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Effective doses of Planmeca ProMax® 3D units – low dose protocol

Planmeca ProMax® 3D s

Low dose protocol	kV/mA/mAs/s	µSv
Average - Incisors - Ø50 x 80	84/6/29.0/4.8	35
Average - Incisors - Ø50 x 50 lower	84/6/29.0/4.8	29
Child - Incisors - Ø42 x 68	84/4/19.3/4.8	20
Child - Incisors - Ø42 x 42 lower	84/4/19.3/4.8	13

Planmeca ProMax® 3D Classic

Low dose protocol	kV/mA/mAs/s	µSv
Average - Teeth - Ø80 x 80	84/8/17.1/2.8	36
Average - Incisors - Ø40 x 50 lower	84/6/14.5/2.4	13
Child - Teeth - Ø68 x 68	84/4/11.4/2.8	19
Child - Incisors - Ø34 x 42 lower	84/4/9.7/2.4	12

Planmeca ProMax® 3D Mid

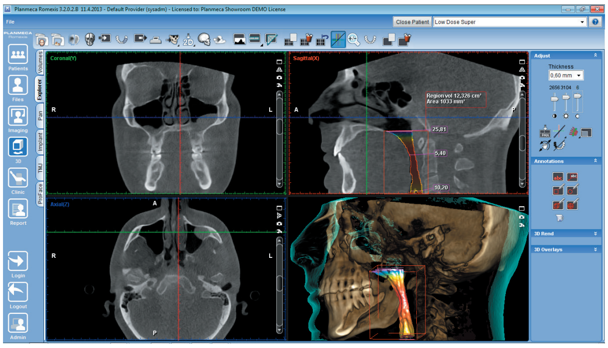
Low dose protocol	kV/mA/mAs/s	µSv
Average - Teeth - Ø70 x 70	90/6/14.5/2.4	28
Child - Tooth - Ø34 x 42 mandible	90/4/9.7/2.4	12
Jaws - Teeth - Ø160 x 90	90/6/54.2/9	54
Jaws - Face - Ø160 x 160	90/6/108/18	77
Average - teeth - Ø90 x 90	90/6/17.1/2.8	24
Average - sinus - Ø90 x 90	90/3/7.2/2.4	4

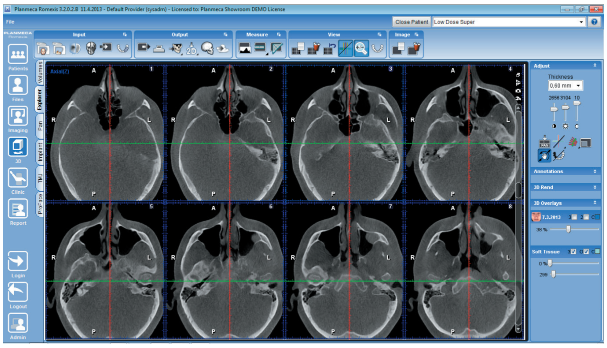
Planmeca ProMax® 3D Max

Low dose protocol	kV/mA/mAs/s	µSv
Adult - Teeth - Ø50 x 55 mm	96/6/29.0/4.8	55
Adult - Teeth - Ø100 x 90 mm	96/5/25.6/4.3	96
Adult - Teeth - Ø100 x 55 mm	96/6/25.6/4.2	62
Sinus/Skull - Ø100 x 130 mm (0.4 mm voxel)	96/12/43.5/3.6	84
Child - Teeth - Ø42 x 50 mm	96/4/19.3/4.8	29
Child - Teeth - Ø85 x 75 mm	96/4/22.8/5.7	86
Skull - Lower - Ø230 x 160 mm	96/6/54.2/9	128
Ent/Skull - Ø130 x 160 (0.4 mm voxel)	96/12/51.3/4.3	73
Ultra low dose *	kV/mA/mAs/s	µSv
Adult - Skull-Lower – Ø230 x 160 mm	96/1mA/9.0/9	21

* available in Planmeca Romexis® 3.2

In addition, **Planmeca ProMax®** Standard panoramic adult effective dose: 15 uSv





Planmeca ProMax® 3D Max Low dose image Adult male, FOV Ø230 x 160 mm, effective dose **21 µSv**

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Effective doses for Planmeca ProMax® X-ray unit

Background and methodology

The dose measurements are performed using an anthropomorphic RANDO phantom and MOSFET dosimeters positioned into the phantom, according to the effective dose measurement protocol described by Ludlow et al. [1]. The effective dose calculation is based on using the revised guidelines given by the **International Commission on Radiological Protection** (ICRP 103) [2]. At Planmeca, the Corporate Physicist Juha Koivisto is in charge of the effective dose measurements.

The MOSFET dosimeters provide good precision with real-time read-out. They were calibrated at the **Secondary Standard Dosimetry Laboratory (SSDL) at the Finnish Radiation and Nuclear Safety Authority** (STUK) and they are characterized for their angular sensitivity [3]. Furthermore, the MOSFET measurement method used for obtaining the results has been validated for reliability in a publication (Koivisto et al.) [4] in co-operation with authors from the following institutions:

- HUS Helsinki Medical Imaging Center, University of Helsinki, Finland
- Medical Imaging Center, Tampere University Hospital, Tampere
- International Comprehensive Cancer Center Docrates, Helsinki, Finland
- STUK, Radiation and Nuclear Safety Authority, Helsinki, Finland

The method used for defining the effective doses has been shown to provide good repeatability, and with error margin included, equivalent results in similar conditions compared with other studies [5], [6]. The differences in the results may well be explained by different choices in dosimeters depicting organ variations between the methods. The differences between individual phantoms and their positioning may have a drastic effect on the overall effective dose especially at the lower part of oral cavity and thyroid gland region.

Since image quality and effective dose are interconnected, it is for the user to decide the exposure parameters and appropriate field of view (FOV) to ensure adequate diagnostic image quality in terms of contrast and noise sharpness while keeping the effective dose to a minimum level according to the ALARA principle. For this purpose all Planmeca ProMax X-ray units provide a multitude of pre-programmed and easily adjustable imaging modalities for all volume sizes.

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Corporate Physicist

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[2] International commission on Radiological Protection (ICRP). Recommendations of the ICRP. ICRP Publication 103. Ann ICRP 2008; 37:2-4.

[3] Koivisto J., Kiljunen T., Wolff J. and Kortesniemi M. Characterization of MOSFET dosimeter angular dependence in three rotational axes measured free-in-air and in soft-tissue equivalent material, Journal of Radiation Research, 2013, 00, 17 doi: 10.1093/jrr/rrt015

[4] Koivisto J, Kiljunen T, Tapiovaara M, Wolff J, Kortesniemi M. Assessment of radiation exposure in dental cone-beam computerized tomography with the use of metal-oxide semiconductor field-effect transistor (MOSFET) dosimeters and Monte Carlo simulations. Oral Surg Oral Med Oral Pathol Oral Radiol. 2012 Sep; 114(3):393-400.

[5] Pauwels R, Beinsberger J, Collaert B, Theodorakou C, Rogers J, Walker A, Cockmartin L, Bosmans H, Jacobs R, Bogaerts R, Horner K. Effective dose range for dental cone beam computed tomography scanners. Eur J Radiol. 2012 Feb;81(2):267-71.

[6] Qu X, Gang L , Li G, Ludlow J B, Zhang Z, Ma X. Effective radiation dose of ProMax 3D cone-beam computerized tomography scanner with different dental protocols. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology and Endontology 2010; Vol. 110 No.6.