



**A TRANSMISSION ELECTRON MICROSCOPIC STUDY
OF EARLY AND LATE ROOT FORMATION
IN THE MOUSE MANDIBULAR MOLAR**

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of the requirements for the degree of
Master of Dental Surgery

by

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ABBREVIATIONS USED IN PHOTOMICROGRAPHS

A	Ameloblast
AC	Acellular cementum
BL	Basal lamina
BV	Blood vessel
C	Cementoblast
CC	Cellular cementum
Cil	Cilia
Col	Collagen fibre
Cyt	Cytoplasmic process
D	Dentine
DF	Dental follicle
Dg	Degenerating cell
Dj	Desmosomal junction
DP	Dental papilla
E	Enamel
Ecr	Epithelial cell rest of Malassez
ED	Epithelial diaphragm
End	Endothelial cell
EO	Enamel organ
Ep	Epithelial cell
ES	Enamel substrate
F	Fibroblast
G	Golgi apparatus
GE	Gingival epithelium
HD	Hemidesmosome
Idc	Inferior dental canal
IE	Inner epithelial cell
Inc	Mandibular incisor
L	Lysosome
Lac	Lacunae
Lig	Periodontal ligament
M1	Mandibular first molar
Mat	Amorphous matrix material
Mit	Mitochondria
MV	Matrix vesicle
N	Nucleus
O	Odontoblast
OE	Outer epithelial cell

P	Pulp
PA	Pre-ameloblast
PD	Pre-dentine
Ph	Phagosome
PO	Pre-odontoblast
Por	Pore
Pr	Polyribosomes
Pyk	Pyknotic nucleus
Rer	Rough endoplasmic reticulum
RS	Hertwig's epithelial root sheath
SI	Stratum intermedium cell
T	Tonofilament bundles
Tj	Tight junction
V	Vesicle
W	Terminal web

SUMMARY

There is a paucity of literature concerning early and late tooth root formation. Various authors have discussed general cellular arrangements associated with tooth development, but apart from varying descriptions of the morphology of Hertwig's epithelial root sheath during cementogenesis, there is little information concerning early sheath development or root apexification. It is recognized that Hertwig's root sheath forms from the confluence of the inner and outer enamel epithelia when crown formation is virtually complete, but the stimulus responsible for initiating the cellular proliferation and/or migration to form the root sheath is unknown. An intact root sheath, which is continuous with the enamel organ, is only seen prior to the commencement of cementogenesis, as it subsequently becomes discontinuous. Previous studies have indicated that the epithelial cells of Hertwig's root sheath are associated with the induction of cell differentiation during root formation, whilst some authors have also outlined an epithelial cell secretory function. The fate of epithelial root sheath cells has been variously described with the cells being reported to either degenerate, become incorporated into cellular cementum, or migrate into the periodontal ligament to form epithelial rests of Malassez.

In the current study, the ultrastructural features of the cervical enamel organ and early Hertwig's root sheath were examined in an attempt to identify cellular changes associated with root sheath formation and to define the morphology of Hertwig's root sheath prior to the onset of cementogenesis. The fine structure of mature epithelial cell remnants of the root sheath was also investigated in an endeavour to clarify the fate of

epithelial cells following apexification. Following an initial histological study, the first mandibular molars from six 7-day-old and six 27-day-old A.L.C.A. mice were prepared and examined using a Jeol 100S transmission electron microscope.

Hertwig's epithelial root sheath associated with M_1 from 7-day-old mice, was observed to be a predominantly bicellular structure which was continuous with the enamel organ and was surrounded by an intact basal lamina. From the morphological observations it was proposed that the outer layer cells added to the inner layer cells at the tip of the epithelial diaphragm, whilst in the cervical enamel organ stratum intermedium cells seemed to either degenerate or add to the inner enamel epithelial layer. Epithelial cell rests of Malassez and remnants of Hertwig's root sheath were observed adjacent to the cementum surface of M_1 from the 27-day-old mice. The rests of Malassez were assumed to form as a consequence of root sheath disruption associated with root formation. Epithelial cells were apparent adjacent to the root apex, along with numerous cementoblasts which were actively involved in the formation of cellular cementum. Epithelial cells were observed incorporated within the cellular cementum and some of these cells provided ultrastructural evidence of cellular phagocytosis resulting in cell deletion, similar to that which was observed within the outer enamel epithelial cells of the enamel organ in the younger mice. From the ultrastructural evidence obtained in the present study, it was proposed that odontogenic epithelial cell deletion by apoptosis, is a normal phenomenon associated with tooth formation whereby degenerating epithelial cells undergo autolysis in phagosomes.

SIGNED STATEMENT

This thesis contains no material which has been accepted for the award of any other degree or diploma in any University.

To the best of my knowledge and belief, the thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

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