

عنوان مقاله:

Biomechanical Evaluation of Temperature Rising and Applied Force in Controlled Cortical Bone Drilling: an Animal in Vitro Study

محل انتشار:

مجله استخوان و جراحی عمومی، دوره 8، شماره 5 (سال: 1399)

تعداد صفحات اصل مقاله: 8

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خلاصه مقاله:

Background: The present study was conducted to quantify the relationships between bone drilling process parameters (i.e., feed rate, resting time, exit rate, and drill bit diameter) and drilling outcome parameters (i.e., thrust force and maximum temperature). **Methods:** This study utilized 10-cm cortical bovine samples to evaluate the effects of four independent parameters, including drill bit diameters, six different feed rates, three various resting times, and three different exit rates on thrust force and maximum temperature (MT). A total of 28 stainless steel orthopedic drill bits with a diameter of 2.5 and 3.2mm, as well as an orthopedic handpiece were attached to the 500N load cell and an accurate linear variable differential transformer to obtain forces. Moreover, two k-type thermocouples were utilized to record the temperature-time curve near the drilling site. The data were analyzed using the two-way analysis of variance and post hoc Tukey-Kramer-Honest test. **Results:** Maximum thrust force (MTF) decreased by almost 230% as the drill bit diameter increased from 2.5 to 3.2mm in the lowest feed rate. The MTF showed a 335% increase, whereas a decrease of 69% was observed as the feed rates rose from 0.5 to 3 mm/sec. Moreover, the MT decreased to 67% with an increasing exit rate from 1 to 3 mm/sec. Furthermore, a slight increase was observed in MT when the resting time increased from 0 to 2 seconds ($P > 0.05$). **Conclusion:** The desired drilling is drilling with lower thrust force and lower final temperature of bone. Increasing feed rate can cause an increase and decline in thrust force and final temperature, respectively. The highest rates of MT were 0.5 and 1 mm/min, and the optimum feed rate would be 1.5 mm/min due to the averaged thrust force. Moreover, the resting time had no significant effects on the final temperature. Attention to resting time would be useful to provide a more accurate, efficient, and uniform drill hole. **Level of evidence:** V

کلمات کلیدی:

Controlled bone drilling, Drilling thrust force, Efficiency of drilling, Heat generation

