Dynamic alignment of scoliotic spine as factor for progression.

G. Rusovs¹, Z. Pavāre², T. Ananjeva³, A. Vētra⁴

¹,²,³,⁴ Riga Stradins University, Department of Rehabilitation
²,³,⁴ National Rehabilitation Center „Vaivari”, Jūrmala, Latvia

1 Introduction.

The unique mechanics of the fully upright human spine as important progression factor of adolescent idiopathic scoliosis (AIS) is suggested by warrior authors [1]. Mechanisms leading to progression of scoliotic curve are described as vicious circle [2]. Spine loading during walking increases dynamically and should influence alignment of spine. Recent publications on gait analysis provided with AIS patients revealed no important gait pattern changes so authors are excluding gait impact on curve progression [3]. The suggestion was made that alignment of cervical part around pelvis is achieved without reference to shape of spine and progression of scoliosis is linked to asymmetric biomechanical mechanisms to realize this task.

2 Methods

2.1 Subjects

21 patient (3 boys and 18 girls) with thoracolumbar scoliosis where evaluated during instrumental gait analysis. Range of age was 12-17 years (mean 13,2, S.D. 2,6). The range of major Cobb angle was 25° - 47° (mean 32,2°, S.D. 16,6). 15 healthy subjects (4 boys, 11 girls) ranging in age from 13 to 17 years (mean 15.1, S.D. 2.5) where evaluated as control group. None had any history of neurological or orthopaedic conditions.

2.2 Apparatus

In the complex gait analysis kinematics were evaluated with Qualisys equipment including 6 infrared digital cameras, kinetics with AMTI force plate, EMG (electromyography) with Delsys, data computed with Visual 3D software. Standard positions of 30 passive markers on segments of lower limbs, pelvis and shoulders were applied. In addition markers where placed on Th7; Th10 and both angles of scapulas. From the recorded data coordinates of C7 position markers where calculated and analysis of motion trajectory performed with 3D pelvic position as reference during gait.

3 Results

The pattern of C7 motion in frontal plane according to central sacral line (CSL) revealed no significant left/ right differences in gait phases of each individual. No statistically significant correlation was revealed about magnitude of spinal curve and changes in C7 movement pattern. Although 3 cases shoved misalignment of C7 more than 1 cm, the side movement pattern was similar to control group.

4 Discussion

These findings support the concept that one of the primary objectives of the postural control system when walking is control of head alignment [4]. Subjects with scoliotic deformation adapt their stabilization to ensure that the head remains stable. Everyday activities as walking and running are creating forces tending to bend spine forward at sagital plane. The stabilization of upright spine is one of the main tasks of paraspinal muscles. Increased activity of paraspinal muscles at convex side is well known finding in research of scoliosis [5]. Biomechanical analysis shows that stability of kyphotic thoracic spine is achieved by first class lever where paraspinal muscles play the role of effort. In scoliotic spine position of load on vertebra is asymmetric and unilateral activation of muscular response is biomechanical consequence. Unilateral activation paraspinal muscles create rotational moment between vertebras.

5 Conclusion.

Central alignment of head has been achieved irrespectively of spinal deformation. Rotating forces coming from asymmetric mechanisms of stabilisation can be considered as deforming factors leading to progression of scoliosis.
References.


