

LOCALIZATION AND FUNCTION OF THE ANIONIC EXCHANGER AE2 IN DEVELOPING RODENT TEETH

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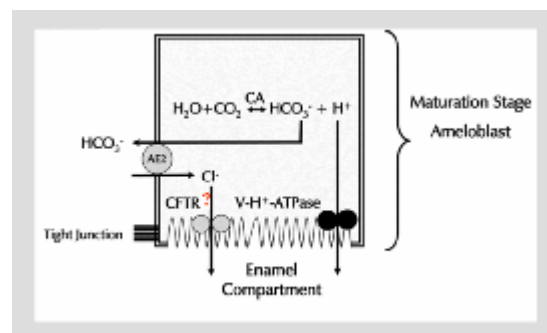
INTRODUCTION: The presence of cytoplasmic carbonic anhydrase II and V-ATPase in the distal cell membranes of maturation stage ameloblasts^{1,2} suggests that these cells produce and secrete protons into the enamel space. Proton secreting cells have to regulate intracellular pH to maintain electroneutrality. One candidate for regulating intracellular pH is the anionic exchanger Ae2 that exchanges bicarbonate for chloride. We tested the hypothesis that the anion exchanger-2 (Ae2) is involved in pH regulation in maturation stage ameloblasts.

METHODS: Paraffin sections of jaws of 2-6 days old hamsters and adult wild type and Ae2 knockout mice were used for immunohistochemistry. MMA embedded tissue blocks of wild type and Ae2 knockout mice were subjected to microprobe analysis

RESULTS: Strong immunostaining for Ae2 was detected in basolateral membranes of maturation stage ameloblasts whereas weak staining was seen in the Golgi area of secretory ameloblasts. Staining was also seen in Golgi area of young odontoblasts, osteoblasts, and osteocytes.

Gene targeting of three of the five isoforms of Ae2 in mice affected the structure of maturation-stage but not secretion-stage ameloblasts. It abolished the immunostaining for Ae2 in ameloblasts and reduced the mineral content of maturation stage enamel along with a slightly higher protein content. Secretory stage enamel, dentin and bone in the transgenic mice were not structurally altered. Mineral content of dentin and alveolar bone in the transgenic mice was not different from wild-type littermates. Incisor enamel was more severely affected than molar enamel. The enamel from transgenic mice wore down much faster than that from wild type littermates.

Fig.1 Proposed model for Ae2 function in maturation stage ameloblasts. CA: carbonic anhydrase-II, Ae2: anion exchanger 2; CFTR: cystic fibrosis transmembrane regulator³



DISCUSSION & CONCLUSIONS: The presence of anionic exchanger Ae2 associated with the basolateral membranes of maturation stage ameloblasts is essential for their function. Ae2 may regulate intracellular pH in maturation phase ameloblasts (Fig.1). Without Ae2 the mineral growth in maturation stage enamel is impaired and eventually the enamel that enters the oral cavity is much softer.

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