Tooth development in a scincid lizard, Chalcides viridanus (Squamata), with particular attention to enamel formation

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Abstract
Comparative analysis of tooth development in the main vertebrate lineages is needed to determine the various evolutionary routes leading to current dentition in living vertebrates. We have used light, scanning and transmission electron microscopy to study tooth morphology and the main stages of tooth development in the scincid lizard, Chalcides viridanus, viz., from late embryos to 6-year-old specimens of a laboratory-bred colony, and from early initiation stages to complete differentiation and attachment, including resorption and enamel formation. In C. viridanus, all teeth of a jaw have a similar morphology but tooth shape, size and orientation change during ontogeny, with a constant number of tooth positions. Tooth morphology changes from a simple smooth cone in the late embryo to the typical adult aspect of two cusps and several ridges via successive tooth replacement at every position. First-generation teeth are initiated by interaction between the oral epithelium and subjacent mesenchyme. The dental lamina of these teeth directly branches from the basal layer of the oral epithelium. On replacement-tooth initiation, the dental lamina spreads from the enamel organ of the previous tooth. The epithelial cell population, at the dental lamina extremity and near the bone support surface, proliferates and differentiates into the enamel organ, the inner (IDE) and outer dental epithelium being separated by stellate reticulum. IDE differentiates into ameloblasts, which produce enamel matrix components. In the region facing differentiating IDE, mesenchymal cells differentiate into dental papilla and give rise to odontoblasts, which first deposit a layer of predentin matrix. The first elements of the enamel matrix are then synthesised by ameloblasts. Matrix mineralisation starts in the upper region of the tooth (dentin then enamel). Enamel maturation begins once the enamel matrix layer is complete. Concomitantly, dental matrices are deposited towards the base of the dentin cone. Maturation of the enamel matrix progresses from top to base; dentin mineralisation proceeds centripetally from the dentin–enamel junction towards the pulp cavity. Tooth attachment is pleurodont and tooth replacement occurs from the lingual side from which the dentin cone of the functional teeth is resorbed. Resorption starts from a deeper region in adults than in juveniles. Our results lead us to conclude that tooth morphogenesis and differentiation in this lizard are similar to those described for mammalian teeth. However, Tomes’ processes and enamel prisms are absent.

Keywords