

Heat and Sound Generation During implant osteotomy when using different Types of drills in Artificial and Bovine Bone Block

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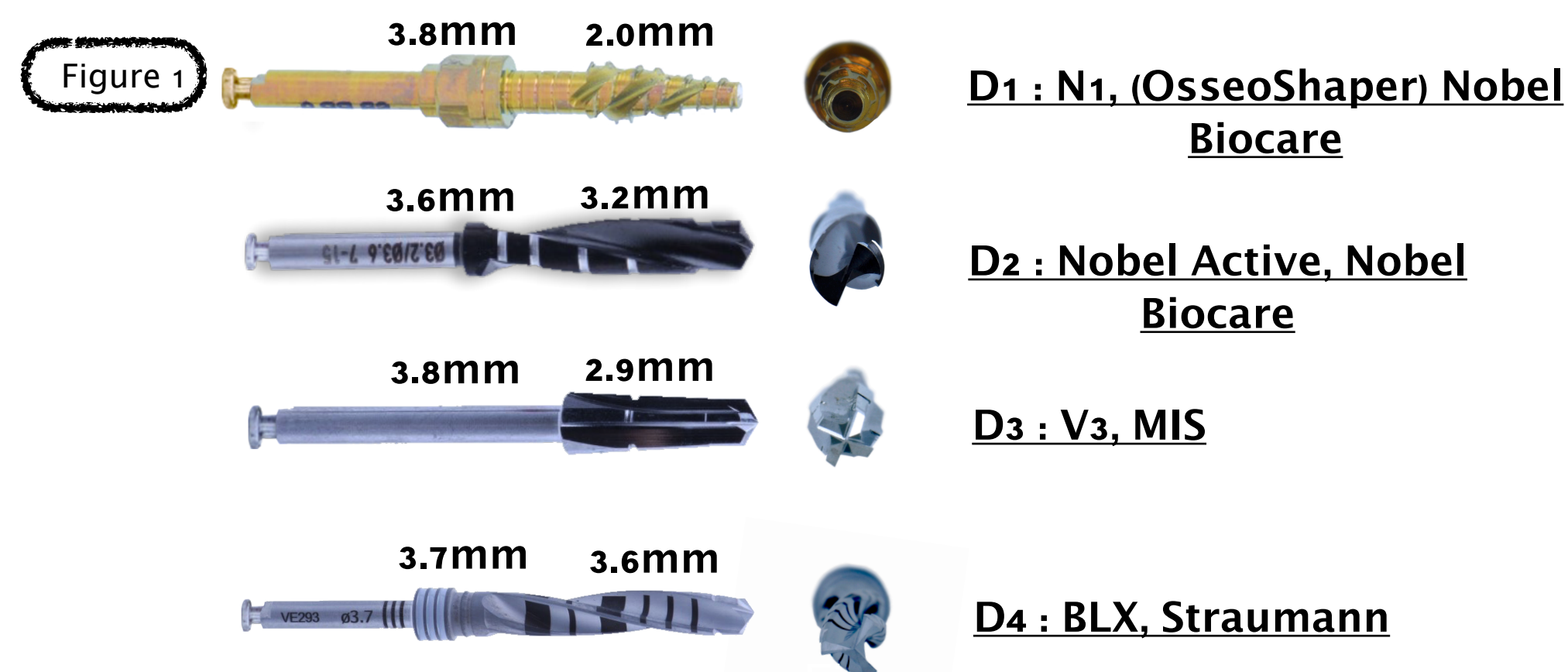
Advanced Education Program in Implant Dentistry, Loma Linda University school of Dentistry Loma Linda California

Aim

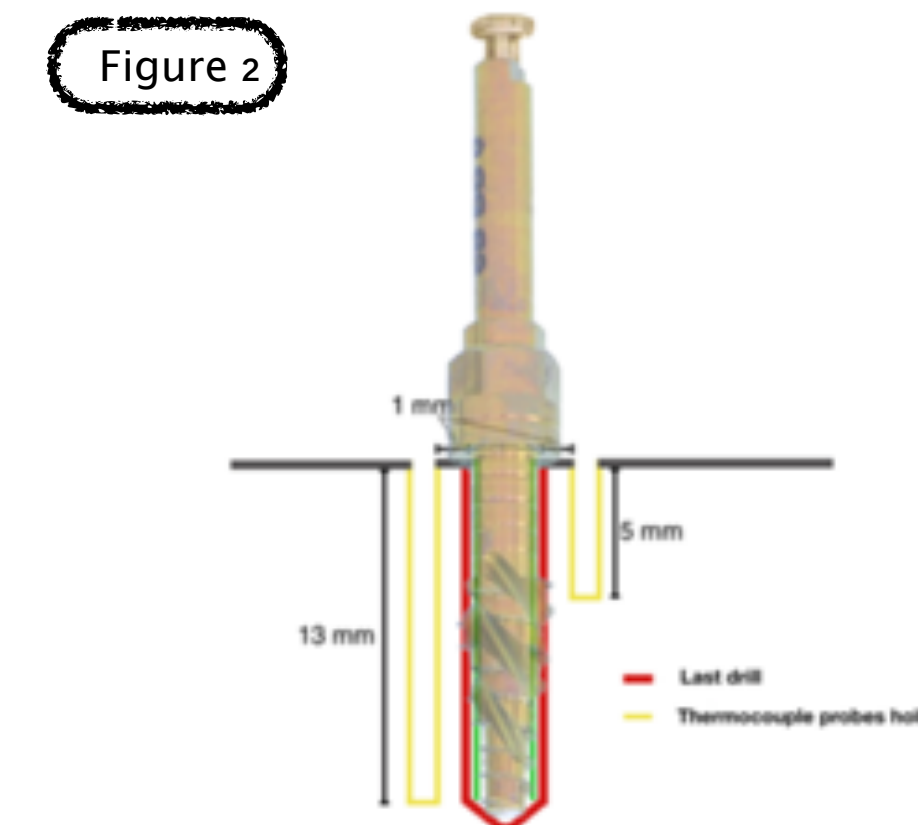
The purpose of this in vitro investigation was to evaluate the temperature change when preparing implant osteotomies (IO) with the final drill of 4 implant systems in both artificial bone blocks (BA) bovine rib bone (BB). The new drill, OsseoShaper, is designed to cut bone at a low (< 50 rpm) rotational speed. The temperature changes were registered with the use of thermocouples as well as an infrared thermography camera. Drilling sound and time required were also recorded.

Methods

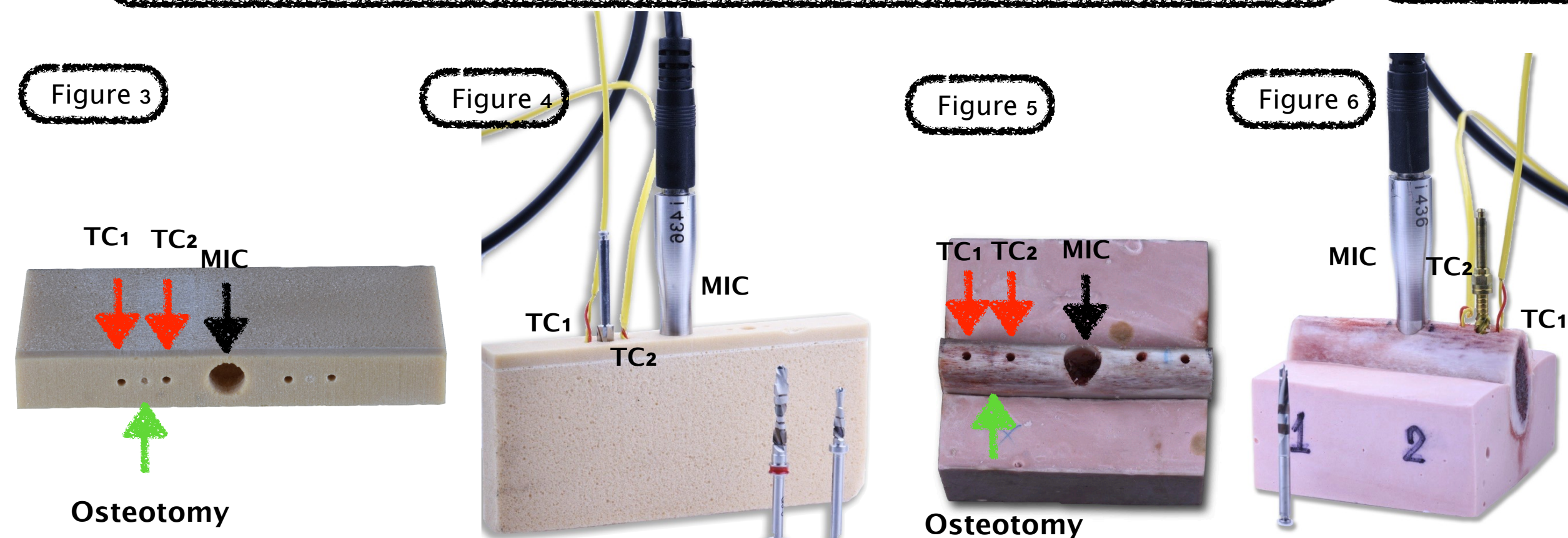
A total of 80 implant osteotomies (IO) were formed using 4 implant drilling systems, D1 (N1, Nobel Biocare), D2 (Nobel Active, Nobel Biocare), D3 (V3, MIS) and D4 (BLX, Straumann) (Fig. 1) in both BA, and BB. Thermocouple probes were used to record temperature change at the depths of 5.0 mm and 13.0 mm of each IO formed by the final drill (Figs. 2-6) In addition, thermographic images, drilling sound, and drilling time were recorded and evaluated (Fig. 7) Statistical analyses were performed at $\alpha = 0.05$.



(Fig. 1) Cross-sectional and side views of four different final drills with different flute geometry, drill cutting angle and drill design. D1: N1 (OsseoShaper™ 3.8 mm). D2: Nobel Active (twist step drill 3.2/3.6 mm). D3: V3 (MIS conical step drill 2.9/3.8 mm). D4: BLX (Straumann X VeloDrill™ drill 3.7 mm).



(Fig. 2) Diagram illustrating drilling depth and distance of thermocouple probe holes at 5.0 mm. (TC1) and 13.0 mm. (TC2).



(Fig. 3-6) Preparation of depth and distance of drilling channels in BA and BB samples.



(Fig. 7) Experimental setup of IO.

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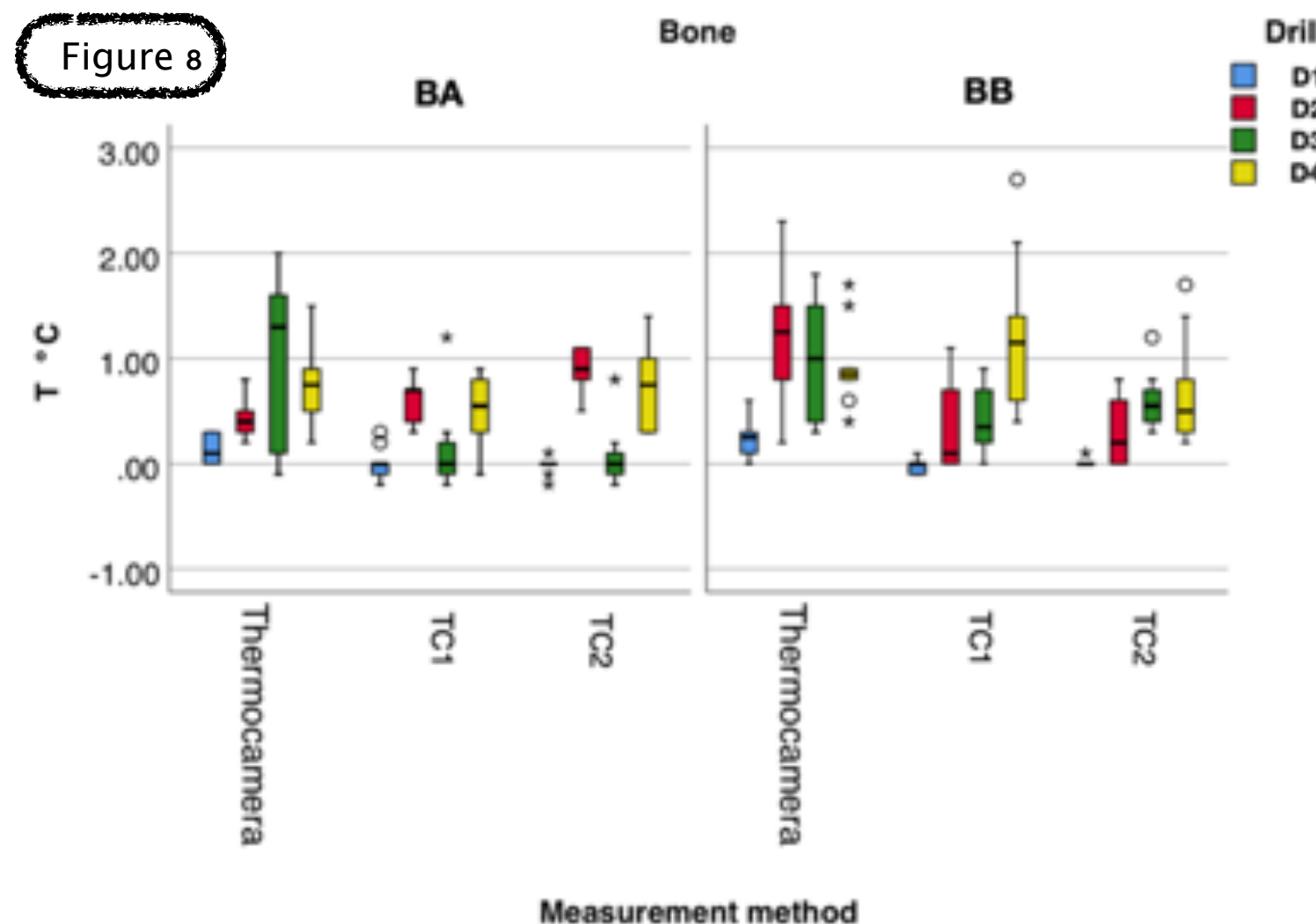
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Results

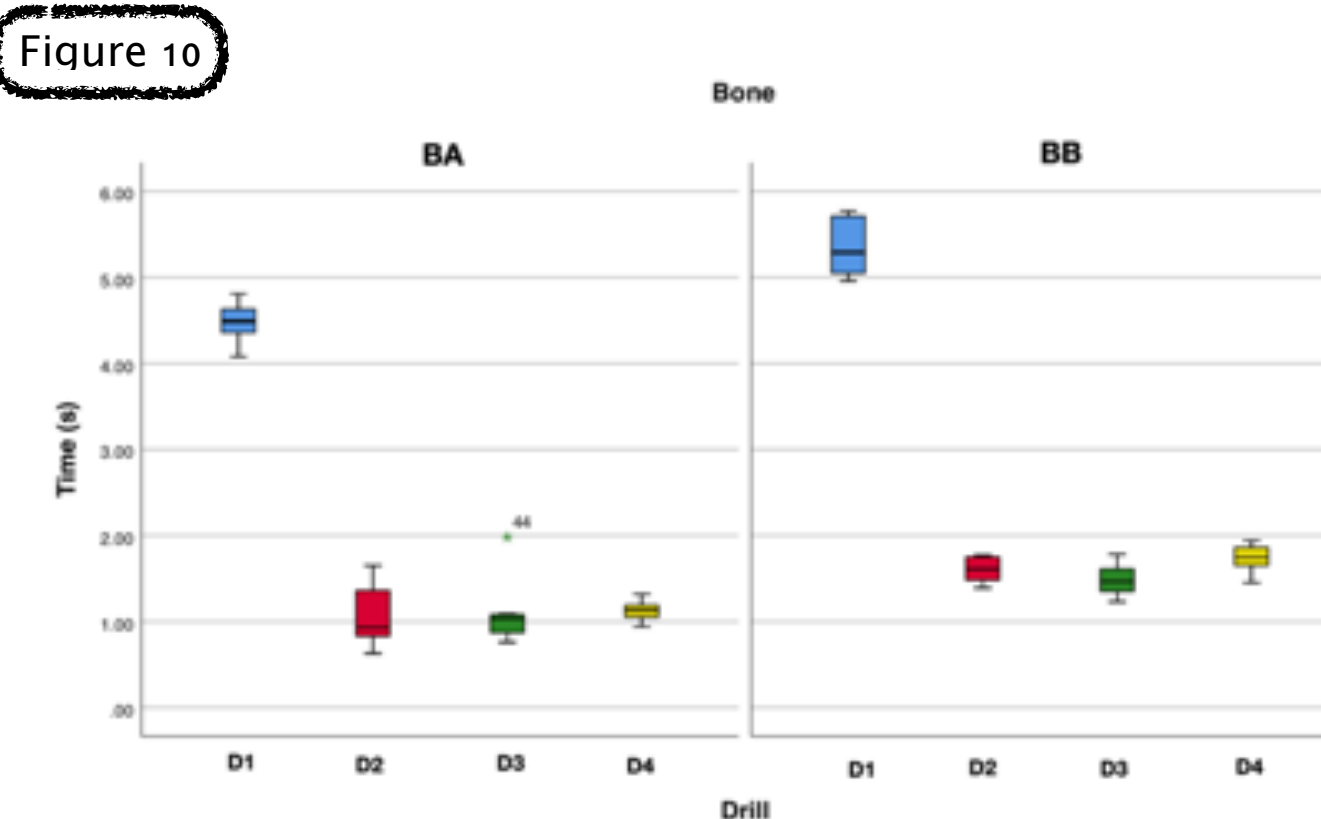
The mean temperature changes as recorded by thermocouple probes and thermocamera were significantly lower in D1 than most other drill-bone (DB) combinations ($p < .05$) (Fig. 8-9). The mean drilling times and sound generation for D1 were significantly higher and lower than most other DB combinations ($p < .05$) (Fig. 10-11) respectively.

Conclusion

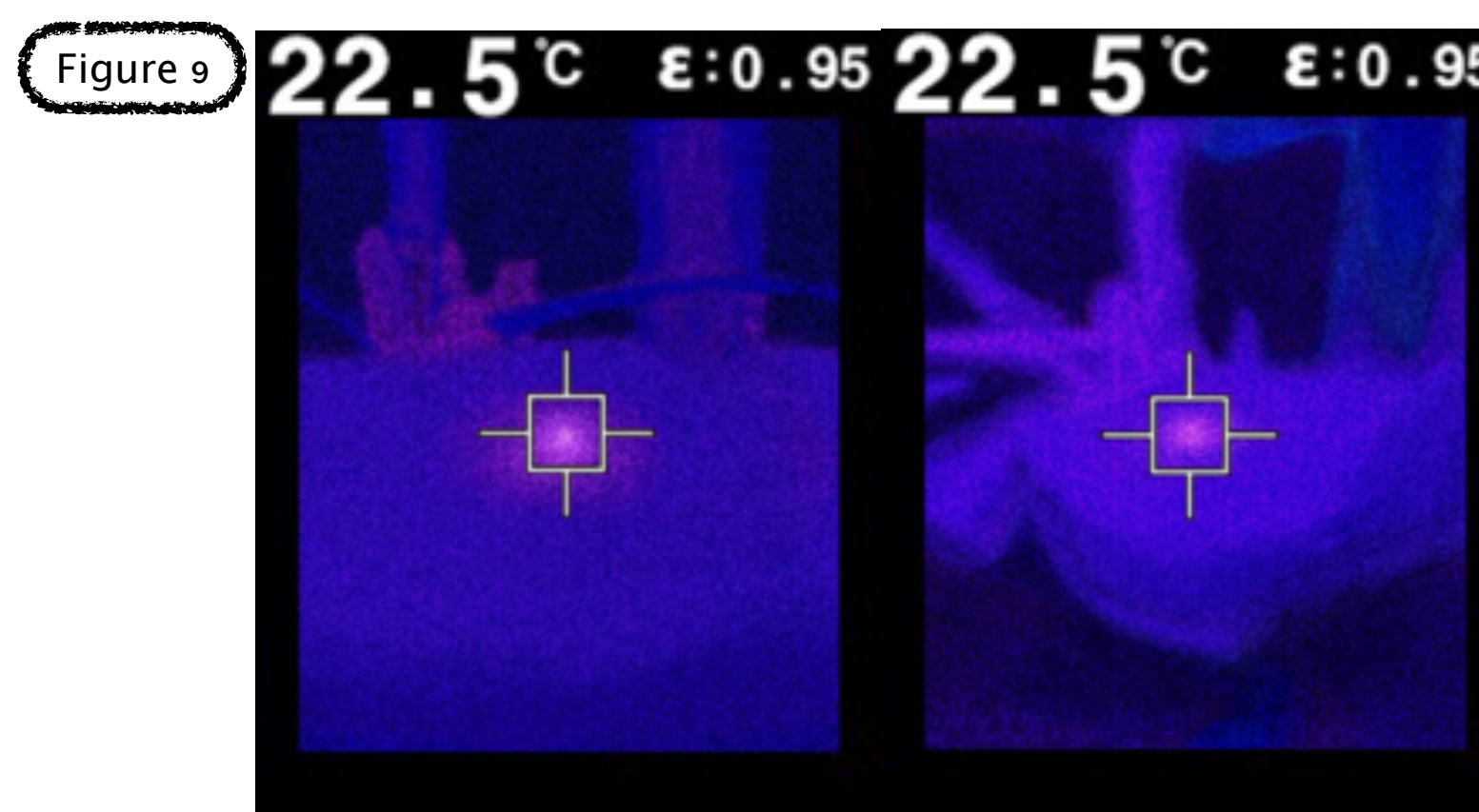
Minimal heat and sound generation can be expected when implant osteotomies are performed using Osseoshaper at a low rotational speed (50 rpm) even without irrigation. However, extended drilling time is required.



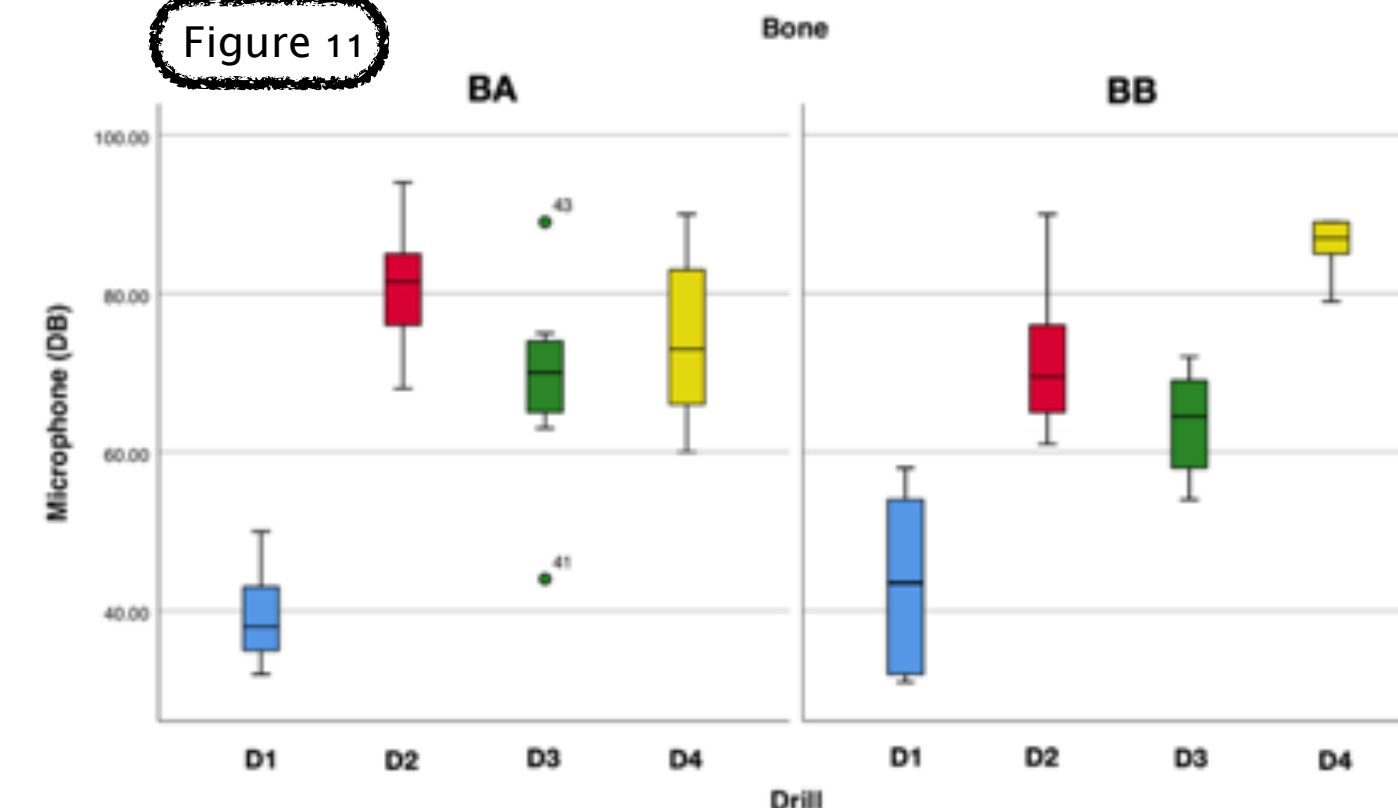
(Fig. 8) Boxplot of mean temperature change (°C) during IO compared between drilling groups (D1-4), measurement methods, artificial bone and bovine bone.



(Fig. 10) Boxplot of mean of drilling times during osteotomy compared between drilling groups (D1-4),



(Fig. 9) Infrared thermocamera images illustrating the area of maximum thermal emission of BA (left) and BB (right) at IO.



(Fig. 11) Boxplot of mean average sound generated during osteotomy compared between drilling groups (D1-4), artificial bone and bovine bone.