

Patient-Specific 3D Printed Guides Reduced Surgical Times and Blood Loss in Scoliosis Surgery: A Patient-Matched Comparison

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INTRODUCTION:

Customized pedicle screw guidance systems use preoperative imaging to construct 3D printed guides that precisely fit the spinal anatomy of an individual patient at a specific level. These patient-specific guides are increasingly used in spinal deformity surgery, but few studies have measured the effectiveness of these systems. We aimed to evaluate whether the use of a patient-specific pedicle screw guidance system would lead to a reduction in surgical time, blood loss, need for transfusion, and radiation exposure compared to conventional fusion techniques.

METHODS:

We retrospectively reviewed a prospectively collected database to find 47 patients who underwent spinal fusion for scoliosis using patient-specific 3D printed pedicle screw guides. A control cohort of 47 patients who underwent fusion using conventional techniques was constructed using propensity score matching based on scoliosis type and number of levels fused. All patients received treatment between the years of 2013-2022 by a single surgeon at a tertiary care pediatric center. Spinal deformity parameters, surgical time, blood loss, transfusion volume, and intraoperative radiation exposure were compared between treatment groups.

RESULTS:

Patients who were treated using customized pedicle screw guides and those treated using conventional techniques had similar major curve angles (56° vs. 58°), number of levels fused (14.1 vs. 13.6), and number of screws placed (20.7 vs. 19.5). Those treated with the customized system had reduced surgical time (302 vs. 359 minutes, $p < 0.01$), lower blood loss (649 vs. 1134 mL, $p < 0.01$), lower average blood transfusion given (171 vs. 265 mL, $p = 0.04$), and reduced intraoperative fluoroscopy exposure time (10.9 vs. 31.7 seconds, $p < 0.01$).

DISCUSSION AND CONCLUSION:

The use of customized pedicle screw guides in spinal fusion leads to significantly reduced surgical time, blood loss, and need for blood transfusion. Radiation exposure can be significantly decreased as well. Patient-specific 3D printed guides improved surgical outcomes in this small cohort.

	3D Printed Guides	Control	p
Operative Time	302 min	359 min	$p < 0.01$
Blood Loss	649 mL	1134 mL	$p < 0.01$
Cell Saver	171 mL	265 mL	$p = 0.04$
Fluoro Time	10.9 sec	31.7 sec	$p < 0.01$