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Estimation of paediatric organ and effective doses from dental cone beam computed tomography using anthropomorphic phantoms

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Objectives: Cone beam CT (CBCT) is an emerging X-ray technology applied in dentomaxillofacial imaging. Previous published studies have estimated the effective dose and radiation risks using adult anthropomorphic phantoms for a wide range of CBCT units and imaging protocols.

Methods: The purpose of the study was to estimate paediatric organ and effective doses from dental CBCT using 10-year-old and adolescent phantoms and thermoluminescent dosimeters. Measurements were made on five dental CBCT units for a range of imaging protocols.

Results: The average effective doses to the 10-year-old and adolescent phantoms were 116 mSv and 79 mSv respectively, which are similar to adult doses. The salivary glands received the highest organ dose and there was a fourfold increase in the thyroid dose of the 10 year old relative to that of the adolescent because of its smaller size. The remainder tissues, salivary and thyroid glands contributed most significantly to the effective dose for a 10 year old, whereas for an adolescent the remainder tissues and the salivary glands contributed the most significantly. It was found that the per cent attributable lifetime mortality risks were 0.002% and 0.001% for a 10 year old and an adolescent patient respectively, which are considerably higher than the risk to an adult having received the same doses.

Conclusion: It is therefore imperative that dental CBCT examinations on children should be fully justified over conventional X-ray imaging and that dose optimisation by field of view collimation is particularly important in young children.