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Cytogenetic changes in exfoliated oral mucosa cells as effect biomarkers in dental diagnostic imaging: insights from a systematic review

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Background:

Identification and validation of sensible and reliable biomarkers in biological samples, easily obtainable though non-invasive techniques, remains an active and attractive field in biomedical research. Saliva and exfoliated oral mucosa cells are among such samples and could become an important source of clinically relevant biomarkers for a vast spectre of applications. Diagnostic imaging techniques employing ionizing radiation (IR) are vastly used in modern dentistry but carry a cytotoxic and genotoxic risk. Through a systematic review of studies on dental patients submitted to radiological diagnostic techniques, we sought to verify whether cytogenetic changes in exfoliated oral mucosa cells can be used as sensible and reliable effect biomarkers of low dose IR exposure.

Materials and methods:

- ✓ PRISMA methodology
- ✓ PICO question: Does low dose IR exposure from diagnostic imaging induce cytogenetic damage in exfoliated oral mucosa cells from dental patients?
- ✓ Databases searched: Pubmed and Web of Science
- ✓ MeSH term-based search expression: (Mouth mucosa) AND ((Chromosome Aberrations) OR (Cytogenetic Analysis) OR (Cytogenetics) OR (DNA damage) OR (Mutagenicity Tests)) AND ((Dental radiography) OR ((Dentistry) AND (Diagnostic imaging))).

Results:

30 articles were selected for analysis, from the 246 records originally obtained. In 21 studies (70.0% of the total), cytological analysis was performed to determine the frequency of degenerative nuclear changes (pyknosis, karyolysis and karyorrhexis) in exfoliated oral mucosa cells, and diagnostic irradiation was associated with a statistically significant increase ($p < 0.05$) in at least one of the above-mentioned cytotoxicity markers (post-exposure versus pre-exposure comparisons). Changes were observed regardless of the radiographic imaging technique used, e.g., conventional X-ray techniques, panoramic radiography or cone-beam computer tomography (CBCT).

Conclusions:

The frequency of degenerative nuclear changes (pyknosis, karyolysis and karyorrhexis) in exfoliated oral mucosa cells appears to be a sensitive and reliable effect biomarker of low dose IR exposure in the context of dental diagnostic imaging. These effect biomarkers could also prove useful to evaluate the cytotoxicity of other agents and materials commonly used in dentistry. However, further studies will need to be undertaken to ascertain that.

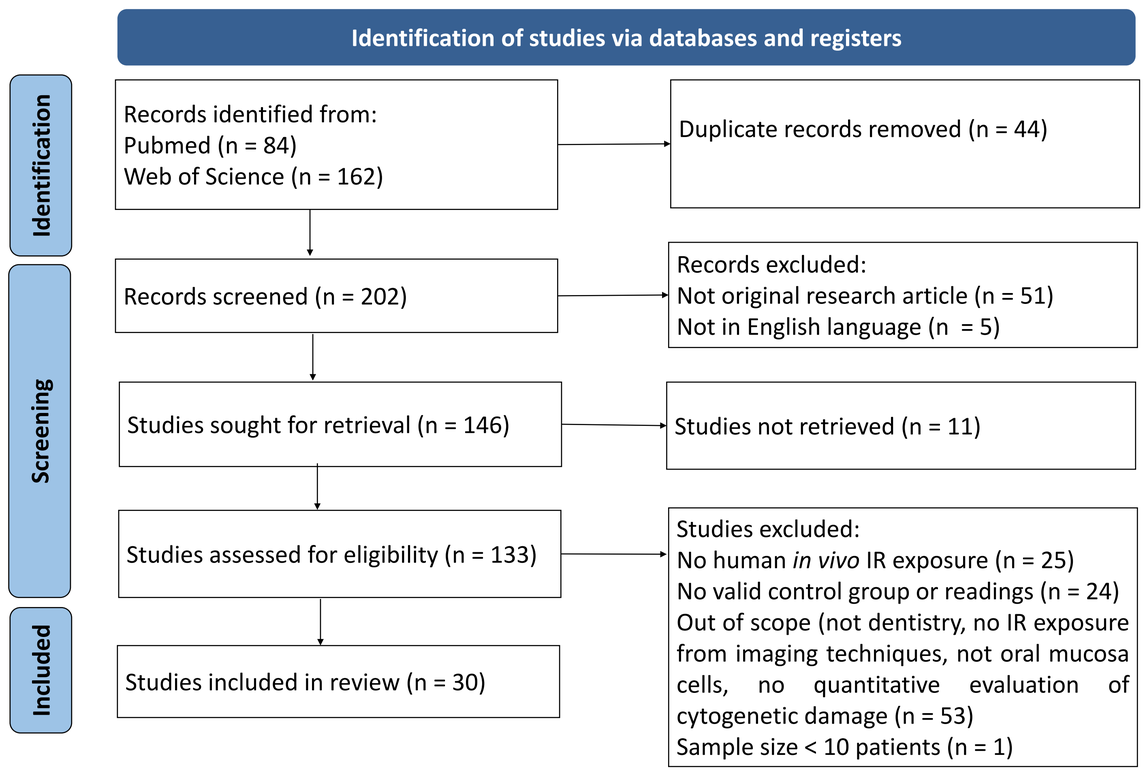

Figure 1: PRISMA flow diagram.

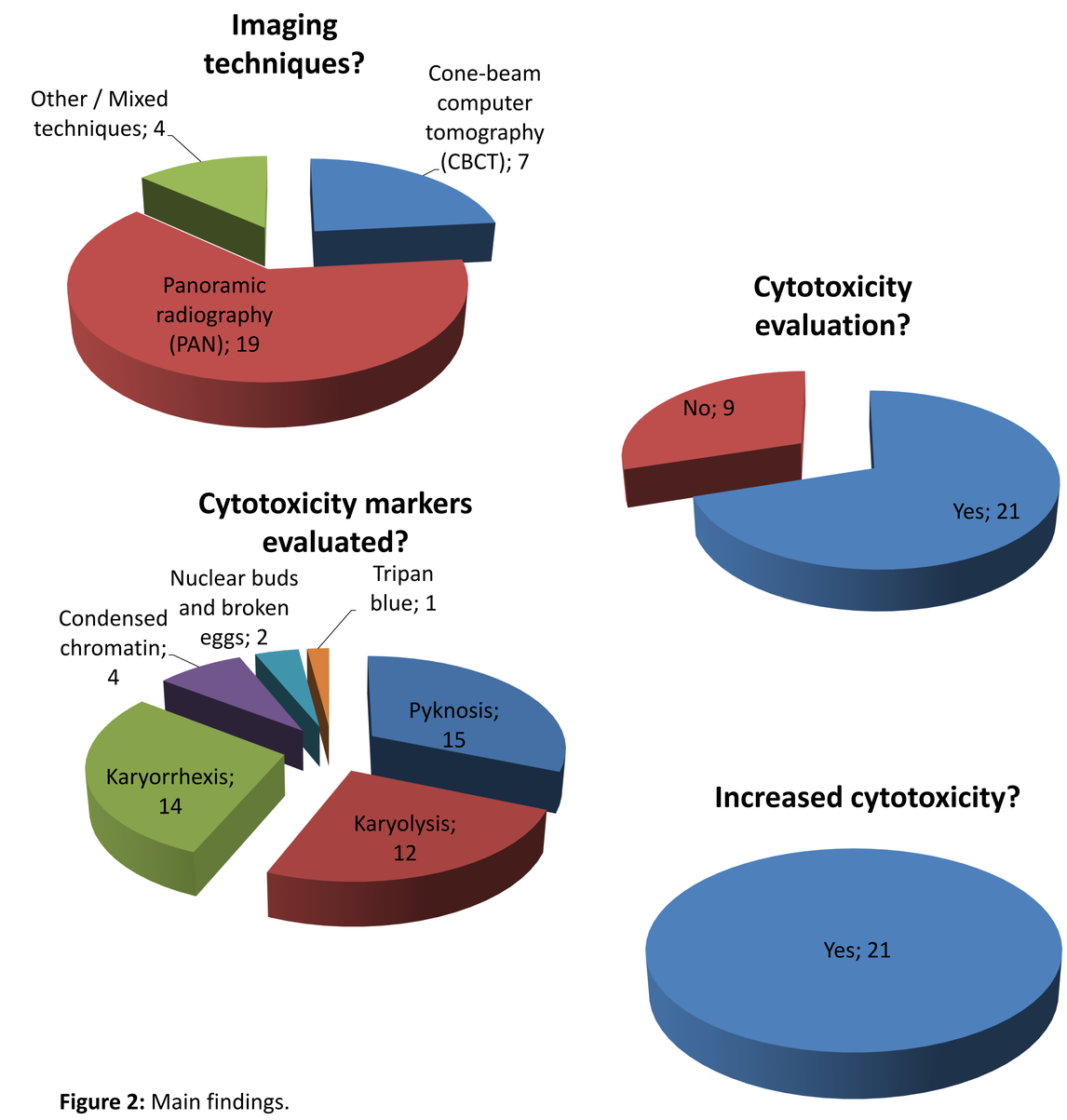

Figure 2: Main findings.

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