

Masticatory retraining effect on masseter muscle, facial morphology and alveolar bone structure in the adult rat

Akademisk avhandling

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av *Anna Ödman*

Fakultetsopponent:

Timo Peltomäki, Professor

University of Tampere and University of Eastern Finland, Finland

Avhandlingen baseras på följande delarbeten

- I. Ödman A, Mavropoulos A, Kiliaridis S. Do masticatory functional changes influence the mandibular morphology in adult rats. Arch Oral Biol. 2008 Dec;53(12):1149-54.*
- II. Ödman A, Bresin A, Kiliaridis S. The effect of retraining hypofunctional jaw muscles on the transverse skull dimensions of adult rats. Accepted for publication in Acta Odontol Scand.*
- III. Mavropoulos A, Ödman A, Ammann P, Kiliaridis S. Rehabilitation of masticatory function improves the alveolar bone architecture of the mandible in adult rats. Bone. 2010 Sep;47(3):687-92.*
- IV. Ödman AM, Hunt NP, Matloub Moawad HA, Sinanan AC, Kiliaridis S, Lewis MP. Molecular changes in detrained & retrained adult jaw muscle. Eur J Orthod. 2013 Oct;35(5):659-63.*

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Anna Ödman

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Abstract

The aim of this series of investigations was to study the effect of masticatory muscle retraining in adult rats with an earlier reduced masticatory muscle function on the craniofacial morphology, on the internal alveolar bone structure and on the deep masseter muscle.

Material and Methods: Sixty young male rats received soft diet for a prolonged period, so that the animals developed weak masticatory muscles. After 21 weeks when the animals had nearly ceased their body growth the rats in the experimental group were divided into two groups. One group continued with soft diet until the end of the experiment (hypofunctional group). The other group received ordinary hard food to get the possibility to retrain their masticatory muscles (rehabilitation group). A third group (control) received ordinary hard food during the whole experimental period (27 weeks). Morphometric analysis of the mandible, cephalometric analysis of the skull, microtomographic histomorphometry (μ CT) of the alveolar process of the mandible and quantitative reverse transcriptase polymerase chain reaction (qRT-PCR) on “muscle biopsies” were performed.

Results: The rehabilitation group was only marginally different compared to the hypofunctional group concerning the lateral view morphology of the mandible, although a general tendency to approach (catch-up) the normal group was observed. The variables under study concerning the trabecular bone in the rehabilitation group also showed a catch-up towards the control group. The increase of the anterior zygomatic arch width and interzygomatic width were slightly larger in the rehabilitation group compared to the other groups. The gene protein expression of MYH 3 and MYH 7 were significantly higher in the rehabilitation group compared with the other groups.

Conclusions: The increased functional demands seem to influence the craniofacial morphology in adult rats at areas under direct influence of the masticatory muscles. Alveolar trabecular bone architecture did improve after functional rehabilitation although the negative effects of hypofunction were not completely reversed. Muscular retraining induced genetic expression of the slow contracting (MYH 7) isoform levels and embryonic (MYH 3) isoform to withstand increased masticatory mechanical load.

Keywords: Adult, rat, craniofacial morphology, alveolar trabecular bone, MYH, mandible, masticatory function