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HIGH-RESOLUTION MICROSCOPY AND MICROANALYSIS IN ORAL BIOLOGY AND DENTISTRY

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The oral region contains all types of mineralised tissues found in the body. Its normal mucosa lining exhibits a greater variation in histo-structure than found in the entire skin surface. As such the oral cavity gives rise to diseases not found elsewhere in the body and additionally, a great variety of systemic diseases may express themselves in the oral cavity and paraoral region. High-resolution microscope applications in oral biology and dentistry, (1). brings structural biology understanding and maps the natural state of its biological cell e.g. odontoblasts, osteoclasts, cementoblasts etc under normal and pathological conditions-expanding research capabilities and ability to understand cellular structures and processes with direct impact to pain management (2). Its probing capabilities facilitate the characterization of the atomic structures of dental composites materials thus allowing observation of their dynamic behaviors under various different conditions. These observations are important especially to improve the quality, performance of the dental cosmetic composites and restorative materials and finally (3). the developments of microscopy and its techniques e.g. for isolation and growing cells under reproducible

conditions have contributed to the understanding of oral biology controversies thus providing better insight of actual descriptions. Dentine is a biological mineralised tooth structure that is densely perforated with dentinal tubules that extend from the pulp chamber to the enamel-dentine junction. The presence of dentinal tubules is an attributing factor to dentine permeability (Thomas, 1985). In the literature there are numerous descriptions of odontoblast processes in dentine tubules (Ten Cate, 1967; Brannstrom and Garberoglio, 1972; Garberoglio and Brannstrom, 1976 but the extent of the process and the volume of the dentinal tubule it occupies are some features, which remain controversial. Using fluorescent microscopy Byers and Sugaya, (1995), reported that the odontoblast process in rats does not extend into outer dentine except during the early stages of development. The study also reported that the processes present along the innervated regions of the crown were long and straight, whereas those in root dentine were extensively branched and shorter in length. In a scanning electron microscope study Szabo, *et al.*, (1984) showed the presence of the odontoblast process in inner, middle and peripheral dentine and reported that the odontoblast process observed in the inner third of the dentine was closely apposed to the tubule wall and was present in most tubules in that region. These earlier

studies measured the diameter and number of the dentinal tubules in animal and human dentition using both the light and the conventional scanning electron microscope but still the extent of the process and the volume of the dentinal tubule it occupies especially in human tooth model are some features that still remain until now controversial. At present the odontoblast layer is being suggested as a barrier. Little knowledge is known now to suggest the mechanism orchestrated by this layer. To understand the barrier there is a need to acknowledge the functional odontoblast cellular kinetics that maintains its intactness as a layer and its ultrastructural significant. This will further understanding of the role of the intercellular junctional complexes of the odontoblast layer towards exogenous permeation of fluid and substances.

In 1905, von Korff reported the presence of argyrophilic fibres between the odontoblasts in early stages of dentinogenesis in teeth of pigs and calves. Ever since then the existence of these corkscrew argyrophilic fibres has been very controversial. In 1994, Ohsaki and Nagata confirmed that the von Korff fibres seen in a developing mouse molar consisted mainly of type III collagen in which a non-collagenous protein fibronectin was found to be densely associated. The association of fibronectin with von Korff fibres may be related to the organisation and maintenance of their structural integrity. These von Korff fibres extend from the dentine between the apical ends of the odontoblast cell bodies into the interodontoblastic space and from the interodontoblastic space into the subodontoblast layer of the pulp (hence also known as interodontoblastic fibres).

There are various macroscopic changes observed on the tooth morphology, especially in its form and colour that occurs concurrently with age. These changes are usually associated related to wear and attrition. To date there is various high-grade research end light and electron microscope available that is of importance to dentistry, among them is the confocal true laser microscope, variable pressure scanning electron microscope and the fully automated analytical transmission electron microscope. The prevention and treatment of oral and dental diseases requires a thorough knowledge of the histological and biological variables influencing the aging and disease patterns.

References

- Brannstroms, M., Garberoglio, R. (1972). The dentinal tubules and the odontoblast process; A scanning electron microscopic study, *Acta Odontol Scand* 30: 291.
- Byers, M. R., Sugaya, A. (1995). Odontoblast process in dentine revealed by fluorescent Di-I. *J. Histochemistry and Cytochem.* 43(2). 159-168.
- Garberoglio, R., Brannstrom, M. (1976). Scanning electron microscopic investigation of human dentinal tubules. *Archs oral Biol.* 21. 355-362.
- Ohsaki, Y., Nagata, K. (1994). Type III is a major component of interodontoblastic fibers of the

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NAMA PROJEK : "HUMAN MOLAR TOOTH DENTINAL TUBULES AND ITS ODONTOBLAST PROCESS.
 A COMBINED INVESTIGATION USING VARIABLE PRESSURE SCANNING ELECTRON MICROSCOPE & IMAGE ANALYSIS"

PENYATA PERBELANJAAN BAGI TEMPOR BERAKHIR PADA 31 DISEMBER 2003

PECAHAN KEPALA	PERUNTUKAN (RM)	PERBELANJAAN 2002	BAYARAN 2003	TANGGONGAN	PERBELANJAAN 2003	JUMLAH PERBELANJAAN	BAKI KESELURUHAN
11000 GAJI DAN UPAHAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14000 ELAUN LEBIH MASA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15000 BONUS	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21000 PERJALANAN & PENGANGKUTAN ORANG	5,000.00	1,894.10	0.00	0.00	0.00	1,894.10	3,105.90
22000 PENGANGKUTAN BARANG-BARANG	0.00	0.00	0.00	0.00	0.00	0.00	0.00
23000 PERHUBUNGAN DAN UTILITY	300.00	5.00	0.00	0.00	0.00	5.00	295.00
24000 SEWAAN	5,000.00	0.00	0.00	0.00	0.00	0.00	5,000.00
25000 BAHAN-BAHAN MAKANAN & MINUMAN	0.00	8.50	0.00	0.00	0.00	8.50	(8.50)
26000 BEKALAN BAHAN-BAHAN MENTAH & BAHAN PEMBAIKAN	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27000 BEKALAN BAHAN-BAHAN LAIN	7,000.00	11,682.40	3,813.50	0.00	3,813.50	15,495.90	(8,495.90)
28000 PENYELENGARAAN & PEMBAIKAN KECIL YANG DIBELI	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29000 PERKHIDMATAN IKTISAS & LAIN-LAIN PERKHIDMATAN & HOSPITALITI	600.00	195.00	301.00	0.00	301.00	496.00	104.00
35000 LAIN-LAIN HARTA MODA	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JUMLAH BESAR	17,900.00	13,785.00	4,114.50	0.00	4,114.50	17,899.50	0.50