

Patient-specific templates for pedicle spine screws placement: literature review and proposal of a new design

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Introduction. Pedicle screw fixation to stabilize lumbar spinal fusion has become the gold standard for posterior stabilization. Computer Assisted systems allow to increase the accuracy of pedicle screw placement, but they are used only by few surgeons due to the costs and troubles related to their use. An alternative image guided approach, less expensive and less complex, is the using of Patient Specific Templates similar to the ones used for dental implants or knee prosthesis.

Materials and Methods. Preoperative planning and template developing is done using a modified version of an open source CT segmentation software ITK-SNAP 1.5. The templates are then realized using a 3D Printer. We designed a single level template with multiple contact points on bone to guarantee a high template stability and a low soft tissue invasiveness. Preliminary ex-vivo animal testing on 2 porcine specimens has been conducted to evaluate template performance in presence of the soft-tissue in place. A post-operative CT scan was performed to evaluate the Kirschner wire positioning.

Results. The post-operative CT evaluation showed a discrepancy between the planned trajectory and the obtained trajectory less than 1 mm in 93% of the cases and between 1-2 mm in 7% of the cases. We recorded a grade II pedicle cortex violation.

Conclusions. Guide positioning is facilitated thanks to the using of the spinous processes contact point, while false stable positions can be avoided using four redundant contact points. The results obtained during our preliminary ex-vivo animal tests encourage further studies comprising in-vivo human evaluation.