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Experimental design of a novel prosthesis for total lumbar disc replacement

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Introduction: Lumbar disc degeneration is a natural process that increases with age. In those patients in whom conservative treatments fail, the lumbar disc prosthesis is an alternative to fusion that has gained wide acceptance in the past two decades, because it preserves the affected segment mobility without compromising adjacent levels. Then we present the development and biomechanical analysis of a discal prosthesis of new generation that combines limited mobility and shock absorption.

Goals: To present the experimental design of new lumbar disc prosthesis with emphasis on the improvements, it would have on the kinematic parameters over other implants that are currently available in the market.

Material & Methods: The kinematic study was conducted in several vertebral segments of the lumbar spine of cadaveric specimens by photogrammetry. We use KINESCAN/IBV, which is a complete system of 3D motion analysis based on digital video technologies to assess the actual shifts in the functional units of the column. It took into account the average size, range of motion, mechanical properties and wear properties. The data were then analyzed to determine the CIR (Instant Center of Rotation) of the vertebral units and a novel geometry. This geometry reproduces the movement of the functional spinal unit based on position changes of the CIR. The prosthesis was fabricated and tested to static loads, fatigue and wear.

Results: From the study of the biomechanical behavior of the column surfaces that define the movement of the prosthesis in flexion/extension, lateral bending and axial rotation were defined. Moreover implant design will consist of two end plates made of CoCr alloy and an intermediate component PCU (Polycarbonate-urethane) with shock absorption and redistribution of loads function. The tests demonstrated that the prosthesis had a mobility ranges similar to physiological, and fatigue and wear behavior equal or lower than others prosthesis currently available on the market.

Conclusion: We have developed a lumbar disc prosthesis limiting flexion and rotation by a unique geometry that at the same time allows a damped transmission of loads and less wear.

Biography

Vicente Vanaclocha-Vanaclocha is the Chief of Neurosurgery. He is the Doctor of Medicine from the University of Valencia. He has over 25 years experience in neuro-oncology, minimally invasive and minimally invasive surgery techniques. He is the Specialist in neurosurgery both nationally and internationally and has been the Chief of Neurosurgery at the University Hospital of Navarra and Head of Neurosurgery Service of San Jaime Hospital in Torrevieja. He was also Associate Professor of Neurosurgery at the Faculty of Medicine of the University of Navarra and is a Professor of Neuroanatomy at the Catholic University of Valencia. He is also serving as an Editorial Board Member of repute.

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