

Introduction:

The potential benefit of cervical motion preservation technique using a cervical total disc replacement (cTDR) is increasingly acknowledged. The instantaneous center of rotation (iCOR) of a motion segment has been shown to correlate with its total range of motion (ROM) and the determination of the iCOR is thought to describe the quality of motion. Additionally, a correlation of the correct placement of cTDR to preserve a physiological iCOR was found. Nevertheless, the changes of these parameters and their clinical relevance have not been analyzed for most current devices. Therefore, the aim of this study was to assess the radiological and clinical correlation of iCOR and ROM following cTDR. Materials and

Methods:

A retrospective multi-center observational study was conducted and radiographic as well as clinical parameters were evaluated preoperatively as well as at the 1-year follow up after cTDR (ROTAIO disc prosthesis, SIGNUS, Alzenau). Radiographic parameters including flexion/extension x-rays (flex/ex), ROM, iCOR and the implant position (IP) plus the corresponding clinical parameters [(Neck Disability Index (NDI) and the Visual Analogue Scale (VAS))] were assessed. Statistical analysis was performed by RAYLYTIC GmbH, Leipzig.

Results:

57 index segments of 53 patients treated with cTDR were analyzed. Pre- and postoperative ROM showed no significant changes (8.0° vs. 10.9° ; $p > 0.05$). Significant correlations between iCOR and IP (Pearson's R: 0.6; $p < 0.01$) as well as between ROM and IP (Pearson's R: -0.3; $p = 0.04$) were revealed (Fig. 1). NDI and VAS improved significantly from pre- to postoperative evaluation ($p < 0.01$). A significant correlation between NDI and IP after 1 year (Pearson's R: -0.39; $p < 0.01$) was found.

Conclusion:

Implantation of the tested prosthesis maintains ROM and results in a physiological iCOR. The exact position of the device influences the clinical outcome. These results thus optimize implant positioning and corresponding data should be available for all cTDR devices to potentially improve device function by optimal positioning.

