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150460 Histomorphometric Study of Orthodontic Tooth Movement under Mechanical Vibration

Thursday, March 17, 2011: 3:30 p.m. - 4:45 p.m.

Location: Hall C (San Diego Convention Center)

Presentation Type: Poster Session

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Objective: To study alveolar bone modeling and remodeling during orthodontic tooth movement (OTM) under mechanical vibration (MV)

Methods: Thirty-six C57BL/6 mice were divided into 4 groups: (1) control (n=9), (2) MV (n=9), (3) OTM (n=9), and (4) OTM+MV (n=9). Twenty grams of force was delivered by a "Ω" shape spring to move the upper 1st molars buccally. Mechanical vibration (frequency: 4Hz, displacement: 20μm, duration: 5min/day) was applied to the left upper 1st molars (in comparison to the non-vibrated right upper 1st molars) of the designated mice, which was repeated every 3 days for 27 days. All the mice were injected two fluorescent markers - calcein on day 7 and 21, and alizarin on day 14. At the end of the experiment, all the mice were sacrificed and the upper jaws were dissected, fixed and embedded in PMMA. Using 3-D μCT images as guidance, a series of 5μm undecalcified tissue sections perpendicular to the long axis of the 1st molar was prepared. The tissue sections were either directly observed to measure new bone formation (MS/BS, MAR, BFR/BS) on the tension side of PDL, or stained with TRAP to measure bone resorption (osteoclasts/surface area) on the compression side of PDL. One-way ANOVA was used to compare each parameter among the 4 designed groups (p value being set at 0.05).

Results: No difference of bone formation or resorption was found between control and MV groups. The OTM group showed relatively equal amounts of bone formation and resorption between the bilateral 1st molars. Compared with OTM, the "OTM+MV" group showed significantly increased amount of bone formation (by 71%, p=0.021) on the tension side of PDL and increased bone resorption (by 55%, p=0.037) on the compression side of PDL.

Conclusion: Mechanical vibration enhances orthodontic tooth movement by increasing both resorption and formation of alveolar bone.

Keywords: Bone, Loading, Mineralization, Orthodontics and Osteoblasts/osteoclasts

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