

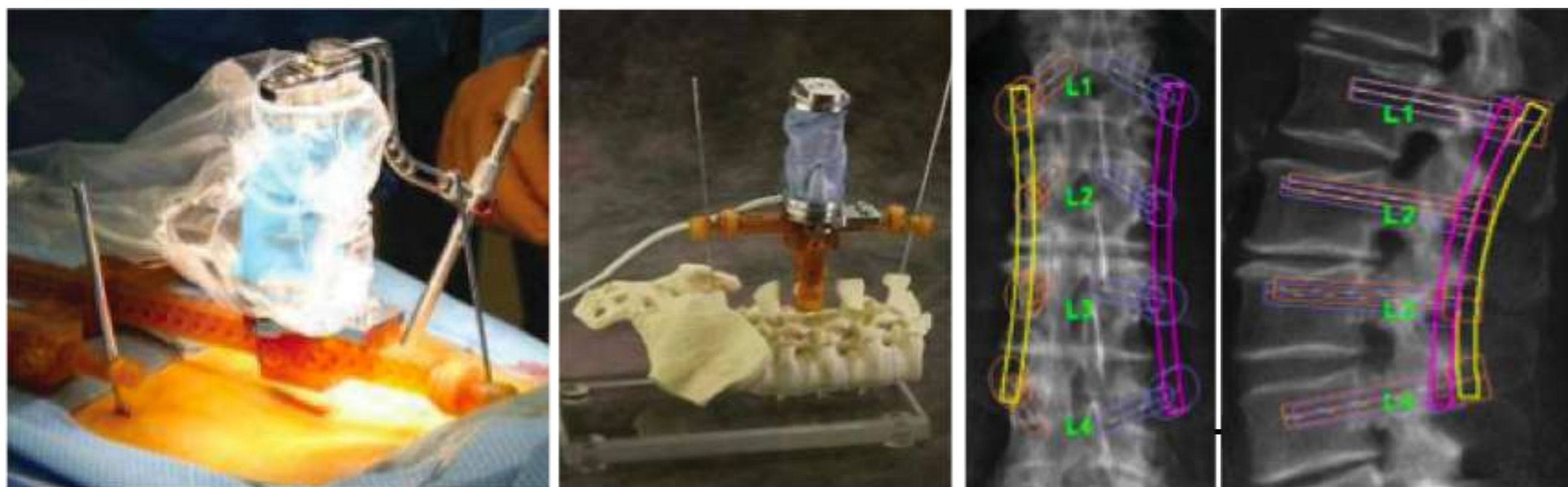
Robotically assisted pedicle screw insertion. A CT based matched controlled study.

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Introduction

Pedicle screw insertion is accompanied with a significant misplacement rate. In order to improve accuracy of placement, new techniques have been developed such as computer aided navigation. A new miniature robotic system has been recently developed with a view to assist screw placement in the lumbar and thoracic region.



Robot mounted on spine

Planning

Results

Screw misplacement

	Robot	Freehand	
Rampesaud A, B	61	59	
Rampesaud C, D	3	5	
% C&D (misplaced)	4.9%	8.4%	not statistically significant, P=0.72

No difference in misplacement between thoracic and lumbar screws.

Proximity of nerve tissue

Compound muscle action potentials

Robot: 30mA **Freehand:** 24mA

But C.I. of the difference (6mA): 1.8mA to 10.1mA

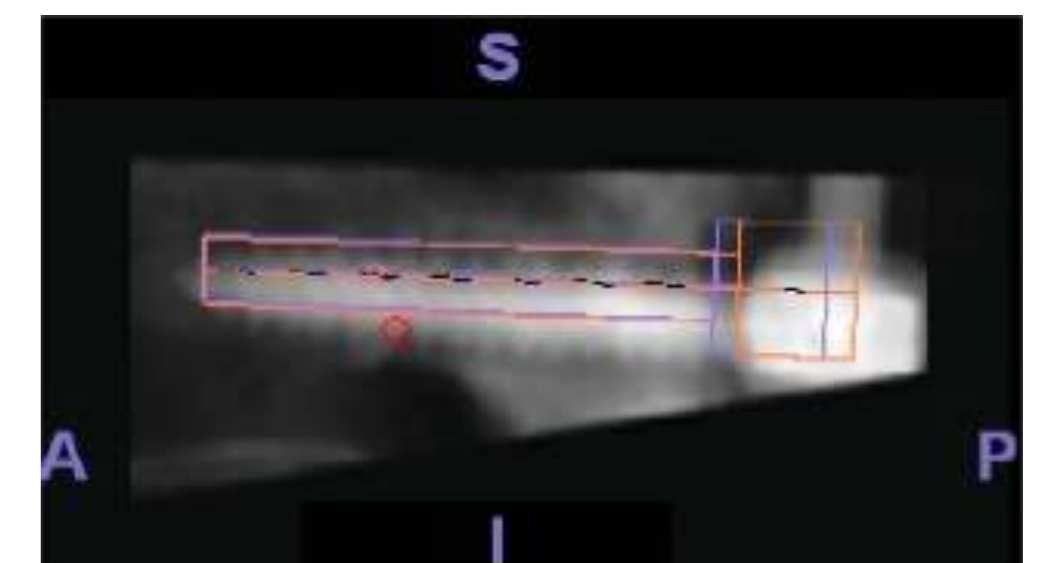
Comparison planning – result

Deviation (ex. in fig.below) from robot's preoperative plan

Total average position: 0.03mm

Angular deviation: 1.24

Deviation example:



Materials and Methods

- 34 patients
- 128 screws: 104 lumbar and 20 thoracic
- Screws introduced by a single experienced spinal surgeon
- 64 screws introduced with a miniature robotic device based on pre operative CT images and fluoroscopic control
- 64 screws introduced by freehand technique under fluoroscopy matched for level and diagnose
- All patients underwent intraoperative EMG monitoring
- Screw position assessed on post operative CTs by two independent observers in axial, sagittal and coronal planes using the A to C classification described by Rampesaud
- CT images of the robotically treated patients were compared to the preoperative CT-based planning, in order to assess accuracy of screw trajectory execution

Discussion

The number of misplaced screws (C&D grade) was generally low. The accuracy of execution of robot planning was also very good. Robotic placement did not improve to a statistically significant level the placement of screws but we noted that misplacement rates using this miniature device equals that of published navigation aided insertion series. Electrophysiological differences though suggest that robotic placement further improved our safety margin between implants and nerve tissue. Robotically assisted spine surgery might therefore enhance the safety of screw placement in particular in training settings where different users at various stages of their learning curve are involved in pedicle instrumentation. Larger future series should include thoracic screws inserted in scoliotic spines to show utility of this new technique.