



UNIVERSITY OF TORONTO
FACULTY OF DENTISTRY

Induced physiological bone changes in the absence of mechanical loading by internal pulsed electromagnetic implant: A pilot study in animal model

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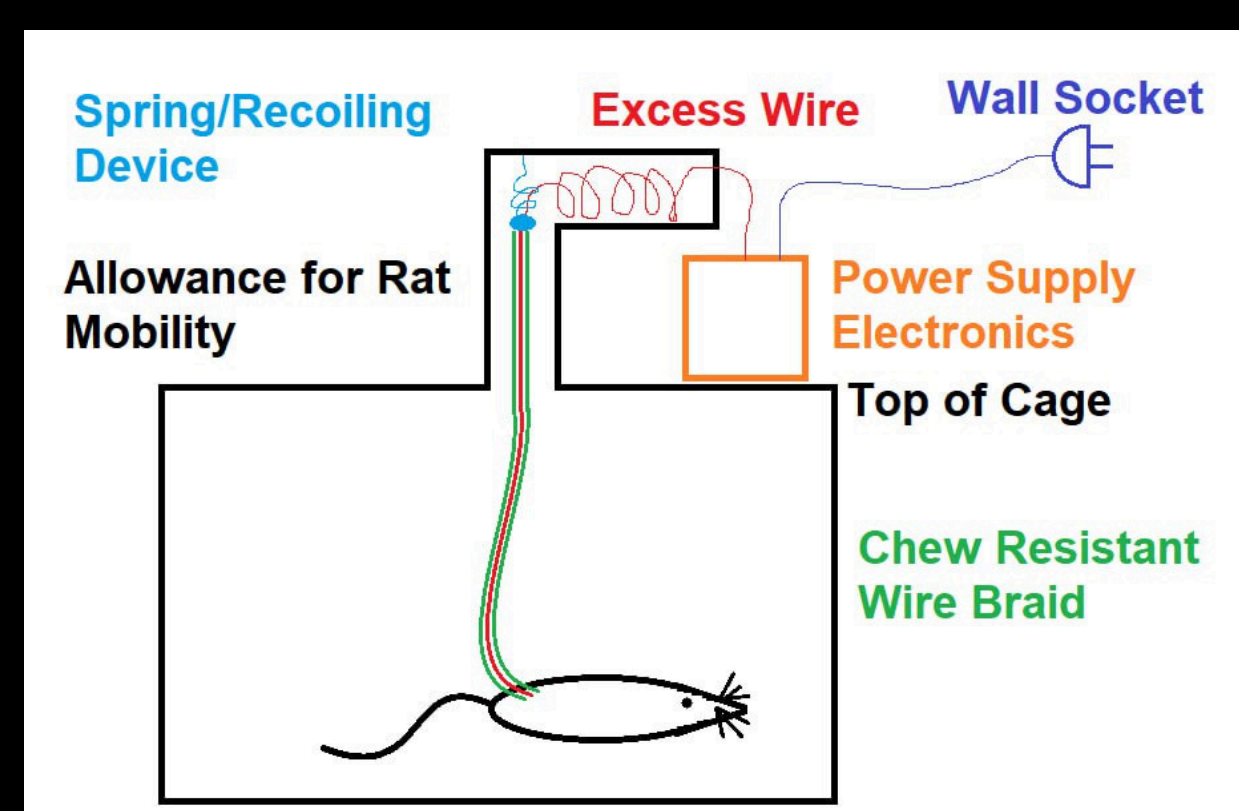
Introduction

Tooth loss results in a rapid, progressive quantitative loss of jaw-bone and qualitative degradation of its architecture which may negatively impact functional and aesthetic treatment outcomes of conventional and implant-supported prostheses (1). Currently, there are no predictable solutions to prevent these occurrences. Emerging evidence suggests that electromagnetic fields may improve healing of fractured appendicular-bones (2). Shayesteh et al. showed previously that constant electrical field could accelerate osseointegration and decrease the time of healing following the first stage of implant surgery in an animal model (3).

Objectives

To test whether electromagnetic fields can affect jaw-bone loss at extraction sites in rats when compared to a control group and use micro-computed tomography to analyze the results.

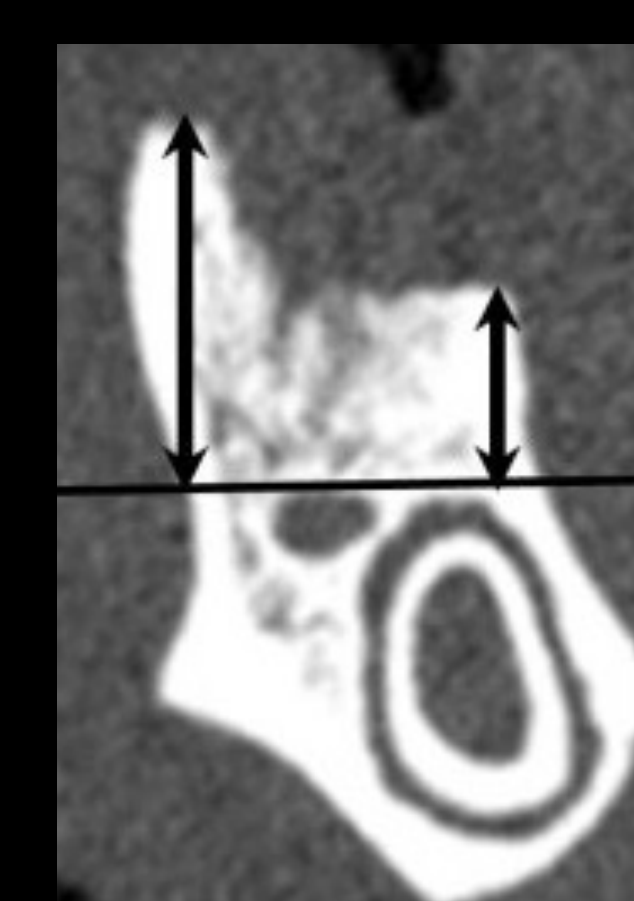
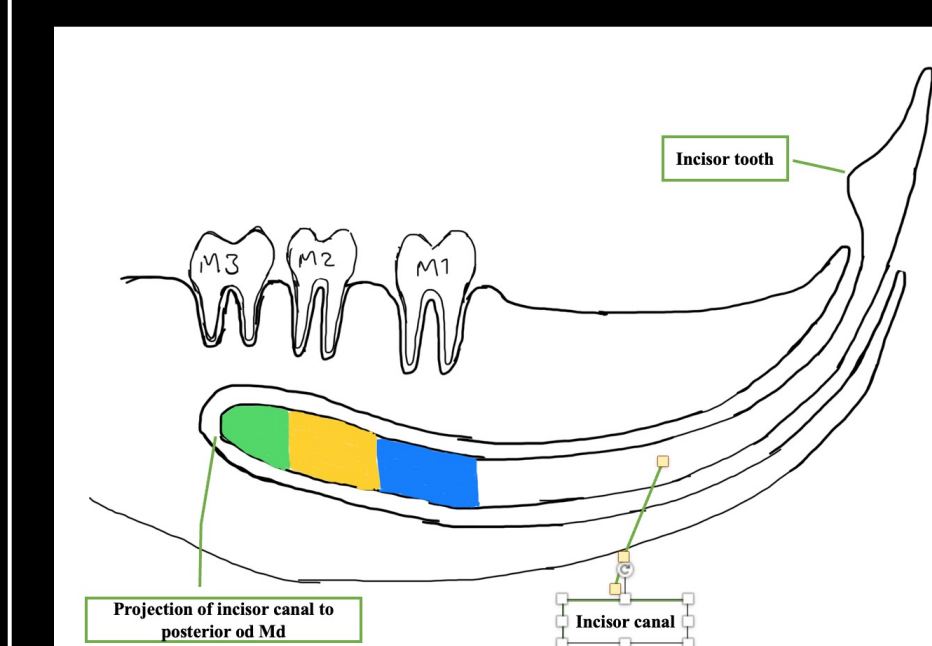
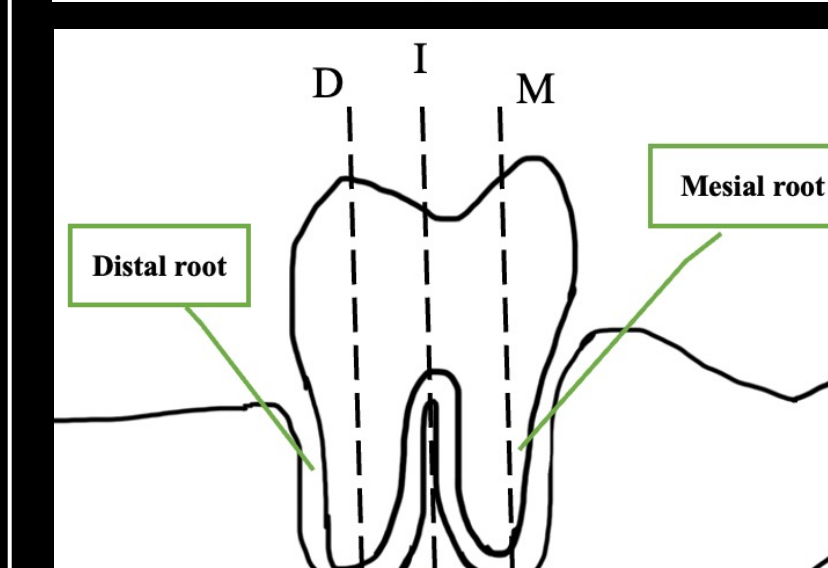
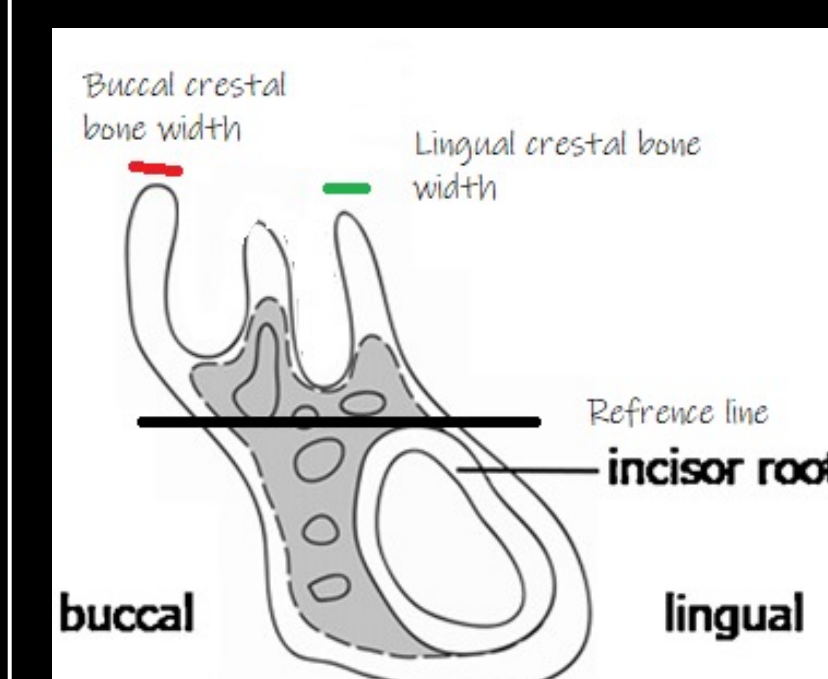
Clinical steps



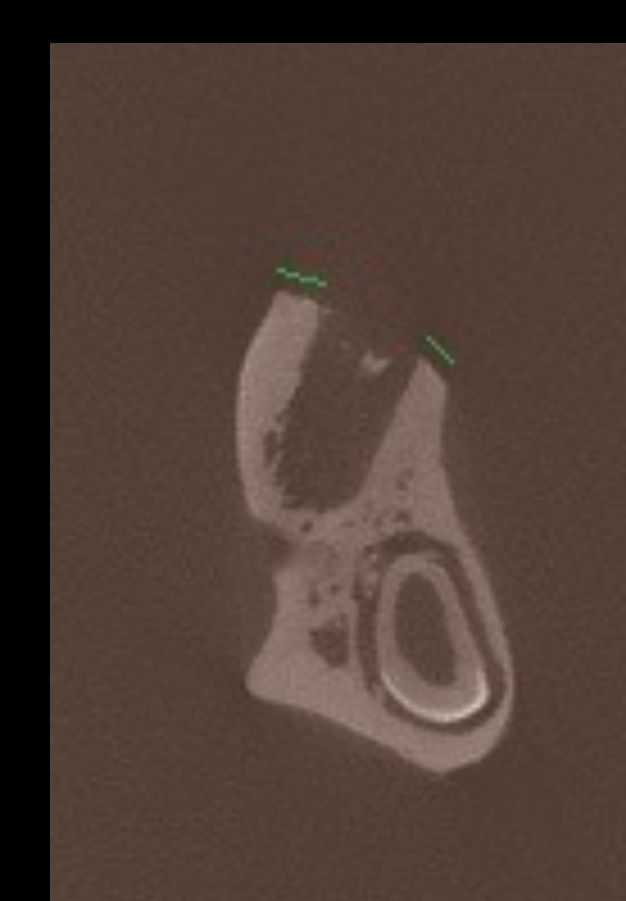
Healthy female adult Wistar rats were randomly divided into control and experimental groups (n=8/group). Under local and general anesthesia, the right mandibular first and second molars were extracted. Experimental rats had a rectangular electromagnetic device screwed to the buccal surface area of extraction sites. The device generated an electromagnetic field intensity of 0.007 Tesla/sec at 75 Hz and a gradual decay of up to 15 mm. Rats were euthanized at day seven or ten (n=4/group) following tooth extractions. Micro-computed tomography was performed to quantify bone volumes, morphometry, and architecture at extraction sites.

Methods

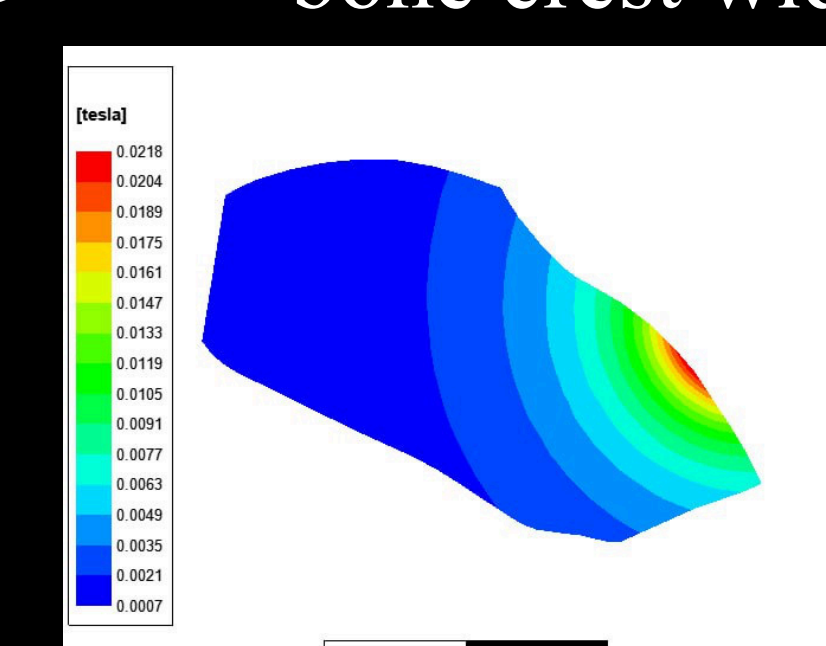
Micro-CT assessment



Measurement of buccal and lingual height

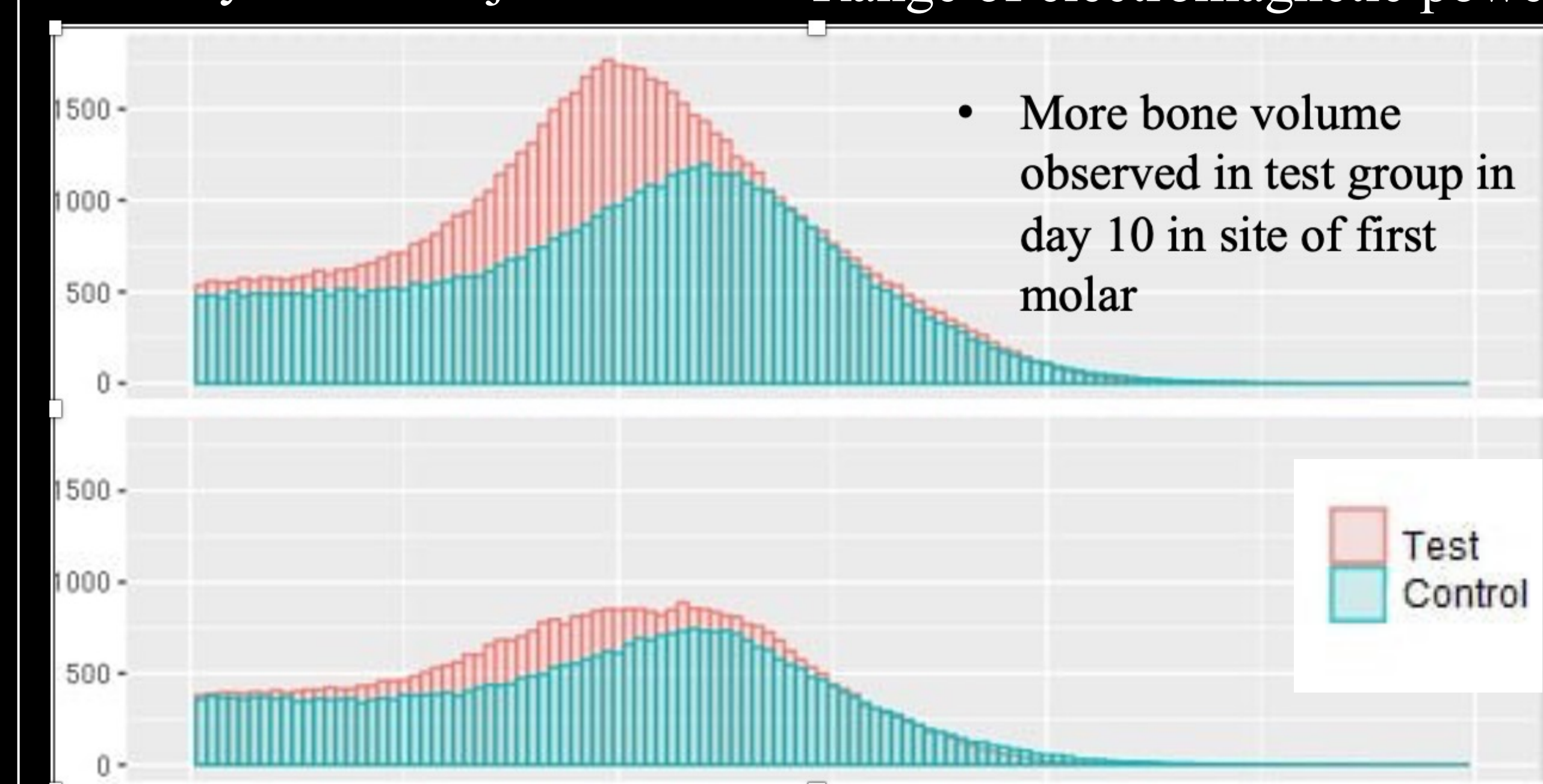


Measurement of buccal and lingual bone crest width

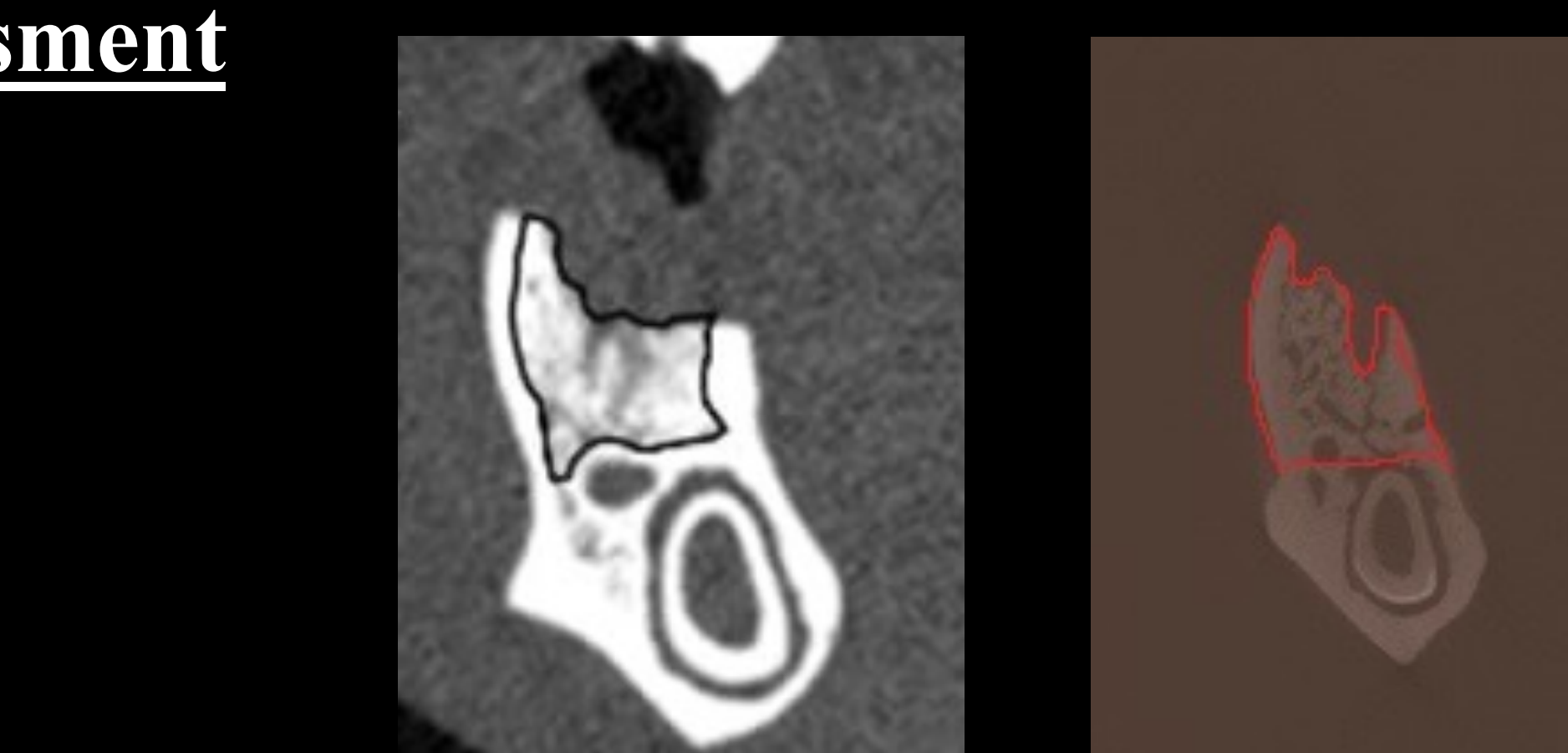


Anatomy of Lower jaw in Rat

Range of electromagnetic power



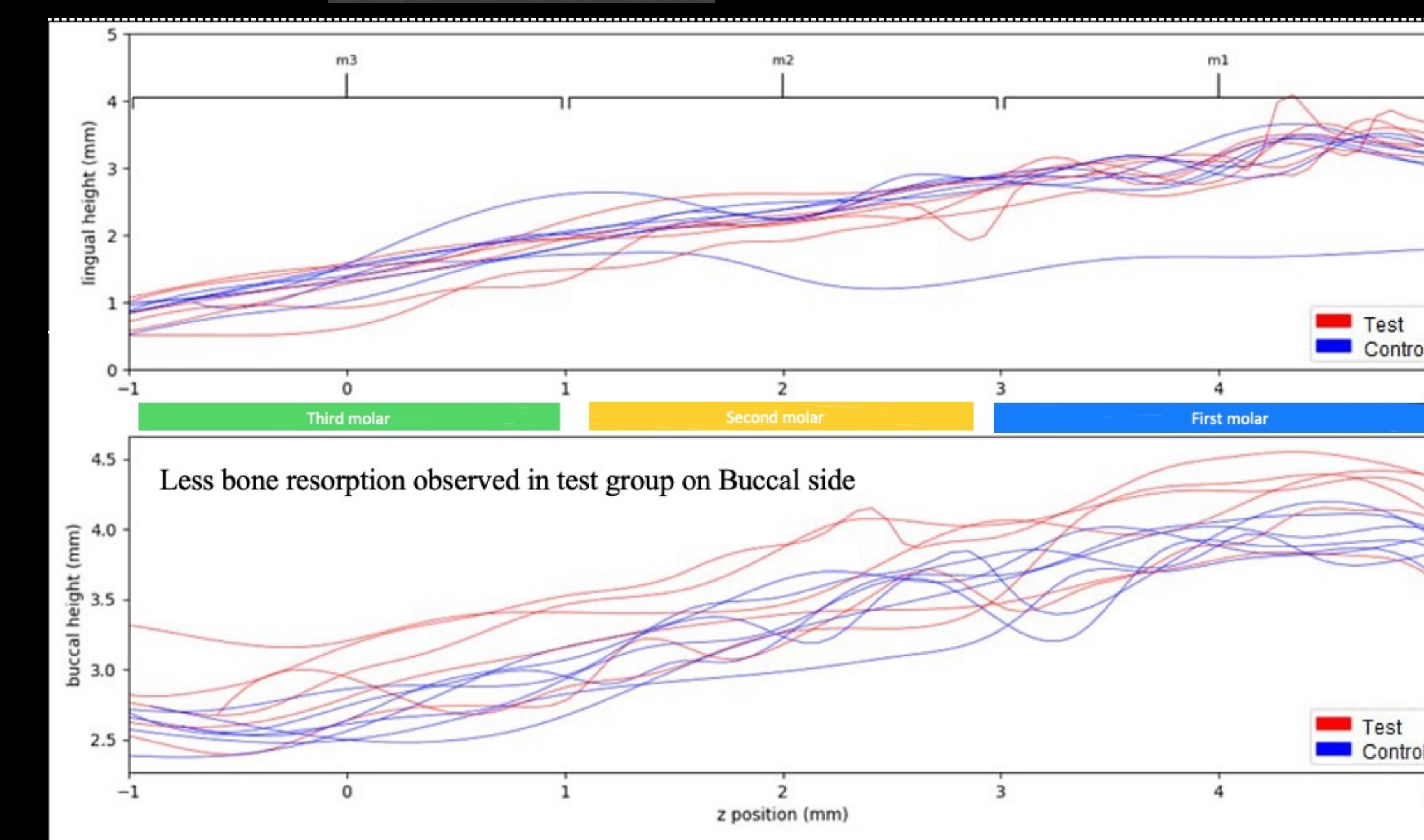
• More bone volume observed in test group in day 10 in site of first molar



Measurement of bone volume above the superior border of incisive canal

C 10

T 10



Conclusion

Applying electromagnetic fields at extraction sites may reduce bone resorption and preserve bone volume following tooth extraction in rats. Additional morphometric, architectural and histological analysis on a larger number of rats may further support our findings and conclusion.

Clinical significance

Applying electromagnetic fields may minimize bone loss at extraction sites in humans.

Acknowledgements

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References

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- Shayesteh Y, Eslami B, Dehghan M, Vaziri H, khojasteh A. The Effect of a Constant Electrical Field on Osseointegration after Immediate Implantation in Dog Mandibles: A Preliminary Study. *Journal of Prosthodontics* 2007;16(5):337-342.