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NUCLEAR DRY MASS AND AREA IN BINUCLEATE HUMAN BUCCAL MUCOSA CELLS

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Abstract

The means for nuclear dry mass (NDM), nuclear area (NA), and cell area (CA) for 30 binucleate human buccal mucosa cells were 55.3 x 10^{-12} g (55.3 pg), 66.4 x 10^{-8} cm^2, and 4833 x 10^{-8} cm^2, respectively. The NDM means for large (L) and small (S) nuclei were 62.2 and 48.4 pg, respectively. The NA means for L and S nuclei were 76.0 and 56.8 x 10^{-8} cm^2, respectively. The NDM and NA were not highly correlated (L, r = 0.52; S, r = 0.49). When the nuclei were studied for maturation changes using shape (round, oval, rod-pycnotic, and pycnotic), the binucleate cells were found to follow similar maturation patterns as mononucleate cells, although one of the nuclei in the binucleate cells undergoes the changes before the other.

Sandritter et al. (1958) reported the averages for cytoplasmic area (CA), cytoplasmic dry mean (CDM), nuclear area (NA), and nuclear dry mass (NDM) for human buccal mucosa cells to be as follows: CA, 4105 x 10^{-8} cm^2; CDM, 1941 pg; NA, 87 x 10^{-8} cm^2; and NDM, 55.5 pg. This was based on a study of 38 cells. Schiemer and Lauschke (1970) reported the average NDM of 800 human buccal cells to range from 39.9 to 53.3 pg. They cited other work in which the average of 5000 cells were about 39 to 43 pg. The sex and age of donors was not given. Pappelis (1972) reported NDM and NA of 80 of his cells (age 13) to be 73.1 pg and 83.1 x 10^{-8} cm^2, respectively. The agreement in average NA with that of Sandritter suggested possible r e related NDM differences. Pappelis et al. (1973) and Pappelis and Pappelis (1972) reported low correlation coefficients between donor age and nuclear traits for male donors age 6 to 84. The NDM mean for 330 cells was 54.3 pg and for two groups of 210 cells the NDM means were 54.4 and 53.9 pg. The NA mean for 330 cells was 82.4 x 10^{-8} cm^2 and for two groups of 210 cells 80.7 and 77.5 x 10^{-8} cm^2. Lee et al. (1973) have data on parabasal (Pb), intermediate (I), rod-pycnotic (R-P), and pycnotic cells of the oral mucosa (cheek and upper lip). The means for cheek Pb cells were as follows: CA, 1713 x 10^{-8} cm^2; CDM, 1021 pg; NA, 69.5 x 10^{-8} cm^2; and NDM, 42.8 pg. When compared to Pb cells, changes in cheek cells through I, R-P, and P were as follows: CA is 230, 284, and 214%; NA is 128, 64, and 33%; and NDM is 145, 112, and 81%. CA and means for NDM and NA for the four cell types were highly correlated (r = 0.96) as were NDM and CA (r = 0.85) and NA and CA (r = 0.86). In another of their studies, when compared to Pb cells (CDM, 1021 pg; CA, 1482 x 10^{-8} cm^2), the CDM of I and P cells were 277 and 260%, while the CA changes were 319 and 305%. The means for CA and CDM were

highly correlated ($r = 0.99$). The means for cell and nuclear indices for upper lip Pb cells were as follows: CA, 1591 x 10^{-8} cm^2; CDM, 768 pg; NA, 87.1 x 10^{-8} cm^2; and NDM, 46.7 pg. When compared to Pb cells, changes in lip cells through I and R-P were as follows: CA was 266 and 223%, CDM was 226 and 233%, NA was 122 and 51%, and NDM was 116 and 85%. Means for NDM and NA were highly correlated ($r = 0.97$) as were CA and CDM ($r = 0.95$). Thus, normal changes with respect to development in the human oral mucosa show that CA, CDM, NA, and NDM increase as cells pass from Pb to I cell types. Nuclear degeneration begins and NA and NDM decrease as cells pass from I through R-P to P cell types. The CA also decreases but CDM does not. Although binucleate cells were sometimes observed, they were not included in the studies.

This report represents NDM, NA, and CA measurements in binucleate buccal mucosa cells.

Materials and Methods

The NDM, NA, and CA were determined for 30 binucleate buccal mucosa cells (from seven smears) using quantitative interference microscopy methods previously described (Pappelis, 1972; Pappelis and Pappelis, 1972; Pappelis *et al.*, 1973). The cells were from the senior author (female, age 26). Cells were classified by the cell maturation index suggested by Pappelis *et al.* (1973), based on the Impaired Cell Maturation Index (Niebergs, 1967). Nuclei were distinguished as being largest (L) or smallest (S) within the cell for comparative studies.

Results and Discussion

The NDM means for 30 binucleate cells were 62.2 pg (L) and 48.4 pg (S). The NA means for 30 binucleate cells were 76.0 x 10^{-8} cm^2 (L) and 56.8 x 10^{-8} cm^2 (S). The CA mean for the 30 cells was 4833 x 10^{-8} cm^2. The means for all nuclei were: NDM, 55.3 pg; and NA, 66.4 x 10^{-8} cm^2. The correlation coefficients for NDM and NA for the 30 L and S nuclei were: L, $r = 0.54$; S, $r = 0.49$; and combined data for L and S, $r = 0.54$. These are like those correlation coefficients reported by Lee *et al.*, Pappelis (1972), Pappelis and Pappelis (1972), and Pappelis *et al.* (1973) for studies done on mature, mononucleate cells of the buccal mucosa. The NDM and NA means for L and S nuclei and the means for both nuclei are in close agreement with earlier reports for mononucleate cells which are given in the introduction. The CA means for these binucleate cells is like that reported by Sandritter *et al.* (1958), 4105 x 10^{-8} cm^2, and intermediate and rod-pycnotic cells reported by Lee *et al.* (1973), 4733 and 4857 x 10^{-8} cm^2, respectively.

The 60 nuclei in this study were classified by size and shape as round (R), oval (O), rod-pycnotic (RP), and pycnotic (P), following the system of Pappelis *et al.* (1973). The R nuclei were in parabasal cells, O and RP, in intermediate cells, and P in pycnotic cells. The following combinations of both nuclei were found: R-R, 4; R-O, 12; O-O, 9; O-RP, 2; RP-RP, 1; RP-P, 1; and P-P, 1. Since buccal mucosa cell maturation involves CA, NA, and NDM increases (parabasal to intermediate) followed by decreases in NA and NDM, we conclude that the binucleate cells follow a similar maturation pattern, although one of the nuclei in each cell undergoes the changes before the other. The only nuclei that appeared

to be alike in both NDM and NA were P-P.

We conclude that NDM, NA, and CA determinations are valuable data for use in cell maturation studies in mononucleate and binucleate cells of the buccal mucosa.

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