

Surface Ultrastructure of Human Soft Palate Epithelium

P Cleaton-Jones

Dental Research Unit of the South African Medical Research Council and the University of the Witwatersrand, Johannesburg

SUMMARY

The surface of specimens of clinically healthy soft palate epithelium was examined using scanning and transmission electron microscopy. The surface of the non-keratinized epithelium was covered with numerous microprojections which corresponded to microvilli seen with transmission electron microscopy, and are probably the remains of cell interdigitations.

OPSOMMING

Die oppervlak van klinies gesonde sagte verhemelte epiteel monsters is deur middel van die skandeer- en transmissie-elektronmikroskoop ondersoek. Die voorkoms van die oppervlak van die ongekeratiniseerde epiteel, soos onder die transmissie-elektronmikroskoop gesien, is met talle mikroprojeksies wat ooreenstem met mikrohaartjies oortrek, en is bes moontlik die oorblyfsels van sel interdigiterings.

Thilander (1968) has subdivided the ultrastructural studies of normal human oral epithelium by means of transmission electron microscopy into two groups. Firstly, those focussed on a particular detail (Sognnaes and Albright, 1956, 1958, Albright 1960, Melcher 1965, Stern 1965, Frithiof and Wersall 1965, Listgarten 1966, Silverman and Kearns 1970, Silverman 1971, Silverman, Barbosa and Kearns 1971, Barnett and Szabo 1973); and secondly those concerned with a more or less complete description of epithelial layers in a particular region. This group includes gingiva (Kurahashi and Takuma 1962, Listgarten 1964, Schroeder and Theilade 1966, Schroeder 1969); cheek (Zelickson and Hartman 1962, Hashimoto, Dibella and Shklar 1966); hard palate (Thilander 1968) and lip (Hashimoto 1971).

In contrast to the numerous studies above, scanning electron microscopy has been little used in the investigation of normal human oral epithelium. Whitaker and Adams (1971) studied foetal oral mucosa while Wilding (1973) looked at hard palate epithelium.

The present study was undertaken to describe the ultrastructural features of the surface of human soft palate oral epithelium.

Materials and methods

Six excision biopsy specimens of clinically healthy soft palate epithelium were obtained from Caucasoid and Negroid volunteers.

Three of these specimens (2 Caucasoids, 1 Negroid) were fixed in 10 per cent neutral buffered formal saline; dehydrated in ethanol, amyl acetate and liquid CO₂ using a Polaron E2000 critical point drying apparatus (Polaron Equipment Ltd., Watford, Herts, U.K.); and mounted on aluminium stubs with colloidal graphite (DAG dispersion 580, Acheson Colloids Ltd., Plymouth, U.K.). They were then coated with a thin layer of gold palladium in an Edwards

E12E4 coating unit (Edwards Ltd., Crawley, Kent, U.K.). All the specimens were examined in a Cambridge S4 Stereoscan operated at 20 kV and with the beam/specimen angle varied to give the best visual results.

The other three specimens (2 Caucasoids, 1 Negroid) were cut into small pieces and fixed in chilled 4.5 per cent glutaraldehyde, phosphate buffered at pH 7.3 for 1 h, followed by post fixation in 1 per cent phosphate buffered osmium tetroxide at pH 7.3 for 30 min (Millonig 1961). The tissues were washed in phosphate buffer prior to dehydration in ethanol and propylene oxide. They were embedded in Araldite (Luft 1961) and sections cut on a Reichert OM-U3 ultramicrotome. These sections were mounted on copper grids, stained with a saturated alcoholic solution of uranyl acetate followed by lead citrate (Reynolds 1963), and finally examined in a Siemens Elmiskop I transmission electron microscope operated at 60 kV.

RESULTS

Scanning electron microscopy

At low magnifications the surface of the soft palate epithelium showed many broad folds and was seen to be pierced by the openings of the ducts from the underlying mucous glands (Fig. 1). These duct openings were irregular in shape and size and the surface epithelial cells could be seen continuing over the duct edge into the lumen. At this duct edge occasional cells were seen to be lifted off those underneath.

When the magnification was increased, the surface of the polygonal cells was seen to consist of numerous microprojections running in all directions (Fig. 2). Intercellular ridges demarcated the cell boundaries. It was at these intercellular ridges that the surface cells separated as they apparently exfoliated (Fig. 2). Examination of the microprojections at still higher magnifications showed that their surface was smooth and



Fig. 1. Surface of human soft palate showing the opening of a mucous duct, polygonal cells, and a slightly folded surface. A cell is exfoliating at the rim of the duct opening. 1 000.



Fig. 2. Surface of epithelial cells showing microuplications running in all directions. An exfoliating cell is arrowed. 3 000.

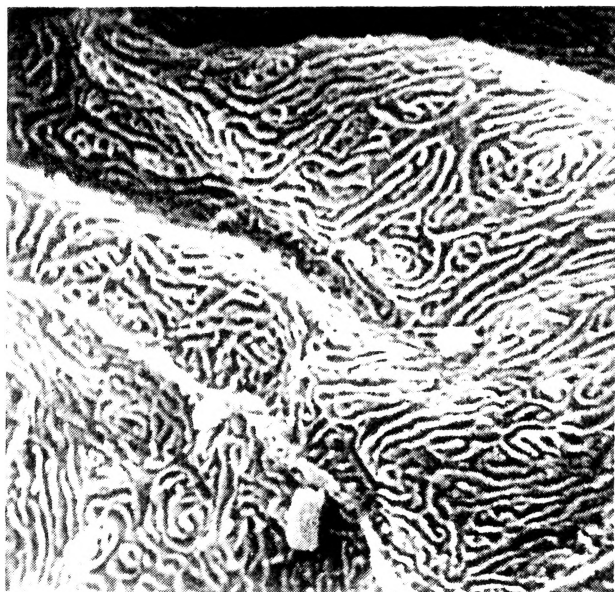


Fig. 3. High magnification of the surface microuplications and intercellular ridges. 5 100.



Fig. 4. Surface cell showing irregularly shaped microvilli (V) due to variation in the plane of section of the surface microuplications. The microvilli resemble the deeper intercellular interdigitations. The outer cell membrane is of varying thickness and electron density. 44 500.

that they were fairly uniform in thickness. The pattern of their arrangement was very irregular varying from parallel rows in some areas to whorled arrangements elsewhere (Fig. 3). No obvious organisation of these microuplications could be seen between adjacent cells, or collections of cells.

In the specimens examined no pitting of the surface or microvilli were seen, only the microuplications.

Transmission electron microscopy

This portion of the study is limited to the surface of the most superficial cells. From the surface of these cells, numerous microvilli protruded (Fig. 4). They varied greatly in shape although most were of similar height. They closely resembled the intercellular interdigitations on the deeper cell surface.

The electron density of the surface cell membrane was



Fig. 5. Intercellular ridge formed by two adjacent microvilli. $\times 44\,500$.

not homogeneous but was less in some areas than others. No particular pattern of variation in electron density was seen other than it was less where the membrane was widest. No structures resembling desmosomes were seen related to the membrane.

At the surface junction between two cells two of the microvilli lay closely alongside each other to form a thicker intercellular ridge (Fig. 5).

DISCUSSION

The small numbers of specimens examined in this study was solely the result of difficulty in obtaining material. Biopsy of soft palate epithelium produces a painful wound and only a few volunteers were prepared to accept this.

The appearance of the surface of the soft palate, namely, an irregular arrangement of microprojections is identical to that described in the vervet monkey as being typical of a non-keratinized epithelium (Cleaton-Jones and Fleisch 1973, Cleaton-Jones 1975). It is different to the pitted or cratered surface noted in the keratinized epithelium of the human hard palate by Wilding (1973). Wilding's findings in the human hard palate are similar to those described by Cleaton-Jones and Fleisch (1973) and Cleaton-Jones (1975) in the vervet monkey, as being typical of the surface of keratinized epithelia.

The finding in the present study that the surface of the non-keratinized epithelium of the soft palate consists of microprojections, adds further weight to the sugges-

tion that the surface appearance of oral epithelium may be typical of the type of keratinization, rather than the area of the mouth in which it occurs.

The pattern of the microprojections seen in the human material is identical to that seen in the vervet monkey (Cleaton-Jones and Fleisch 1973). This suggests that the surface appearance of non-keratinized epithelium may possibly be constant in primates and perhaps even in other species as well. Comparative studies between species are necessary to confirm or refute this.

The transmission electron microscopy findings of microvilli on the surface result from sectioning of the microprojections in various planes. The varying plane of section is responsible for variations in shape and thickness of the microvilli.

No surface pits were seen in this study. Thus no support was found for the theory of Overton (1968) that with desmosomal breakdown recesses are formed on the cell surface.

The change of the typical trilaminar cell membrane appearance into a single electron dense structure has been shown in cells of the stratum corneum of human palatal epithelium (Thilander 1968). The single layered membrane seen in the present study differed slightly from that shown by Thilander (1968) by being more variable in electron density and thickness. The reason for this is not clear and in view of the small numbers of specimens examined requires more investigation.

I believe that the surface microprojections are in fact exposed cell interdigitations.

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