On a new type of implant in the treatment of cypho-scoliosis
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Introduction
Implanting various types of devices can surgically treat severe cypho-scoliosis. The paper presents such a device, which was designed after an original idea by Professor Corneliu Zaharia MD. The device has proved to be highly effective, for different reasons. First, it is very easy to assemble – and consequently the length of the surgical procedure is substantially reduced. Second, it weights less than similar devices therefore patients tolerate it better. Last but not least, it costs less than other devices.

Description of the implant
Two rods united through a connective part with a double thread constitute the device. Two hooks are propped up at both extremities of the device and can be fixed on spinous processes, like in the case of the Harrington device. By the manipulation of the connective part, the surgeon can stretch the device (fig. 1).

The mechanical function of the device
The authors of the study undertook a 3D graphical simulation of the scoliotic spine, by taking into account the fact that the deformity of the spine consists in both the bending of the axis and the rotation of vertebrae. They also developed an animation program, which showed that by setting a rigid chord in the spine’s curvature and by its forced stretching, one can achieve both the reducing of the curvature and the de-rotation of the vertebrae.

Figure 1: Device for cypho-scoliosis correction

Figure 2: a) scoliotic spine before device extension; b) after device extension spine straightening and vertebrae untwisting
**Particularities of designing the implant rod**

A series of testing and analyses of the stress state have been conducted, aiming to improve the shape and the dimensions of the implant rod. Here are some of them:

- Mechanical testing in the case of simple axial stress and for eccentric axial stress. The testing helped establishing the main dimensions of the device as a whole. For bending tests, had been made up support beck irons instead of spinal apophysis. Implant strains have been measured with strain gauges 1 and 2 (fig. 3).

![Figure 3: Device bending tested](image)

- Finite element method analysis of the stress state in the implant device. The analysis was conducted with brick elements, using the ANSYS software (fig. 4).

![Figure 4: Device meshing for FEM analysis](image)

- Photo-elastic study of the model. The study established the effect of the stress factors in the area where the hook is supported by the rod. Plane models of the device made at a larger scale, from epoxy resin CT-200, stressed at eccentric compression by a brake lever attachment have been analyzed. In fig. 5 we can see the isochromatic specter, in circular polarized light, white and monochromatic.

![Figure 5: Isochromates layout](image)

Following the study, the authors were able to adapt the construction of the device, in order to avoid its accidental breaking.
Results of the research
Following testing, the authors of the research gathered the information needed for designing and constructing the implant device.

Conclusions of the research
The effectiveness of the device promoted by and analyzed in this paper recommends it for using in the surgical treatment of severe cypho-scoliosis. The construction either on a small or large scale of the device should observe a number of rules, as shown by the research we conducted, in order to make sure that the device would function properly both during and after the surgical intervention.

References