

3. How forced fixation affects patients' clinical outcomes

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Background

The literature indicates that 15 years after lumbar fusion, 27.3%¹ to 37.5%² of patients require a new surgical treatment due to adjacent segment disease (ASD), depending on the diagnosis. 75% of patients were dissatisfied with their outcome². In recent decades, the number of hardware-related reoperations has increased³. Approximately 70% of all revisions are due to mechanical failure, such as screw pull-out, screw loosening, disassembly, implant breakage, pseudarthrosis, ASD and proximal junctional kyphosis^{3,4}, and another 10% due to infection³. Since it is known that in 90% of all loosened screws, screw pull-out occurs during intraoperative tightening of the pedicle screw-rod assembly⁵, special consideration must be given to the forces applied to the spine during this process. In many cases where implant failure and early ASD occur, mismatch of the pedicle screw head and rod (S/R) can be seen on postoperative radiographs. Mismatched pedicle screws and rods are clear signs of overload. This overload is transferred to the surrounding tissues and has significant impact on the biomechanics and alignment of the spine. The objective of this study is to analyze the impact of mismatches on clinical and radiological outcome.

Material and Methods

Retrospective review of patients who underwent fusion surgery with pedicle screw/rod systems for predominantly degenerative pathologies between 2013 and 2018 and for whom clinically and radiologically complete preoperative, postoperative, and 1-year follow-up data were available. 1,183 patient records were reviewed accordingly. Comparisons were made between patients with and without mismatch in terms of fast appearing ASD, VAS pain and revision surgery. S/R alignment is measured as the angle between each pedicle screw head and the associated rod. Angles other than 90° +/- 0.3° are considered mismatched.

Results

406 patients met the inclusion criteria for the study. A total of 3,016 pedicle screws were implanted in them between T2 and S2. Mean follow-up time was 5 years (1 to 7 years). In 42.1% of the patients (171/406) a S/R mismatch was found in at least one of the pedicle screws, affecting 20.3% of all pedicle screws (613/3016). Of the patients who developed a new radiographic ASD sign at the upper adjacent level at final follow-up, 83.9% were in the mismatch group (47/56). Patients with S/R mismatch experienced significantly more pain (mean (SD) VAS pain 2.8 (0.8) vs. 1.4 (0.8)). The overall revision incidence was 11.8% (48/406). Of the cases that underwent revision surgery, 95.8% belonged to the mismatch group (46/48). When comparing patients who underwent intraoperative correction and/or reduction with those who did not, there were statistically significant differences in screw mismatch ($p=0.004$) and revision incidence ($p=0.001$).

Conclusions

Orthogonal alignment between pedicle screw head and rod plays an important role in clinical and radiological outcome. In addition, the control of spinal parameters is mandatory. Mismatch of the pedicle screw/rod interface should be considered as an important factor for unexpected outcomes.

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