LOCALIZATION AND NON NEURONAL CONTRIBUTION OF CHOLINESTERASE ENZYME IN HUMAN TOOTH MORPHOGENESIS

B.G.T.L. NANDASENA, J.A.C.K. JAYAWARDENA, A.K. SURAWEERA*, W.M. TILAKARATNE* AND C.D. NANAYAKKARA

*Department of Basic Sciences, *Department of Oral Pathology, Faculty of Dental Sciences, University of Peradeniya*

A number of recent studies report that cholinesterase (ChE) enzyme, which is originally described as a neurotransmitter degradation enzyme in cholinergic synapses, is expressed in non synaptic tissue sites. ChE expression in developing embryonic tissue sites, hematopoietic and osteogenic tissues leads to postulate a growth regulatory role of ChE during cell proliferation, differentiation and apoptosis, in those sites. ChE activity was also observed and reported in the continuously erupting guinea pig teeth of matured animal although its precise role in tooth morphogenesis is not fully understood. The purpose of the present study is to demonstrate the ChE reactive sites in the developing human tooth germs to provide valuable insights into the role of ChE in embryonic tooth development.

Human dead fetuses (around 22 week IUL), aborting spontaneously, were collected from the Teaching hospital, Peradeniya after obtaining consent from the hospital authorities. Immediately after the collection of fetuses the jaws were dissected and fixed in 4 % paraformaldehyde in 0.1 M phosphate buffer followed by decalcification in 4 % neutral EDTA. 20 µm thick cryosections of the jaws were made and stained for ChE reactivity according to Karnovsky and Root (1964).

Many jaw sections contained deciduous tooth germs at the "late bell" stage. The permanent tooth germs at the "bud" or "early cap" stages were also found close to the deciduous tooth germs in most of the sections. In the deciduous incisors and molar tooth germs at the late bell stage of development, we detected moderate reactions for ChE activity in the epithelial cells of the cervical loop region, and the inner (IEE) and outer enamel epithelia (OEE). The staining intensity of ChE was consistent throughout the IEE, but became significantly more distinct in the preameloblasts, which lay on a thin layer of newly formed dentin matrix. However, secretory ameloblasts were devoid of any staining for ChE activity. Cells in the stratum intermedium and stellate reticulum, odontoblasts, and other dental papillary cells showed weak or no activity for ChE. Nerve fibers and the vascular endothelium in the dental papilla and the developing periodontal tissues stained strongly for ChE. In the permanent tooth germ, distinct reactions for ChE were confined to the epithelial cells facing toward the lingual mucosa of the oral cavity. In contrast, the cells of the tip, the center and those facing the deciduous tooth germ, were unstained for ChE reaction. The ectomesenchymal cells surrounding the permanent tooth bud were also free from ChE reactions. In addition, the basal cells of the oral epithelium showed modest ChE reactions. Interestingly, the cells of the disintegrating dental lamina were strongly stained for ChE activity.

Our observations further support the contribution of cholinesterase enzyme in tooth morphogenesis through its putative roles in the regulation of proliferation, differentiation, and apoptosis during tooth development.