

Anabolic Modeling of the Lamina Dura Following Selective Alveolar Decortication



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Introduction

Decortication-facilitated orthodontics is a relatively new technique combining braces and alveolar corticotomy plus grafting. (Wilcko, WM, et al. Internat J Perio Restor Dent 21:9-19, 2001) Dental arches are decrowned and finished in 60-70% less active orthodontic treatment time. (Wilcko WM, et al. World J Ortho 4:197-205, 2003)

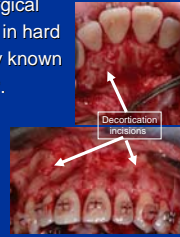


Pre-Tx Post Tx (6 months) Pre-Tx Post Tx (6 months)
(after: Wilcko WM, et al. World J Ortho 4:197-205, 2003)

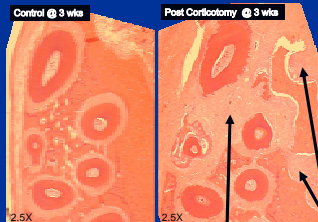
Decortication is an incision made into cortical bone after the orthodontic appliances have been placed. Surgical scarring of alveolar bone induces an increase in hard and soft tissue turnover, a process collectively known as Regional Acceleratory Phenomena or RAP.

(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.



(after: Wilcko WM, et al. Internat J Perio Restor Dent 4:9-19, 2001)



Control @ 3 wks Post Corticotomy @ 3 wks
3X spongiosa turnover Corticotomy incisions

Although increased turnover within the periodontium has been demonstrated, the character of anabolic changes in the lamina dura following selective alveolar decortication is unknown.

(from: Sebaoun J.D, Masters Thesis, BU, 2005)

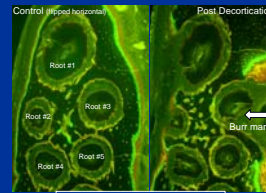
Objectives

The aim of this study was to analyze bone apposition in the lamina dura following selective alveolar decortication.

Methods & Materials

Sample:

Six rats underwent unilateral selective alveolar decortication buccal and lingual to the upper left first molar with the right side serving as control; then were divided into 2 groups.



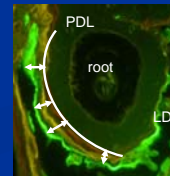
Serial fluorescent label X3 @ 7 Weeks

Procedure:

- Fluorescent bone stains were injected sub-peritoneal at 1-week intervals in the following order: **calcein** < **tetracycline** < **alizarin red**
- Group 1** - starting 1 week post-op; **Group 2** - starting week 4 post-op
- Sacrifices: **Group 1** - post-op week 4; **Group 2** - post-op week 7
- Maxillary halves were harvested and processed for un-decalcified fluorescent stain histology.
- Bone apposition perimeter and apposition width per root were measured only where 3 fluorescent labels were visible.
- Multiple systematic measurements (80 to 294 values per specimen) of bone apposition surrounding the 5 roots of the first molar were made using Olympus Micro Suite FIVE analysis software.

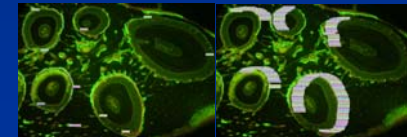
Data of Interest:

- Bone Apposition - fluorescent staining of new bone formation:
- total 3-week apposition width =
 - apposition length as percent of overall root perimeter =

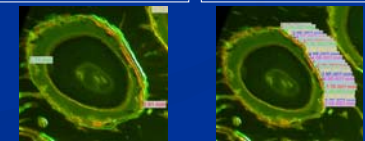


Data of Interest:

Examples of measurements made for apposition length and apposition width in the lamina dura.

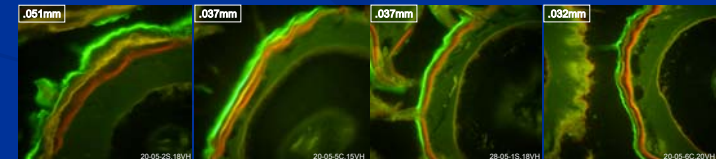


Examples: Lamina Dura Apposition Length Examples: Lamina Dura Apposition Width



Results

One-way ANOVA with Tukey post hoc testing demonstrated that first molar lamina dura apposition width was significantly greater ($p=.000$) following surgery at 4 weeks post decortication (.051mm) compared with 4 week control (.037mm), and 7 week surgery (.037mm) and 7 week control (.032mm).



Decortication Side @ 4 wks Control Side @ 4 wks Decortication Side @ 7 wks Control Side @ 7 wks

No differences were observed in apposition length of the lamina dura as a percentage of first molar root perimeters.

Conclusion

Anabolic modeling (apposition) of the lamina dura increased 46% at the 4-weeks stage following selective alveolar decortication in the rat. The anabolic aspect of regional acceleratory phenomena (RAP) was demonstrated.