Estimation Of Age by Oral Exfoliative Cytology: Newer Perspectives in Forensic Science - A scoping review

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INTRODUCTION **Age determination** of a person involved in judicial or legal proceedings is crucial information that helps to identify the culprit. Oral exfoliative cytology is a non-invasive, inexpensive, painless technique for the collection of intact cells from the epithelial strata. In the past, normal exfoliated cells from healthy individuals have been subjected to cytomorphometric analysis. Hence, exfoliative cytology is an **upcoming relevant tool** for age estimation in forensic science.

AIM To evaluate the data available on age estimation by oral exfoliative cytology using cytomorphometry in published literature from 2000-2021.

MATERIALS & METHOD A literature search was performed in PubMed, Scopus, and Google Scholar from 1st January 2000 to 5th September 2021 using the key words "**age determination and oral exfoliative cytology/cells**" and "**forensics and/or healthy individuals**."
A total of 7 original studies fulfilled the inclusion and exclusion criteria and are included.

INCLUSION CRITERIA:
- Exfoliated cells from buccal mucosa, gingiva, other parts of oral cavity
- Systemically healthy individuals
- Cytomorphometry using software
- Original studies
- Studies in English language

EXCLUSION CRITERIA:
- Smears from other parts of body like vagina, cervix, esophagus.
- Studies combining exfoliative cytology with other methods of age estimation (Radiovisiography)
- Cytomorphometry using ocular micrometer
- Any reviews, short communications except original studies
- Other foreign languages

Author/ Yr	Sample size	Sample and Area of collection	Stain used	Parameters	Method of parameter estimation	Results	Limitations
Anuradha A/ 2007[1]	320 (8 groups)	Wet wooden spatula Attached gingiva	PAP staining	Cell & nuclear diameter and N/C ratio	Not mentioned	➢ND, CD and N:C increased from 0-20 age to 20-40 age group. ➢After 40, there is a steady decrease in ND, CD and N:C ratios ➢ND, CD and N:C high in females irrespective of age	➢No mention about the method of parameter estimation
Patel PV/ 2011[2]	80 (4 groups)	Interproximal brush Attached gingiva	PAP staining	Cell & nuclear area and N/C ratio	4 smears per subject 50 cells per smear	➢Significant difference in NA, CA, and N:C with age ➢Significant difference between males and females in NA, CA, and N:C ➢Significantly high NA & CA in females except > 60 yr. age group	➢Small sample size
Shetty DC/ 2015[3]	100 (5 groups)	Wet wooden spatula Buccal mucosa	PAP staining	Cell sizes measured	20 cells per smear	➢Significant decrease in average cell size with advancing age ➢Difference in cell size is highly significant in age group above 60 years	➢Did not clarify the parameter used for cell size estimation
Ilayaraja V/ 2018[4]	100 (5 groups)	Wet wooden spatula Buccal mucosa	PAP staining	Cell & nuclear diameter and N/C ratio	25 cells per smear	➢Significant decrease in CD and ND with increasing age ➢N:C ratio is found to fluctuate in different age groups (Without specific pattern)	--
Chaudhary R/2018[5]	50 (5 groups)	Wet wooden spatula Buccal mucosa	PAP staining	Cell and nuclear perimeter	20 cells per smear	➢Significant reduction in the size of the cell with the age ➢Nuclear size reduces with increasing age but was not consistent ➢NP:CP ratio increased with advancing age	➢Small sample size
Radhika T /2019[6]	100 (5 groups)	Wet wooden spatula Buccal mucosa	PAP staining	Cell sizes measured	20 cells per smear	➢Cytomorphometry revealed a decrease in the average cell size as age advances	➢Did not clarify the parameter used for cell size estimation
Radhakrishnan S /2019[7]	35 (7 groups)	Wet wooden spatula Buccal mucosa	H&E staining	Cell sizes measured	20 cells per smear	➢Cytomorphometry revealed a decrease in the average cell size as age advances	➢Did not clarify the parameter used for cell size estimation ➢Very small sample size

CONCLUSION The above-mentioned studies have shown that there was a **statistically significant reduction in the size of the cell with the age** which correlates with the chronological age of the individual. There are other parameters which also change with age, but results are variable. Hence, **cell size is a more reliable parameter of age estimation** and can be used as a tool in forensics.

Future perspectives There is need of studies on age estimation by oral exfoliative cytology using a **large sample size** which can provide more significant results because small sample size is a limitation in the above-mentioned studies. Also, there is a need for studies in the future relating the **cell size with gender** as only two of the above-mentioned studies relate these two parameters.

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