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Determination of patient dose and evaluation of ionizing radiation risk from CBCT

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Objective: Although the advanced imaging procedures providing additional information may cause higher radiation doses to the patient. Although dental radiology is a low-dose technique, with the introduction of volumetric and 3D techniques, this claim has changed. Patient dose in CBCT is lower than conventional and multi-slice CT scan; however this low dose has the hazards of ionizing radiation. As the application of the CBCT is increasing in dental radiology and the department with this equipment is developing, determination of patient dose and evaluation of ionizing radiation risk from CBCT seems to be necessary. In this study the eyes, thyroid and parotid glands doses in CRANEX® 3D dental CBCT examination and panoramic has compared.

Methods: In this study the eyes, thyroid and parotid glands doses has calculated in panoramic and dental CBCT imaging using practical measurement method. Used equipment is: CRANEX® 3D dental CBCT and panoramic device (Soredex, Tuusula, Finland) SOLARO 2A TLD reader and a GR 200 TLD. TLDs were calibrated in individual and batch steps before measurement. A number of 35 patients for panoramic and 39 patients for CBCT examination being the case of maxillofacial imaging were evaluated. For any patients 5 TLDs as a pair in the back of eyelid, a pair 2 cm in front of small anterior ear cartilage and one on neck bumps skin were placed and after imaging removed and were reading. The average absorbed dose was calculated for comparison of different organ doses in two examinations.

Results: The results in this study show that in CRANEX® 3D panoramic examination, right eye with 0.00203 ± 0.00022 cGy has the lowest and right parotid with 0.0283 ± 0.0053 cGy has the highest mean dose. Also in CBCT examination, the highest mean dose is for right parotid (0.465 ± 0.078) and the lowest is for left eye (0.0311 ± 0.004). Mean absorbed dose for eyes, parotid and thyroid in panoramic respectively is equal to 0.0022 ± 0.00029 , 0.027 ± 0.0051 , 0.0027 ± 0.0002 and in CBCT is 0.033 ± 0.005 , 0.441 ± 0.074 , 0.0389 ± 0.0051 .

Conclusion: The absorbed dose difference in two examinations for all organs was meaningful ($p < 0.001$). Because wider beam (cone beam) and higher exposure factors in CBCT, organs dose in this examination is higher than panoramic (more than 10times). In both examinations, parotid glands receive higher dose due to irradiated whit primary beam. Maxillary CBCT is result in more eyes and parotid dose, but thyroid dose in mandibular CBCT is 4.5 times the maxillary scan, as in this scan head position and beam set so that the thyroid received higher exposure rather than maxillary scan.

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