

***In Vitro* Biomechanical Study of Pedicle Screw Pull-Out Strength Based on Different Screw Path Preparation Techniques**

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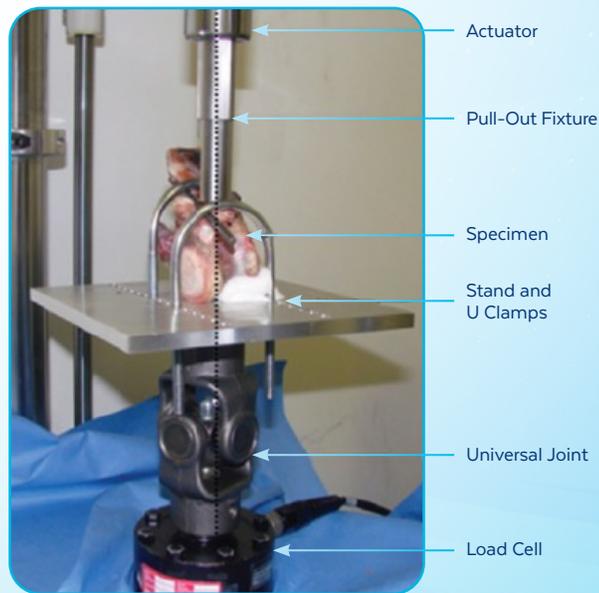
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OBJECTIVE: The study aimed to determine whether pedicle preparation with a sequential tapping technique alters screw-to-bone fixation strength.

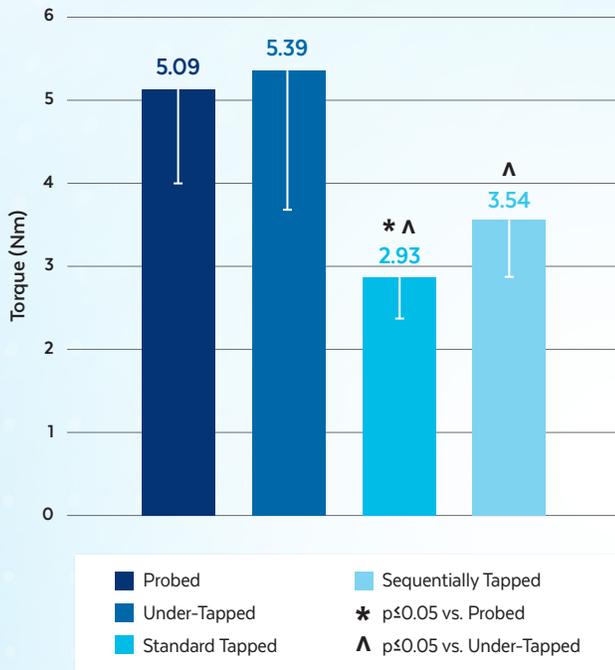
METHOD: Three thoracolumbar calf spines were implanted with pedicle screws (Ø 6.5 mm, length: 50mm) using four different techniques to prepare the pedicle screw track: probed (P), under-tapped (UT), standard-tapped (ST), or sequentially tapped (SQT). Screws were inserted along the midline of the long axes of the pedicle with minimal convergence.

To measure pull-out strength, a stress relaxation protocol was used, where withdrawal of the pedicle screw was incremental to allow for stress relaxation (1000s of relaxation every 0.5mm). The maximum torque required for pedicle screw insertion was also measured and reported.



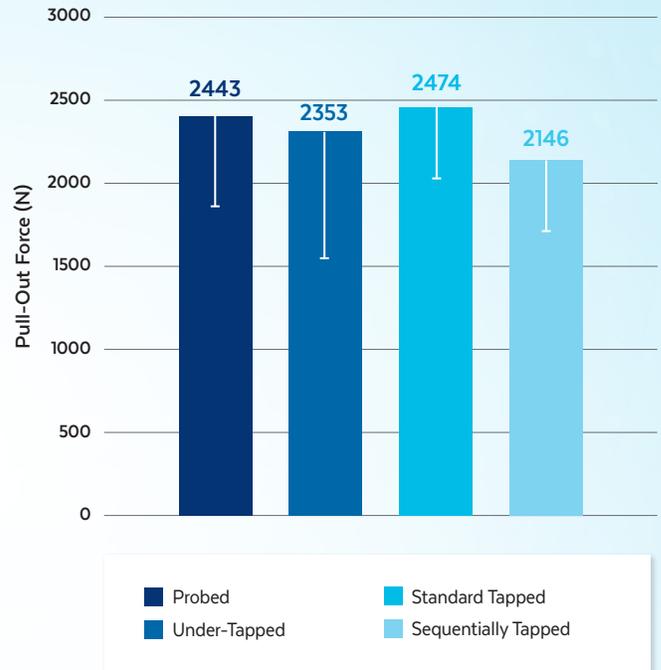
Testing setup to measure pull-out strength (MTS Mini Bionix III)

PEDICLE SCREW INSERTION TORQUE



Insertion torque of pedicle screw relative to track preparation technique

PULL-OUT STRENGTH



Pull-out strength of pedicle screws with respect to track preparation technique

RESULTS:

- Pedicle screw insertion torque for the standard tapped technique was significantly less than that of the probed and under-tapped techniques ($p < 0.05$).
- Standard and sequentially tapped techniques resulted in significantly less insertion torque than the under-tapped technique ($p < 0.05$).
- No significant differences in pull-out strength were observed among tapping techniques.

CONCLUSION:

Pedicle screw tapping technique did not affect screw-to-bone fixation strength. However, greater insertion torque was observed with the probed and under-tapped techniques in comparison to standard and sequentially tapped techniques.



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