Comparative Electrogoniometric Study of the Global Cervical Range of Motion and Velocity, after Cervical Disc Herniation, Anterior Cervical Discectomy and Fusion or Disc Arthroplasty

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Introduction: Three-dimensional electrogoniometry (CA6000, OSI) is shown to be a reliable, accurate, reproducible and unconstraint tool for continuous tracking of cervical spine range of motion (ROM) and velocity of motion (VM). Already used in healthy subjects and in patients with cervicalgia or after whiplash, it has never been used to compare the cervical pattern and ROM of patients with cervical disk herniation (HD) before and after anterior discectomy and fusion (ACDF) or cervical total disc replacement (TDR).

The aim of the study was to compare the range, velocity and patterns of global motions of the cervical spine in four different clinical conditions:
1) healthy subject (control group),
2) after HD,
3) after ACDF,
4) after TDR, using the CA 6000 Spine Motion Analyzer.

Material and methods: Since 2005, sixty-three patients (mean age: 48 y (range 26-73 yo)), admitted for cervical HD, were included in our biomechanical study. The ROM and VM were measure using the 3D-electrogoniometer (CA6000-OSI) before and/or after treatment. The ROM, VM and patterns of motion were analysed between the first thoracic vertebra and the head for flexion-extension, lateral bending and rotation in neutral sagittal plane position and in full flexion. Thirty-seven patients were measured in preoperative (HD group). In the 63 patients included, 39 were treated by TDR (TDR group) and 23 by ACDF (Fusion group). ROM and VM were compared to the results obtained from 42 healthy subjects (control group).

Results: All movements (ROM and VM) tested were significantly (p< 0.001) affected in the 3 clinical conditions (HD, ACDF or TDR group) if compared to control group. After TDR, a significant better recovering was observed for the ROM and VM if compared to ACDF group (p< 0.05), without complete return to normal. If compared to preoperative (HD group), only VM were significantly improved after TDR (p< 0.05). After ACDF, all modality of movement (ROM and VM) were significantly reduced if compare to the other group.

Conclusion: Using TDR as treatment of HD allows to significantly better restoring the global ROM and the VM of the cervical spine if compared to the ACDF. CA6000 electrogoniometer is an interesting tool to measure, in vivo, the impact on the cervical ROM and VM of cervical disc herniation. It allows a quantitative and comparative evaluation of the spine kinematic after the different modalities of treatment available.