3D Assessment of the Intervertebral Kinematics after Total Disc Replacement at the Cervical Spine in vivo Using the EOS Stereoradiography System

M.-A. Rousseau¹,², S. Laporte⁶, T. Dufour³, J.-Y. Lazennec¹, W. Skalli²

¹Assistance Publique - Hopitaux de Paris (APHP), Pitié Salpêtrière Hospital, Orthopedic Surgery, Paris, France, ²Arts et Metiers ParisTech, Biomechanics Lab, Paris, France, ³CHR La Source, Neurosurgery, Orleans, France

Study design: A biomechanical study of the 3D kinematics of the cervical spine at the segmental level in vivo after total disc replacement with using the EOS stereoradiography system.

Objective: To investigate the intervertebral angular motion in 3D in vivo using the EOS stereoradiography system after total disc replacement, including the assessment of the uncertainty in the measurements.

Summary of background data: Intervertebral mobility after cervical disc replacement has been evaluated in flexion extension. The novel EOS imaging system allows the assessment of the 3D mobility of the spine in upright position. The 3D mobility of the cervical artificial disc in vivo has not been evaluated in vivo before.

Methods: Nine patients with 16 Mobi-C prostheses (LDR Medical, France) had EOS stereoradiography of the lower cervical spine (C3 to C7) in neutral upright position of the neck, flexion, extension, left and right lateral bending, left and right axial rotation. The angular displacements were measured from the neutral position to every other posture. The metallic endplates of the prosthesis were used as markers. A reproducibility study was done.

Results: The range of motion extension, flexion, right axial torsion, and right lateral bending were 3.1° (4.7), 3.1° (7.2), 3.2° (4.1) and 1.5° (3.2) respectively. Axial torsion and lateral bending were coupled similarly to the normal disc.

Conclusions: This study show the feasibility of using the dynamic EOS stereoradiography for measuring disc prosthesis kinematics in 3D in vivo. The uncertainty of the measurement has to be improved for taking full advantage of the EOS system.