

Assessment of sagittal balance disturbances in patients with compression fractures of the spine and idiopathic scoliosis

STRESZCZENIE w języku angielskim (SUMMARY in English)

Introduction: Optimal sagittal balance is achieved through the interplay of pelvic parameters and spinal curvature. Sagittal imbalance is a complex issue that results as a consequence of a multitude of etiologies of spinal deformity. There are morphological skeletal changes of the spine in the course of scoliosis. Vertebral compression fractures can lead to structural kyphotic spinal deformity. Sagittal imbalance leads to pain and disability. Investigating the characteristics of changes in the sagittal balance among patients with adolescent idiopathic scoliosis and patients with osteoporotic vertebral body fractures seems important, especially as currently there is a lack of papers that discuss on this topic. Furthermore, few authors have investigated the effect of spinal brace treatment on sagittal balance in these patient groups. This study aimed to investigate the effect of six months of spinal brace treatment in two independent groups of patients with scoliosis and osteoporotic vertebral compression fractures.

Material and methods: The study involved 151 patients. The study group was divided into two subgroups. The first subgroup included 55 patients with idiopathic scoliosis. Of these, 26 patients participated in spinal brace treatment. The second subgroup included 96 patients with osteoporotic vertebral compression fractures. Of these, 30 patients participated in spinal brace treatment. Patients were treated in the Department of Orthopedic and Traumatology of the Locomotor System. Digital radiographs and measurements of 3D structured light posture assessment system were used to evaluate the sagittal balance. Dedicated questionnaires were used to assess pain and quality of patients' life. Patients treated with spinal braces were examined twice, before treatment and after six months of treatment.

Results: The mean value of the thoracic spine kyphosis angle based on radiographs was 33.90 (± 13.94) degrees and the mean value of the lordosis angle based on radiographs was 47.32 (± 13.14) degrees in the group of patients with idiopathic scoliosis. The mean value of Pelvic Incidence was 48.81 (± 11.42) and Pelvic Tilt was 9.41 (± 6.55) degrees in the group of patients with scoliosis. In this group of patients, the mean Sacral Slope value was 39.57 (± 9.35) degrees. The median kyphosis angle measured by surface topography was 13.20 degrees and the mean lordosis angle determined by 3D structured light posture assessment was 32.84 (± 9.48) degrees in the group of patients with idiopathic scoliosis. There were no statistically significant differences between the sagittal balance parameters after six months of spinal brace treatment in the group of patients with scoliosis. There was no statistically significant difference in the results of disability assessment using the Oswestry Disability Index before and after spinal brace treatment in the group of patients with idiopathic scoliosis. There was a statistically significant increase in SRS-22 questionnaire scores after spinal brace treatment compared to scores before spinal brace treatment in the group of patients with scoliosis. No statistically significant correlation was found for the angle of kyphosis and the angle of lordosis determined by 3D structured light posture assessment and the corresponding angles determined on radiographs in the group of patients with idiopathic scoliosis. A statistically significant correlation was found between Sacral Slope derived from the X-ray examination and trunk angle derived from the 3D structured light posture assessment in the group of patients with idiopathic scoliosis. The mean value of the thoracic kyphosis angle determined on radiograms was 54.66 (± 14.55) degrees in the group of patients with osteoporotic vertebral compression fractures (OVCF). The mean lordosis angle determined on radiographs was 42.14 (± 15.52) degrees and the mean Pelvic Incidence values were 53.76 (± 14.01) degrees in the group of patients with OVCF. The mean Sacral Slope was 33.78 (± 11.21) degrees in the group of patients with OVCF. The median Pelvic Tilt was 19 degrees in the group of patients with osteoporotic vertebral compression fractures. The median kyphosis angle determined from the 3D structured light posture assessment was 18.42 degrees and the median lordosis angle determined from the same examination was 29.06 degrees in the group of patients with osteoporotic vertebral compression fractures. The median trunk angle determined from 3D structured light posture assessment was 5.01 degrees in the group of patients with OVCF. The mean angle of kyphosis determined on radiographs increased statistically significantly after six months of spinal brace treatment in the group of patients with OVCF. The angle of kyphosis determined by 3D structured light posture assessment did not change between the examinations in this group of patients. The other parameters determined on radiographs and based on 3D structured light

posture assessment did not change statistically significantly between the study before the start of spinal brace treatment and after six months of wearing the spinal brace in the group of patients with OVCF. There was a statistically significant reduction in disability index measured by the Oswestry Disability Index at the examination after six months of wearing the spinal brace in the group of patients with OVCF. There was no statistically significant difference in the quality of life of patients with osteoporotic vertebral compression fractures based on the results of the QUALEFFO-41 between studies performed before and after spinal brace treatment.

A statistically significant correlation was found between the angle of lordosis determined on radiographs and the angle of lordosis determined by 3D structured light posture assessment in a group of patients with OVCF.

Conclusions: Sagittal balance parameters assessed from radiographs are related to indices obtained from 3D structured light posture assessment. There is sagittal imbalance in patients with idiopathic scoliosis and osteoporotic vertebral compression fractures. The sagittal imbalance was found on both spinal radiography and three-dimensional examination. No significant changes in sagittal balance were found on radiography and 3D structured light posture assessment after six months of treatment with a personalized spinal brace in a group of patients with idiopathic scoliosis. Spinal brace treatment in a group of patients with idiopathic scoliosis significantly improves quality of life, while having no significant effect on pain, the intensity of which was low. Six-month spinal brace treatment of patients with OVCF did not reduce the increase in kyphosis angle determined on radiographs. However, the angle did not increase enough to affect the change in kyphosis angle measured by 3D structured light posture assessment. Six-month spinal brace treatment in a group of patients with osteoporotic vertebral compression fractures resulted in a reduction in pain. Spinal brace treatment did not significantly affect the patient's quality of life. It was found that the greater the angle of kyphosis, as determined by 3D structured light posture assessment, the greater the complaints of lower lumbar spine pain in a group of patients with osteoporotic vertebral fractures.