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LETTER TO THE EDITOR

Letter to the editor: RE: Bone heat generated using conventional implant drills versus piezosurgery unit during apical cortical plate perforation

To the Editor: The article recently published by Dr. Lajolo et al., in which the authors compared conventional implant drills and piezoelectric technique during apical cortical-plate perforation, was of great interest. Precisely, the aim of this study was to evaluate temperature variations occurring during implant site preparation at the apical cortical-plate level of a porcine rib ex vivo model by using the two aforementioned devices and different pressure loads. The authors claim that, "the piezosurgery site preparation caused significantly higher temperature increase than conventional drills ($P < 0.05$)," and that, "temperature increases exceeded the critical 10°C threshold in half of the samples prepared with the piezoelectric device," concluding that, "bone overheating using a piezosurgery unit is a potential risk during implant site preparation."

In our opinion, this article presents several important methodologic flaws, conditioning the final outcomes and, consequently, the interpretation of the results.

First, the diamond-coated ultrasonic tip* used in this experiment was not designed to perform implant site preparation, and it is not included in the Implant Prep Kit (Mectron, Carasco, Italy), as stated in the article. The manufacturer's booklet describes it as a "crown lengthening file," and the suggested clinical applications are "interproximal osteoplasty and root planing." *This ultrasonic tip is mainly a side-cutting insert* and does not have the sharp point necessary for an efficient perforation of dense cortical bone, which limits heat generation during the cutting action. This insert tip presents external irrigation, which is likely insufficient for an efficient cooling action at 12 mm depth while working on cortical bone, as done in this study. On the contrary, all ultrasonic inserts for implant site preparation present internal irrigation with the one exception of IM1 (Mectron, Carasco, Italy), which is used only for initial pilot osteotomy and whose safety in terms of heat generation during the early working phases was previously demonstrated.[1] Moreover, in the control group of this study, a predrilling was performed with a round bur before using a 2 mm twist drill, while the incorrect ultrasonic tip (1.9 mm diameter) was used as single step in the test group.

There is the possibility that the authors made a typing error, indicating OP4 (Mectron, Carasco, Italy) instead of OT4 (Mectron, Carasco, Italy). All of the previously raised issues would remain valid for OT4, an externally irrigated diamond-coated tip with round point (2.4 mm. diameter), designed to correct pilot osteotomy axis and unsuitable for cortical perforation. *Even if another insert (instead of OP4) had been used, the protocol would still be incorrect because at least two inserts must be used to replicate an osteotomy that is similar to the one produced in the drills group.*

Second, samples of the study were allocated in different groups according to pressure load applied (1,000 g or 1,500 g). It has been well documented that higher working loads induce a higher temperature elevation,[2,3] but it is also known that the ideal pressure for piezoelectric tips is much lower than the one to be applied on surgical motor handpieces. In piezoelectric devices, the maximum depth of cut with minimum restraining of tip motion has been shown to occur at a pressure of 100 to 150 g.[4,5] The inadequate load applied in this experiment could have also influenced cutting efficiency and, consequently, heat generation.

Third, when using the proper tips, the correct use of the piezoelectric handpiece during implant site preparation requires a light pressure load coupled with a quarter-turn rotatory movement (alternating right and left) to enhance bone cutting efficacy and dissipate potential energy otherwise converted to heat. *The supported sliding arm used in this experiment exerts a standardized force but does not seem to be able to reproduce rotating movements*.

In conclusion, heat generation remains an issue to be controlled during ultrasonic bone surgery,[6] and strict adherence to validated clinical protocols is necessary to prevent thermal damage. Ultrasonic site preparation was clinically tested in a study with > 3,000 implants, resulting in 97.8% osseointegration[7] and suggesting that when using a standardized protocol with appropriate steps, piezoelectric surgery could be considered a reliable and safe alternative to conventional drill technique. *Furthermore, in a recent systematic review with meta-analysis, Atieh et al. reported better initial stability when piezoelectric technique was compared with conventional drilling for implant osteotomy.*[8] *No relevant difference was found when they compared marginal bone changes and implant failure. They also concluded that*

* OP4, Mectron, Carasco, Italy

piezosurgery can be considered a viable and safe alternative to the traditional technique.[8]

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