and sitting posture in girls with left lumbar IS and evaluation of usefulness of Zebris CMS-10 in the assessment of physiological curvatures in standing and sitting position.

3. Material and methods

The studies were conducted in the Department of Rehabilitation, Faculty of Medical Sciences of the University of Warmia and Mazury in Olsztyn in 2011–2013. Guardians of participants of the study provided a written informed consent for the conduct of the tests.

In total, 284 subjects, including 146 girls and 138 boys, were examined in a relaxed standing position. A group of 30 girls aged 11–17 years with left lumbar IS, with a Cobb angle of 10°–21°, not treated with orthoses, was separated from the study population. Measurements of the scoliotic curve were performed on radiographs in accordance with Cobb methodology (Table 1).¹³

Control group consisted of 30 girls without scoliosis, with an acceptable trunk asymmetry and the value of the angle of trunk rotation (ATR) up to 5°, measured with Bunnel scoliometer (Table 2).^{9,12}

The study was conducted in standing (P1) and sitting position (P2).^{5,15,19}

3.1. Basic standing position (anthropometric)– P1

Examined patients were standing upright with their heads slightly elevated, in Frankfort horizontal plane (*planum horizontale frankfurtensis*), i.e. tangent to the lower border of the orbit and upper margin of the external auditory meatus was parallel to the floor, with shoulders straight and relaxed, no tension of back muscles, upper limbs hanging by the sides with the palms facing (but not pressed against) the thigh, lower limbs straight (no hyperextension of the knee joints)

with feet resting parallel to each other on the selected test square.^{6,16}

3.2. Sitting position (anthropometric)– P2

Examined patients sat on a stool with their entire lower buttocks, with ischial tuberosities and back of the thighs leaned on the surface of the stool. The head, trunk and shoulders were positioned as in the basic standing position. Arms hanging vertically in line with the trunk with the palms facing the stool. Thighs set horizontally to achieve a 90° angle between the shank and the thigh, feet parallel to each other.¹⁶ In the study, a square-shaped flat top stool was used. Its height was adjustable and matched the popliteal height.^{6,16}

In the main study analysis of trunk postures of the IS girls in the sagittal plane was performed. The test was conducted in two positions with the use of Zebris CMS-10 Measuring System.^{11,17,19}

The Zebris CMS-10 Posture Measuring System (Zebris Medical GmbH) uses the WinSpine software that runs under Microsoft Windows XP operating system.^{17,19} This software contains a database of information on the projects, patients and individual measurements. The second component of the measuring system was a measuring device, ultrasonic marker and reference marker. Measuring device was fixed on the floor stand with the adjustable height. Pointer stick, which is directly touched to the bony landmarks, has two ultrasonic markers, center of which is in line with the tip of the sensor. The program precisely calculates position of the tip of the sensor. A reference marker in the form of a belt is fastened laterally below the posterior superior iliac spine and anterior superior iliac spine, not to cover measuring points. It is used to eliminate position changes during the conduct of the study. Prior to each test, the device was calibrated in relation to the ground. Average duration of the test in standing and

Table 2 – Characteristics of control group.

Values	Characteristics of control group (n=30)	
	Age	Height
Mean	13.90	161.90
SD	1.92	9.05
Minimum	10	140
Maximum	17	176
Median	14	164

Table 1 – Characteristics of patients with left lumbar scoliosis.

Values	Characteristics of study group (n=30)		
	Age	Height	Angle of curvature, according to Cobb, deg
Mean	14.0	162.3	14.0
SD	1.7	7.1	2.9
Minimum	11	146	10
Maximum	17	177	21
Median	14	163	14

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