Evaluation of a Newly Designed Step Drill

Kirstin A. Bubeck, DMV; José M. García-López, VMD; and Louise S. Maranda, DVM, MSc, PhD

Comparison between sequential drilling and the use of a newly designed step drill resulted in significantly shorter times to complete and in our opinion, comparable temperature generation during creation of a 6.2-mm pilot hole for transfixation pin insertion. Therefore, the step drill seems to be a viable alternative to traditional sequential drilling when used in the equine third metacarpal bone. Authors’ addresses: Department of Clinical Sciences, Tufts Cummings School of Veterinary Medicine, 200 Westboro Road, North Grafton, MA 01536 (Bubeck, García-López); and Department of Environmental and Population Health, Tufts Cummings School of Veterinary Medicine, 200 Westboro Road, North Grafton, MA 01536 (Maranda); e-mail: kirstin.bubeck@tufts.edu. © 2008 AAEP.

1. Introduction
A major factor that can lead to premature pin loosening during transfixation pin casting is thermonecrosis of the bone around the pin holes that is caused by excessive temperature generation during the drilling process. In this study, cortical bone temperature generation was compared during the creation of a 6.2-mm pilot hole in the equine third metacarpal bone using sequential drilling (SQ) versus using a newly designed step drill (ST).

2. Materials and Methods
Eight pairs of third metacarpal bones were used to compare temperature generation between sequential enlargement using 4.5-, 5.5-, and 6.2-mm drill bits and a newly designed step drill. Drilling was performed using a constant force of 60N, 80N, and 120N. Thermocouples were implanted in both cortices 1-, 2-, and 3-mm from the margin of the pilot hole. Maximum temperature rise during drilling and drill time were recorded and compared between groups using a two-way ANOVA and a paired t-test with statistical significance set at p < 0.05.

3. Results
There was a significant difference (p = 0.009) in temperature generation between SQ (5.36 ± 5.38°C) and ST (6.41 ± 5.66°C). At 1-mm distance, a temperature rise of >10°C was surpassed with both drilling methods. No sustained temperature rise >10°C was observed on either cortex 2- and 3-mm from the pilot-hole margin. No significant differences in temperature generation (p > 0.5) were found between the three different drill forces. Drill time was significantly shorter (p < 0.001) for ST.

4. Discussion
Drilling with ST is faster but results in slightly higher temperatures than using SQ. This may not be of clinical relevance, because the 1-mm area around the drill hole will be ablated when inserting the transfixation pin.

Reference