

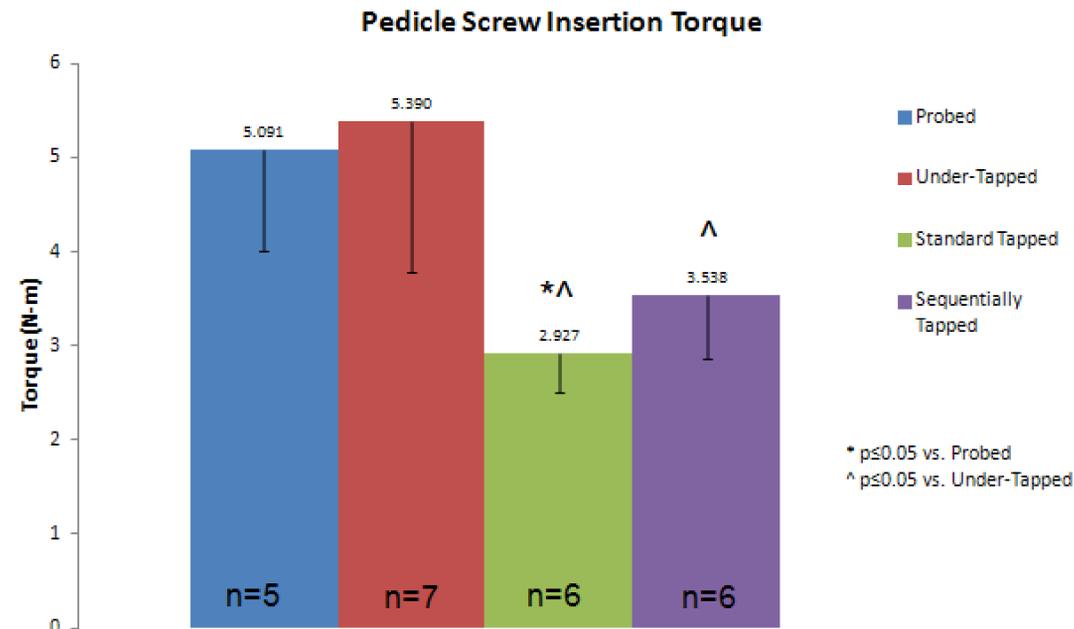
**Introduction**

Maximizing pedicle screw-to-bone strength is challenging in osteoporotic patients. Preparation of the pedicle screw trajectory through the pedicle and into the vertebral body can affect the pullout strength. Four different preparation techniques were used in calf vertebral bodies. Insertion torque and pullout strength were compared.

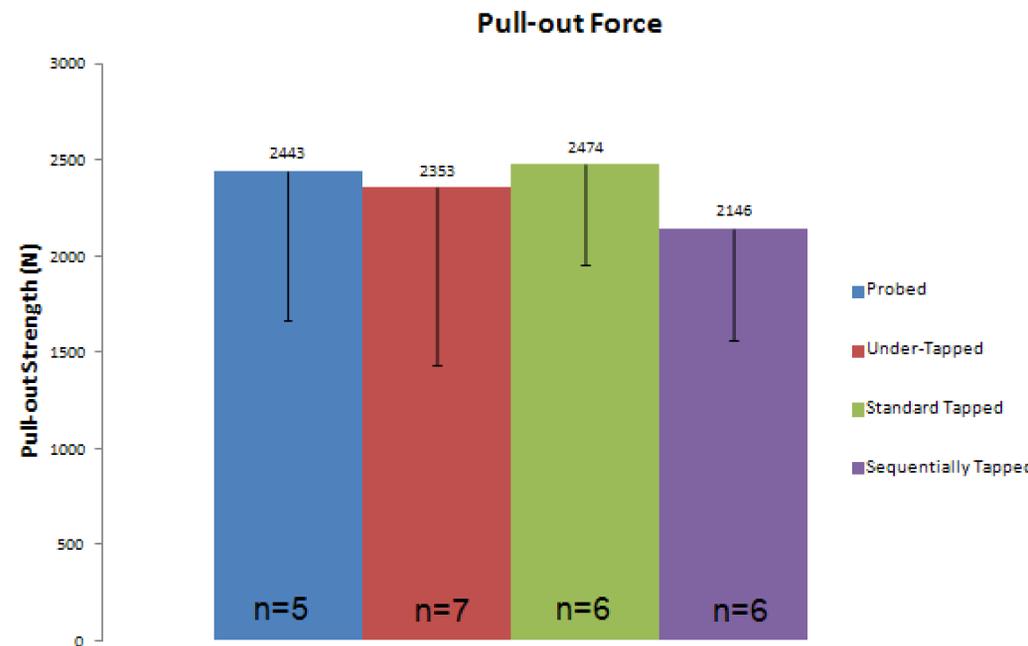
**Methods**

A 6.5mm diameter, 40mm length screw, REVERE<sup>®</sup> (Globus Medical Inc.; Audubon, PA) was used for all testing. The preparation techniques were as follows: After an awl was used to perforate the cortex; 1) a pedicle probe is inserted to a depth of 40mm (probed), 2) a probe is inserted to a depth of 40mm then a 5.5mm diameter tap is inserted 40mm (under-tapped), 3) a probe is inserted to a depth of 40mm then a 6.5mm diameter tap is inserted 40mm (standard tapped), 4) a probe is inserted to a depth of 40mm then taps are inserted to a depth of 40mm in the following order: 4.5mm, 5.5mm, and 6.5mm (sequentially tapped). Insertion torque was measured during final screw insertion.

A stress relaxation loading protocol was used to simulate a physiological screw loosening. An axial pull-out load rate of 5mm/min was applied using an 858 Mini Bionix<sup>®</sup> II (MTS Corporation, Minneapolis, MN). Tensile loading was paused for 1,000 seconds every 0.5 mm of advancement. A one-way ANOVA and Tukeys *post hoc* test was used to determine significance.



**Figure 1:** Total insertion torques for probed, under-tapped, standard tapped, and sequentially tapped techniques.



**Figure 2:** Pull-out force of pedicle screw for probed, under-tapped, standard tapped, and sequentially tapped techniques.

**Results**

The pedicle screw insertion torques for the probed, under-tapped, standard tapped and sequentially tapped techniques were 5.09 (±1.08) N-m, 5.39 (±1.61) N-m, 2.93 (±0.43) N-m, and 3.54 (±0.67) N-m, respectively. There is a significant difference between probed compared to standard-tapped ( $p \leq 0.05$ ), as well as under-tapped compared to both standard tapped and sequentially tapped ( $p \leq 0.05$ ) [Figure 1].

The pull-out force for pedicle screws for the probed, under-tapped, standard tapped and sequentially tapped techniques was 2443(±782) N, 2353(±918) N, 2474(±521) N, and 2146(±582) N, respectively, with no significant differences in any group ( $p \geq 0.05$ ) [Figure 2].

**Conclusion**

The screw insertion torque significantly increased based on the pedicle preparation technique used. The probed technique resulted in the highest pull-out force, while the sequentially tapped technique resulted in the lowest. However, there was no significant difference in the pull-out values based on preparation technique. These findings suggest that while the insertional technique has an impact on the screw fixation at the time of placement, other factors such as bone density may have a greater influence on pull-out strength.

**Disclosures**

J.M. Educational support: Globus, Stryker. M.M.; K.S.; B.B.; and S.K. are Globus Medical Inc. employees