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KEY PROCEDURES

# Placement of Thoracic Pedicle Screws

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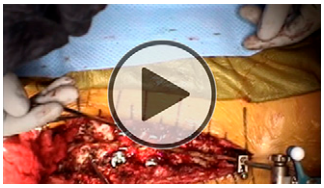
Published outcomes of this procedure can be found at: *Spine (Phila Pa 1976)*. 2003 Sep 15;28 (18):2058-65, *Spine (Phila Pa 1976)*. 2001 Nov 1;26(21): 2340-6, and *Spine J*. 2014 Jan;14 (1):137-44





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## Abstract

Thoracic pedicle screws have become the spinal anchor of choice because of the superior biomechanics of this technique. It is widely used for the treatment of scoliosis, spinal deformity (such as kyphosis), trauma, tumors, infection, and other pathologies. The technique demands precision as malposition can result in spinal cord or visceral injury with potential catastrophic consequences (death or paralysis).

There have been many published articles looking at the anatomy and the anatomic variation in various populations according to race, age, deformity, etc. Lenke and others have developed start point guidelines that seem to have reasonable validity.

There are two basic screw trajectories:

1. The straightforward technique.
2. The anatomic trajectory.

The straightforward technique parallels the superior end plate of the instrumented vertebra. It has the best insertional torque. The anatomic trajectory bisects the sagittal axis of the pedicle, typically 15° cranial to caudal, and has the largest available bone channel. The accuracy of placement is a debated topic. There are several meta-analyses and systematic reviews that address this question. However, there are a variety of definitions of acceptable compared with optimal placement. The current gold standard for judging screw placement is the use of computed tomography; however, it carries a substantial radiation burden to the patient, which must be considered.

There are a myriad of described techniques, including freehand (anatomically based), fluoroscopy-guided, and three-dimensional (3-D) image-guided methods. All have their advantages and disadvantages. Surgeons must find the technique that is safe and reliable in their hands.

The procedure is performed with the following steps:

1. Preoperative planning is done by initially looking at plain radiographs and by assessing bending radiographs and preoperative computed tomography scans, if available.

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2. The patient is placed on a Jackson table, which is radiolucent and allows easy access for C-arm or O-arm technology.
3. Locate the start point around the thoracic level (T12, T8, etc.); a review of the Lenke start point map is helpful.
4. Create the dorsal cortical hole, which is best done with a small pilot hole; we recommend the use of a 3-mm high-speed burr (Midas Rex; Medtronic).
5. Create a track within the pedicle by probing with either a navigated probe or a Lenke-style freehand probe.
6. Confirm the accuracy of the screw tract placement, which can be done by palpation although it is not 100% reliable.
7. Place the screw after tapping 1 mm less than the nominal screw diameter.
8. Confirm the accuracy of screw placement with fluoroscopy or plain radiographs; 3-D intraoperative imaging is the most reliable technique, but it also exposes the patient to the most radiation.
9. Confirm the neurological status of the patient by monitoring the motor evoked potential signals after screw placement.
10. Close the wound after the screws have been checked with intraoperative 2-D or 3-D imaging to ensure that they have not cut or plowed out.

The results of thoracic pedicle screw placement are specific to the spinal condition treated. For adolescent idiopathic scoliosis, no brace is needed and walking can be progressed as tolerated. With good thoracic screw placement, rehabilitation typically is accelerated because a stable spinal construct is achieved. Most patients are able to walk without any sort of external mobilization or special adjunctive protection.

## Acknowledgment

Note: The chart entitled "Pedicle Screw Starting Points for the Straight-Forward Trajectory" by Lawrence G. Lenke, MD, from the CD Horizon Legacy Spinal System, was provided by Medtronic. Reproduced with permission.

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