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Citation	The 19th Annual Scientific Meeting of the International Association for Dental Research (Southeast Asia Division) & 13th Annual Scientific Meeting of the Southeast Asia Association for Dental Education, Koh Samui, 3-6 September 2004. In Journal of Dental Research, 2004, v. 83 Sp Iss B
Issued Date	2004
URL	http://hdl.handle.net/10722/53780
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Bone remodeling in adult rats' condyles under mechanical strain

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Objective: This study was designed to explore the relationship between neovascularization, hypertrophic cartilage and the microstructural properties of cancellous bone in adult rat's condyle in response to mechanical strain produced by mandibular advancement. Methods: Seventy-eight 120-day-old female Sprague-Dawley rats were randomly allotted to six groups, nine animals in each experimental group according to different time points. Mandibular advancement appliances were used to produce mechanical strain onto to the mandibular condyle of rats. Immunostaining of VEGF and type X collagen were carried out. Tartrate-Resistant Acid Phosphatase (TRAP) reaction was used to assess the activity of chondroclasts. Direct three-dimensional morphometric analysis was carried out with microcomputed tomography (Micro-CT) scanning to evaluate the properties of microstructure of cancellous bone in the mandibular condyle. Results: Results showed that mechanical strain produced by mandibular advancement induced neovascularization in the posterior condyle marked by the increased expression of VEGF. Neovascularization coupled the remodeling of calcified cartilage as marked by the expression of type X collagen and new bone formation. The new bone formed in the adult condyle was characterized by thinner trabecular thickness, more trabecular number and increased trabecular space. Conclusion: In conclusion, mechanical strain produced by mandibular advancement induces neovascularization and osteogenesis leading to adaptive growth of condyle in adult rats. This study was supported by The University of Hong Kong (CRCG grant 10203764.15633.08003.323.01).

Craniofacial Biology I - Molecular

The Preliminary Program for Annual Scientific Meeting, 19th International Association for Dental Research-Southeast Asia Division and 13th Southeast Asia Association for Dental Education (September 3-6, 2004)