BIOMECHANICS OF SPINE SCOLIOSIS TREATMENT BY BRACES

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Orthopaedists in the Czech Republic use corrective braces of type Cheneau or Cerny for conservative treatment of non skeletal scoliosis. The brace has force effects on a child spine and if it is used for enough long time the spine defect is corrected. The brace is made individually for each patient in this way: first, the negative plaster form of a child trunk and then the positive plaster form are made. The positive plaster form is deepened in the places where brace has to push on the patient trunk. The laminate brace made according to this plaster form pushes the child trunk like a tight shoe principle. The paper shows the manner of determination and computer algorithms for solving of the stress state in vertebrae and inter-vertebrae discs and the spinal curve correction under brace force effects for a concrete child patient. The pathologic spinal curve deformities are measured on the X-ray of patient. The spine stress state and spine deformation correction are solved as a beam (spine) on an elastic ground (soft tissue). There are used two algorithms. The 1st algorithm solves the spine stress state and deformation under brace force effect given by displacements of trunk surface. The 2nd algorithm has as input the spinal curves of a patient with and without brace measured on the X-rays. The difference of the two curves is the spine deformity correction and the spine stress state and necessary trunk surface displacement are the results. If the ideal spine curve is set as the curve under brace effect then the trunk surface is equal to the optimal brace form. The calculation algorithm and parameters ware verified with treatment courses. The trunk surface load was checked by sensor plates which ware put into braces to measure the load values between the brace and the child trunk surface.

Key words: *scoliosis, spine defect, axial skeleton defect, brace force effect, spine stress state*

1. Introduction

Spinal corrective braces (see fig. 1) are used for treatment of spine scoliosis of children (pathologic deformation of the chest curve). The X-ray of the patient from fig. 1 without and with the brace is shown in fig. 2. The dynamic corrective braces of type Cheneau or according to Cerny's patent No. 281800CZ (see fig. 1) are usually used in the Czech Republic. The breast curve can be classified according to King. The brace of type Chenau is recommended for the spinal curve type King I, II, and IV and the brace of type Cerny for the spinal curve type King II, III and V.

The brace pushes the child trunk and makes a stress state in the patient's spine. The brace changes the spinal curve; it means that the spinal pathologic form is corrected. After a long-term use of the brace, the part of spinal correction is permanent.

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