

Does maintenance of physiologic kinematics in the adjacent segment prevent adjacent segment degeneration following dynamic cervical stabilization?

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Introduction:

New implants for cervical disc replacement aim at maintaining or restoring function. Most studies that include motion analysis examine motion of the segment treated. After successful decompression, however, it is more important to examine kinematics in the adjacent segments with regard to the long term result.

Material and Methods:

Between 2007 and 2011 we selected 121 patients aged 32 to 73 years for treatment with DCI™ (Paradigm Spine) at either one (n=108) or two levels (n=13). Indications were radiculopathies (n=69), axial pain (n=6) or spondylotic spinal stenosis (n=46) excluding chronic myelopathy. Disc surgery was performed at C3/C4 (n=2), C4/5 (n=8), at C5/6 (n=65), C6/7 (n=57) and at C7/T1 (n=2). Patients were followed up at 3, 6, 12, and 24 months after surgery. Besides clinical parameters motion was analyzed in the segment that was operated and also in both adjacent segments using FXA-analysis (ACES GmbH). Based on functional radiographs the following indicators for segmental degeneration were analyzed: 1. Range of motion (ROM, in degrees), 2. Location of the mean center of rotation (MCR) compared to the physiological MCR and 3. Loss of disc height indicating segmental collapse.

Results:

More than 90% of the patients rated their outcome after surgery with DCI™ as good or excellent. There were no implant related complications. VAS for neck pain and arm pain, as well as NDI continuously decreased in successive follow-ups. SF12-measures returned to normal (physical and mental scores). Correspondingly all satisfaction scores continuously increased. In the segment treated with DCI™ the mean ROM was 7.4° after 3 months but returned to 3.3° within 24 months whereas normal values of around 10° were measured at all follow ups without any change. The MCR of the operated segment moved slightly upwards to the top endplate in contact with the DCI™ whereas the MCR of both adjacent segments showed no shift at all during the follow up period. The height of the disc space treated was at least 5mm depending on the size of the implant used. A reduction of height on the posterior rim of the disc space after 24 months could be attributed to some bony bridging and did not affect segmental or foraminal height. Both adjacent segments maintained their preoperative height during the 24 months of follow up. Thus we could not observe any radiological signs of segmental degeneration in either adjacent segment after DCI™ surgery.

Conclusions:

Independent of a good primary clinical result due to proper decompression patients treated with DCI™ showed a continuing improvement during the follow up period of 24 months. Possibly protection of adjacent segments with maintenance of physiological kinematics and preservation of segmental height due to the dynamic properties of the implant are responsible for the good and excellent long term results with restoration of life quality. DCI™-patients will be followed-up continuously for the next years in order to validate these findings.