In order to develop a fundamental understanding and mechanism of the Back-Rack instrument in treatment and prevention of the back pain conditions, a finite element analysis was performed. This new and modern approach is used in many scientific projects for specific applications. In this case it allowed to simulate the displacement parameter affecting decompression of the facet joints of the spinal vertebrae along the whole length of the human spine, figure 1.

The graphical presentation of lumbar in standard-lying position is presented in the picture below.

The linear graphs illustrate the symmetrical displacements in the direction of the applied load occurring along the spine under certain loads. These vary in a systematic way, translating the load and therefore the equivalent force into the relevant part of the spine, causing relief of the mechanical pain. The initial standard position is shown in figure 3 for cervical, thoracic and lumbar regions of the spine. The load varying during specified motions performed by a patient on the Back-Rack, the displacement of a weight bearing part vary accordingly, increasing its function over the affected regions, as demonstrated in figures 4, 5 and 6.

*The Back-Rack device simulation reflects and reproduces the actual and real situations related to mechanical back pain conditions. The device has potential to relief in a systematic manner the pain condition, and the patient is in total control of the treatment and its dose. This is of paramount importance, when treatment is performed at home, or under other unsupervised conditions.
*The device is ideal in prevention of the back pain, and spine relaxation.
*The Back-Rack is a simple and easy device to use and brings the desired result in back pain conditions.

Figure 1: The principle of the Back-Rack device and mechanism showing the load's transfer along the spinal column.

Figure 2: 3D finite element structure of a single spindle. 3-dimensional finite element structure of a single spindle composed of two pseudo-balls and its analytical mesh is shown in figure 2. The dimensions and shape agrees with the patented model.

The stimulation was carried out on a single spindle for three different parts of a human spine: thoracic, cervical and lumbar. The measurements were performed for a number of cases: standard lying position of a person of an average weight, and also for situations when an increased local load was applied to different parts of the spine - facet joints in a process of various exercise position of a person lying on the device.

Figure 3: Displacements for the standard lying position.

As the load vary during specified motions performed by a patient on the Back-Rack, the displacement of a weight bearing part vary accordingly, increasing its function over the affected regions, as demonstrated in figures 4, 5 and 6.

Figure 4: Displacements for the exercise position A - increasing the load acting on thoracic part.

Figure 5: Displacements for the exercise position B, increasing the load acting on cervical and thoracic parts.

Figure 6: Displacements for the exercise position C, increasing the load acting on thoracic and lumbar parts.

Figure 7: Comparison between displacements of the standard position and exercise positions: A, B and C.

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