DOSE DISTRIBUTIONS FROM PANTOMOGRAPHIC AND FULL-MOUTH DENTAL RADIOGRAPHY

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A complete radiological survey of the jaw region is sometimes necessary. The conventional method is a full-mouth intraoral survey consisting of anything between 11 and 27 different films. The same survey using the pantomographic method with a single film is much less time consuming and more reproducible results are practically guaranteed.

The disadvantage of a pantomographic survey is that caries, periodontal, periapical and other types of lesions are not clearly indicated. This shortcoming can be solved by taking two additional bitewing radiographs and any other intraoral radiographs which may be necessary.

The purpose of this investigation was to determine the energy imparted to the jaw region during a pantomographic and other full-mouth examinations. Measuring the absorbed dose at points makes it difficult to compare results with other surveys because of different techniques and exposure values used. By measuring the dose and calculating the average energy imparted to the region enables one to make better comparisons. The survey giving maximum radiological information with the lowest energy imparted, is obviously the technique of choice.

Method:

The following procedures are investigated

1. Pantomographic survey.

2. Pantomographic survey plus two bitewing films at focus skin distances (FSD) of 20 cm and 40 cm.

3. Full-mouth survey consisting of 19 and 13 individual films at 20 cm and 40 cm FSD.

4. Full-mouth survey of 19 films at 10 cm FSD.

5. Combination of intraoral and extraoral techniques consisting of two angled lateral films of the jaw, two occlusal and two bitewing films (Stellenbosch method). For the lateral projection a 13 x 18 cm^2 film and a pair of screens was used.

The pantomographic surveys were done with a GE Panelipse, intraoral films with a GE 1000 using a 7 cm cylindrical cone and all 10 cm FSD films with an Asahi dental unit. The tube voltage of the GE units (2,7 mm Aℓ total filtration) is continuously variable from 50 to 100 kV whilst the tube current can be set at 10 or 15 mA. The Asahi (1,9 mm Aℓ total filtration) is a fixed energy unit of 58 kV and 7 mA.

Table 1. Exposure values.

Survey	FSD	kV	mA.s
Pantomographic		80	240
Bite wing	40	70	6
Bite wing	20	70	3
Stellenbosch	40	70	6
Stellenbosch	20	60	3
Full-mouth	40	68	6
Full-mouth	20	90	1,8

All exposure measurements were done using calibrated lithium fluoride powder as detector and an Alderson Rando tissue equivalent phantom ($\bar{Z}$ = 7,3 ρ = 0,985g/cm^3) simulating the patient. The 2,5 cm thick tissue equivalent slab running through the jaw region was replaced with a similarly contoured wax slab (ρ = 0,93 g/cm^3) in which 77 holes taking the LiF-powder capsules were drilled. Another 30 capsules were arranged on the skin. The dose to the eyes and thyroid was also measured.

The average absorbed dose of the 107 measuring points was determined for each procedure and the energy imparted calculated using the formula

1 joule = 1 gray.kilogram = 100 rad.kilogram

The mean energy and the absorbed dose to the eyes and the thyroid are given in Table 2 and is the average of the experiments.

Table 2. Mean energy and absorbed dose values.

Survey	FSD (cm)	Mean energy mJ	R. Eye mrad	L. Eye mrad	Thyroid mrad
Pantomographic	-	0,925	8 ± 1	8 ± 1,5	6 ± 1
Stellenbosch method	40	1,66	28 ± 3	137 ± 40	13 ± 1
Pan + 2 bite wing	40	2,14	13 ± 2	15 ± 3	12 ± 5
Pan + 2 bite wing	20	2,88	18 ± 5	17 ± 5	12 ± 7
Stellenbosch	20	2,45	46 ± 17	36 ± 4	31 ± 5
Full-mouth 13 films	40	3,57	38 ± 12	35 ± 7,5	20 ± 4,5
Full-mouth 19 films	40	3,76	441 ± 288	506 ± 175	46 ± 6
Full-mouth 13 films	20	5,98	288 ± 75	201 ± 123	54 ± 3
Full-mouth 19 films	20	6,87	577 ± 29	572 ± 25	92 ± 41
Full-mouth 19 films	10	10,3	166 ± 17	132 ± 13	79 ± 44

Discussion

Many publications appeared on dose values of dental radiological procedures. Comparisons are difficult for reasons due to different techniques and exposure parameters used. On the average, our values compare favourably with published data. (Wall, 1979)

Of all the techniques studied the normal pantomographic survey yields the least average energy and dose values. The more films taken and the shorter the FSD the higher the dose and energy imparted. The short FSD techniques tend to use relative low tube voltages which lead to increasing doses.

If more information is required a pantomographic survey with one or two bite wing films at high tube voltage and long FSD will be the method of choice. If a pantomographic unit is not available the Stellenbosch method can be used although the private dentist may have problems in developing the oblique lateral films.

Wall, B.F. et al, 1979, B.J.R., 52, 727-734.