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A COMPARATIVE STUDY OF THE CELLULAR RESPONSE OF THE ORAL MUCOSA TO MECHANICAL LOADING

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Experimental studies on loaded oral mucosae of animals have provided new information on the functional biology of these tissues[1].

Knowledge of the structural changes which occur when the oral mucosae are deformed by masticatory stresses is however sparse, because of technical difficulties in developing model systems which will allow the tissues to be examined in a loaded state.

The present study was undertaken to compare the ultrastructural changes which occur in the cell membrane, nucleus and intracellular organelles in the keratinized attached gingiva, palate and tongue epithelium and non-keratinized alveolar and buccal mucosae subjected to experimental loading.

Samples of normal and loaded attached gingiva, palate, tongue, buccal mucosa and alveolar mucosa in the Vervet monkey (Cercopithecus pygerythrus F Cuvier 1821) were fixed in situ by immersion in 0,02M sodium cacodylate buffered 2.5% glutaraldehyde/2% paraformaldehyde fixative for 24 hours[2]. A 5mm x 3mm diameter cylindrical shoe attached to a spring loaded plunger[1] was used to apply a standardised 50gm load to the oral mucosae. The normal and loaded tissue specimens were excised, trimmed and processed for examination by T.E.M. Loaded epithelium was selected from the deepest part of the indentation produced by the cylindrical pressure shoe and orientated to allow the epithelial cells to be sectioned at right angles to the longitudinal axis of the indentation. Epithelial cells overlying connective tissue papillae were located in normal and loaded tissue in thick sections and ultrathin sections were cut to provide epithelial cells for a histometric evaluation of each tissue type. Randomly selected fields of basal, spinous and surface cells were photographed in normal and loaded epithelium. The greatest width of sectioned cells, nuclei and mitochondria were measured using a Digiplan® electronic image analyser into which the micrograph magnification factor had been programmed. Mean values and standard deviations of the measurements in the control and experimental tissues were calculated and examined for differences using the Students 't' test. The percentage reduction in the widths of the

sectioned cells, nuclei and mitochondria measured in the loaded tissues are detailed in Table 1.

Loading produced flattening of the basal and spinous cells and nuclei in all tissue types. This obliterated cell membrane interdigitation and produced a functional orientation of the tonofilaments along the axis of cell flattening. The mean cell widths and nuclear widths measured at right angles to the plane of cell flattening were decreased by 14-63% and 30-50% respectively. It is interesting to note that no changes in mitochondrial shape occurred in the loaded basal or spinous cells. Although changes in cell dimensions provide an indication of the varying effect of the standardised load on the epithelial cells on a comparative basis, no patterns of change were found which could be specifically ascribed to tissue or cell type. Differences may only become apparent if heavier loads are applied to stress the epithelium more severely.

	Tissue	Basal Cells			Spinous Cells			Surface Cells
		CW	NW	MW	CW	NW	MW	CW
Keratinized	Attached gingiva	37	40	NS	35	47	NS	NS
	Palate	30	43	"	37	32	"	37**
	Tongue	15	30	"	19	31	"	31
Non Keratinized	Buccal mucosa	14*	30	"	45	50	"	43
	Alveolar mucosa	42	43	"	63	45	"	36

($p < 0,01$ for all values except $*p < 0,02$ and $** p < 0,05$.
n = 20 cells NS = not significant)
CW = cell width, NW = nuclear width, MW = mitochondrial width

Table 1.
Percentage reduction in dimensions in loaded tissue.

References

1. Fleisch, L. and Austin, J.C. 1978, J. Prosth. Dent. 39, 241.
2. Bernimoulin, J.P, and Shroeder, H.E. 1977. Cell Tiss. Res. 180, 383.