Biomechanical characteristics of cortical bone regenerate after mandibular distraction osteogenesis in dogs

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ABSTRACT

Objectives: Biomechanical quality of the newly formed cortical bone after mandibular distraction is critical for assessing distraction successfully. This study examined bone density, ultrasound speed, and directions of maximum stiffness in distracted canine mandibles. The hypothesis tested was that because of the orientation of the distraction loads, cortical bone will be stronger in the distraction direction. Methods: Five adult foxhound dogs had a distraction device placed to close a 35 mm mandibular defect. After 7 days of latency, the device was activated 1 mm/day for 5 weeks. After a healing period of 12 weeks animals were sacrificed. 35 cylindrical cortical bone specimens were tested to determine the relationship between the specimen diameter and the minimum time delay from the longitudinal ultrasonic pulse through the specimen in the direction of maximum stiffness. In an additional test, densities were obtained. Results: Density was significantly less in the regenerate bone (172.7 ± 177.8 mg/cm\textsuperscript{3}) than in the control cortical bone (197.4 ± 87.2 mg/cm\textsuperscript{3}). There is significantly reduced maximum ultrasonic speed in the regenerate bone specimens (4.0 ± 0.4 mm/µs), compared to the control bone (4.3 ± 0.1 mm/µs). Conclusions: The mechanical quality of the regenerate bone was lower on the side of the device placement within the time frame of the experiment.

Grant Funding Source: NIH/NIDCR DE017259–01 and a grant from COLCIENCIAS (Bogotá, Colombia)