

The Changes in Matrix Metalloproteinases and Collagens Expression of Rat Articular Cartilage after Continuous Mandibular Advancement: Immunohistochemical Study

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Abstract

Condylar growth modification is induced by mandibular advancement though the changes in Temporomandibular Joint (TMJ) after mandibular advancement could be permanently stable are not yet proved. Therefore, our purpose is to investigate the effects of mandibular advancement on the rat TMJ by changing in Matrix Metalloproteinase (MMPs) and Collagens (COLs) expression immunohistochemically (IHC) after retention treatment. In this study, 54 male Sprague-Dawley rats were divided to control group (n=24) and experimental group (n=30) for three months subgroups period. Only experimental sub-groups were subjected to a full-time orthodontic inclined methyl methacrylate bite plate cemented to the incisors to advance the mandible for one month and continued as a half-day-wearer (retention period) till the end of the 2nd month and stayed without appliance during whole 3rd month (post retention period). Then, the assessment of gross-morphological changes of skull and the examination of the articular cartilage for each sub-group histologically in addition to IHC examination for MMP-1, MMP 8 and MMP 13 and COL-I, II and III were done. The gross morphological changes were clear in experimental group as downward forward mandibular advancement in addition to a high significant decreased in the base mandibular length. There was also an abundant cellular proliferation at the condylar cartilage with a significant condylar ossification and higher osteoplastic activity in the experimental group obviously at retention period. Moreover, a significant increase in MMP-13 expression in both differentiation and hypertrophic layers of an experimental group during active and retention periods with reduction in the expression of COL-II in the experimental group was observed with no significant changes in other markers. These up regulation of MMP-13 in associated with significant reduction in expression of COL-II plays a significant role in cartilage collagen degradation and treatment stability, which is confirmed through the post-retention period due to endochondral ossification pattern improvement.

Statistical Analysis

The data are expressed as the mean \pm SEM and were analyzed using two-way ANOVA. The significance level for all analyses was set at a probability (P) of less than 0.05. All analyses were performed by Graph Pad Prism 5.3 for windows (Graph Pad Software, San Diego, CA, USA).

Tissue Preparation

Sectioning of the paraffin specimen was done by a rotator microtome (Leitz, Lecica Microsystems, Wetzlar, Germany) at 7 μ m thickness followed by staining in haematoxyline and eosin, and examined under the light microscope. The measurements of different layers of articular condyle were done histologically using digital AXIOVISION software imaging carles Zeiss-Germany which was split into three portions at the midpoint of the horizontal line drawn from the most prominent part of the articular condyle.

Appliance Preparation and Fitting

The appliances were used of a similar mode of action to those used with humans, such as forcus, Jasper jumper, Herpst and an inclined plane.

The appliance was a bite jumping device of acrylic type, made up of poly methyl methacrylate (PMMA). Fitting the appliances was done using cement dental material Ketac Cem- 3M ESPE AG Dental Product-Germany as radiopaque glass ionomer luting cement used for cementation of crowns and bridges and orthodontic strips cementation, the appliance was positioned to all experimental group by an inclined anterior bite plane, 20-25° inclination with constant force that it caused mandibular foreword-downward positioning during the rats' rest and functional bite.

Biography

It have more than 15 years of experience in medical and Pharma (incl. targeted therapy or immunotherapy) as well as other fields.

