

Anabolic Modeling of Trabecular Bone Following Selective Alveolar Decortication



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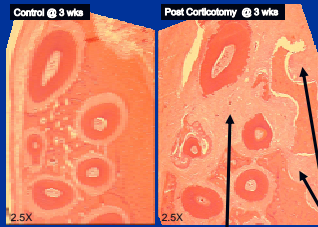


Introduction

Decortication-facilitated orthodontics is a relatively new technique combining braces and alveolar decortication plus grafting. (Wilcko, WM, et al. Internat J Perio Restor Dent 21:9-19, 2001) Some skeletal malocclusions like open bites are finished in 60-70% more rapid orthodontic treatment time. (Wilcko WM, et al. World J Ortho 4:197-205, 2003)



Decortication is an incision made into cortical bone that is made after the orthodontic appliances have been placed. The scarring of alveolar bone induces an increase in hard and soft tissue turnover, a process collectively known as Regional Acceleratory Phenomena (RAP). (Frost HA, Orthop Clin of N Amer 12:725, 1981)



Sebaoun (MS Thesis, BU, 2005) demonstrated an increase in apposition and resorption of rat alveolar spongiosa adjacent to corticotomy incisions with 3X bone turnover and diminished bone density.

3X spongiosa turnover
Corticotomy incisions
(from: Sebaoun J-D, Masters Thesis, BU, 2005)

Although increased turnover within the periodontium has been demonstrated, little is known about the anabolic hard tissue spongiosa response following selective alveolar decortication.

Bogoch (J Orthop Res 11:285-291, 1993) demonstrated 5X increase in apposition & resorption (osteopenia) of rabbit tibia (long bone) spongiosa adjacent to corticotomy.



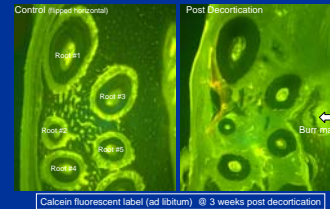
Objective

The objective was to evaluate anabolic modeling of alveolar trabecular bone as a function of time and location following selective alveolar decortication.

Methods & Materials

Sample:

Five rats underwent unilateral selective alveolar decortication B-L to the upper left 1st molar with the right side serving as control.



Procedure:

- All animals were feed fluorescent bone stain calcein in their drinking water ad libitum.
- Sacrifices: **Group 1** (n=3) @ post-op week 3
Group 2 (n=2) @ post-op week 7
- Maxillary halves were harvested and processed for un-decalcified fluorescent stain histology.
- Amount of calcein stained newly formed bone was measured in transverse sections of spongiosa in 1st molar and 3rd molar areas using a 100 x 100 pixel square grid (10,000 sq pixels) and Olympus Micro Suite FIVE analysis software.

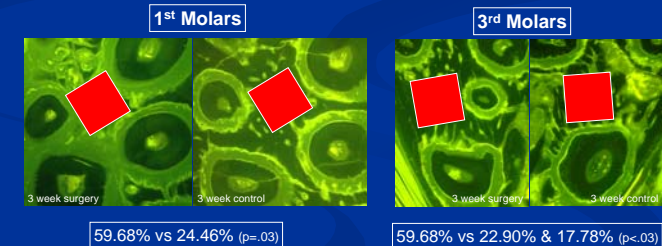
Data of Interest:

Bone Apposition: expressed as percent of calcein stained osteoid on calibrated images in a 10,000 sq pixels grid in 1st and 3rd molar areas.



Results

Percent of New Bone Apposition: At 3 weeks post decortication new bone apposition was 59.68% (5,968/10,000 pixels) and significantly greater compared to the 3 week 1st molar control at 24.46% (p=.03) and 3 week 3rd molar control 22.90% (p=.024) and surgery 17.78% (p=.012).



There were no significant differences (p>.05) between percent of new bone apposition in the 3 week surgery and any of the 7 week groups.

Conclusion

Anabolic modeling of alveolar trabecular bone adjacent to the decortication site increased by about 1.5 times at 3 weeks; this increase represented a 2.6X to 3.4X greater anabolic modeling activity as compared to the 3rd molar area. Anabolic regional acceleratory phenomena (RAP) of spongiosa resulted.