"Thermal changes and drill wear in bovine bone during implant site preparation. A comparative in vitro study: twisted stainless steel and ceramic drills"

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Objectives

The purpose was to assess thermal changes and drill wear in bovine bone tissue with the use of twisted stainless steel and zirconia-based drills, during implant site preparation.

Methods

A total of 100 implant site preparations were performed on bovine ribs using a surgical unit linked to a testing device, in order to standardize/simulate implant drilling procedures. Bone temperature variations and drilling force were recorded when drilling at a depth of 8 and 10mm. A constant irrigation of 50 ml/min. (21 1°C) and drilling speed of 800 r.p.m. were used. Scanning electron microscopy analysis was performed prior and after drilling.

Results

Mean temperature increase with both drills at 8mm was 0.9°C and at 10mm was 21°C (P<0.0001). Statistical significant higher bone temperatures were obtained with stainless steel drill (1.6°C), when comparing with the ceramic drill (1.3°C) (P<0.05). Temperature increase was correlated with higher number of perforations (P<0.05) and drilling load applied. There was no significant association between drilling force applied and temperature increase by either drill or at either depth. No severe signs of wear of either drill were detected after 50 uses.

Conclusions

Drill material and design, number of uses, depth and drilling load applied appear to influence bone temperature variations during implant site preparation. Drilling depth was a predominant factor in bone temperature increase. Both drills can be used up to 50 times without producing harmful temperatures to bone tissue or severe signs of wear and deformation.