

DIAGNOSTIC REFERENCE LEVELS IN PAEDIATRIC INTRA ORAL PERI APICAL (IOPA) DENTAL RADIOGRAPHY AT UNIVERSITY DENTAL HOSPITAL, PERADENIYA.

Hettiarachchi P V K S¹, Jayatissa P¹, Banu H M F², Masmiya M S², Heendeniya H K R L²

¹Head/ Division of Oral Medicine and Radiology, Department of Oral Medicine and Periodontology, Faculty of Dental Sciences, University of Peradeniya, Sri Lanka.

²Faculty of Allied Health Sciences, University of Peradeniya, Sri Lanka

Keywords : IOPA, dental radiography, DRL

Corresponding Author: Hettiarachchi P V K S¹

Copyright: Hettiarachchi P V K S¹

 <https://orcid.org/0000-0003-2618-5050>

ABSTRACT

Dental radiography is a common diagnostic technique practiced among the paediatric patients visiting the dentist. Therefore, to abide the ALARA (as low as reasonably achievable) principal and reduce the undesired exposure especially for the pediatric patients the DRLs in paediatric intraoral periapical dental radiographs was developed using the patient entrance surface doses (ESD).

INTRODUCTION

Dental radiography plays an important role in dental armamentarium as it helps with confirming the clinical diagnoses and there by aid in proper treatment planning. Due to these unique features, dental radiography has become an integral part in pediatric dentistry as well. According to the ICRP (International Commission of Radiation Protection) recommendation of radiation protection, in dental radiography radiation exposure is within the tolerable limits based on as low as reasonably achievable (ALARA) principle¹. Therefore, to ensure better patient care and protection, the need for requesting a radiograph should be justified. As children are more radiosensitive compared to, adults it is paramount important to justify the request of a radiation exposure particularly in this population^{2,3}. In order to ensure this, when performing radiological procedures on children proper radiation protection techniques need to be followed, aiming to recognize and implement minimal dose exposure to mitigate unwanted radiation exposure. DRLs have been established for many common diagnostic procedures that involve radiation resulting in optimal dose delivery to the patient with high levels of acceptance⁴. Several authors have recommended the use of dose area product (DAP) as the dose quantity in establishing reference levels in dental radiology^{5,6}. Therefore, the objectives of this study was to measure the patient entrance surface doses (ESD) for intraoral paediatric dental radiographs and to establish the DRLs in paediatric intraoral periapical dental radiographs.



Vj ku'ku'cp'qr gp/ceegu'ct vlerg'f kvtkdwgf 'wvf gt'vj g'vgt o u'qh'vj g'Etgcvkxg'Ego o qpu' Cvtkdwkp'60'k'vgtpcv'kpcr'Nlegpug.'y j lej 'r gto ku'wpt gntlevgf 'wug.'f kvtkdwkp'cpf " tgr tqf we'kp'kp'cp{ 'o gf kwo 'r tqxkf gf 'vj g'qtki kpcr'cwj qt'cpf 'uqwtg'ctg'etgf ksf 0

MATERIALS & METHODS

IOPA examinations were carried out in 78 patients, aged between 2-18 years old who visited to Division of Oral Medicine and Radiology, University Dental hospital, Peradeniya. Participants' radiographs who gave informed, written consent to participate in the study were included. However, radiographs of patients who were not within the standard height weight range were excluded and the selected participants were allocated to three groups considering their age: aged 2-7 years, 8-12 years and 13-18 years.

The pocket dosimeter was placed at the neck level & the beam was aligned correctly, before making the exposure. The exposure was made & ESD was measured for each patient. Third quartile values (Q3) of ESD & DAP were calculated using Minitab 17 software.

RESULTS

The mean exposure parameters were 65kVp, 8mA & 0.32s.

Mean values of ESD & DAP were,

1.17 mGy & 14.35 mGy.cm² for 2-7 year age group

1.86 mGy & 22.69 mGy.cm² for 8-12 year age group

2.02 mGy & 24.64 mGy.cm² for 13-18 year age group respectively.

The third quartile values of ESD & DAP were,

1.3 mGy & 15.86 mGy.cm² for 2-7 year age group

2.4 mGy & 29.28 mGy.cm² for 8-12 year age group

2.1 mGy & 25.62 mGy.cm² for 13-18 year age group respectively.

DISCUSSION

The literature provides evidence for different DRLs depending on the region that is being imaged. Eun-Kyung Kim et al, 2012 reported a mean exposure parameters of 62.6 kVp, 7.9 mA, and 0.5 s for IOPA radiographs taken at the mandibular molar region in adults. According, to this study, the recommended PED value was 3.07 mGy and DAP, 87.4 mGy.cm². Further, they reported that a significant reduction in the doses at university dental hospitals than those at dental clinics ($p < 0.05$) and also a statistically significant dose reduction with digital radiography (DR) compared to film-based type ($p < 0.05$)⁷. It was reported that to the mandibular incisor region, the mean PED ranged from 1.09 ± 0.31 mGy while for maxillary molars and mandibular molars the values ranged from 2.42 ± 0.33 mGy and 1.59 ± 0.20 mGy respectively⁸.

Another study to assess diagnostic reference levels (DRLs) in intraoral dental radiology demonstrated calculated, third quartile values ranging from 26.2 to 87.0 mGycm² and the results of this study showed that there exists a considerable difference between the patient exposures and therefore, recommend to establish DRLs among different dental facilities⁹.

A study done in Spanish dental clinic, revealed a DRL of 2.8 mGy in 2014, which represents a 41.7 % decrease compared with that of 2002 where the value was 4.8 mGy. Therefore, the stabilization of the mean dose administered to patients has been observed with only a 6.7 % reduction in DRLs, which corresponds to the stabilization of dental radio diagnostic surgery on replacing the use of radiographic film with digital imaging systems¹⁰.

Further, Christofides et al., in 2016 concluded DRLs levels at 3rd quartile for 7 exposure settings corresponding to 12 different areas in both adult and paediatric patients. The values for mandibular and maxillary incisor, premolar and molar, were 197, 163, 128, 102, 81, 65 and 49mGycm⁻² and 7.23, 5.94, 4.75, 3.68, 3.10, 2.41 and 1.88mGy for benchmark nominal exposure times of 1000, 800, 640, 500, 400, 320 and 250ms respectively, at a nominal exposure voltage of 70kVp¹¹. Looe HK et al, in 2006¹² also documented in the study carried out to establish diagnostic reference levels (DRLs) in paediatric intraoral dental radiology, the third quartile values for periapical examination ranges from 14.4 to 40.9 mGy cm² for child settings and 20.6 to 48.8 mGy cm² for adult settings. In addition, they also concluded that there is a large difference between the patient exposures among different dental facilities¹².

The Napier ID et al., 1999 in his study using 6,344, intra-oral x-ray radiographs and 387 panoramic radiographs concluded that the third quartile patient entrance dose for an adult mandibular molar intra-oral radiograph is 3.9 mGy. The third quartile dose-width product for a standard adult panoramic radiograph is 66.7 mGy mm¹³. However, when comparing these results our study reports, ESD values of 1.3 mGy, 2.4 mGy & 2.1 mGy and also DAP values of 15.86 mGy.cm², 29.28 mGy.cm², 25.62 mGy.cm² were recommended for 2-7, 8-12 & 13-18 years age groups respectively as DRLs in paediatric IOPA dental radiography.

CONCLUSION

It is recommended not to exceed the reported DRLs especially for paediatric IOPA dental radiography, in order to eliminate unnecessary & unjustified radiation exposure. Further, these DRLs are recommended considering the weigh of potential benefit against potential risk in paediatric IOPA dental radiography.

References

1. European Union. Council Directive 97/43 Euratom, on health protection of individuals against the dangers of ionizing radiation in relation to medical exposures, and repealing Directive 84/466 Euratom. Off. J. Eur. Commun. L180, 22 (1997).
2. Radiation protection 136. European Guidelines on radiation protection in dental radiology: The safe use of radiographs in dental radiology. European Commission publications.

3. Alme'n, A. and Mattsson, S. On the calculation of effective dose to children and adolescents. *J. Radiol. Prot.* 16(2), 81–89 (1996).
4. Radiation protection 109. Guidance on diagnostic reference levels (DRLs) for medical exposures. European Commission publications.
5. Helmrot, E. and Alm Carlsson, G. Measurement of radiation dose in dental radiology. *Radiat. Prot. Dosim.* 114(1–3), 168–171 (2005).
6. Tierris, C. E., Yakoumakis, E. N., Bramis, G. N. and Georgiou, E. Dose area product reference levels in dental panoramic radiology. *Radiat. Prot. Dosim.* 111(3), 283–287 (2004).

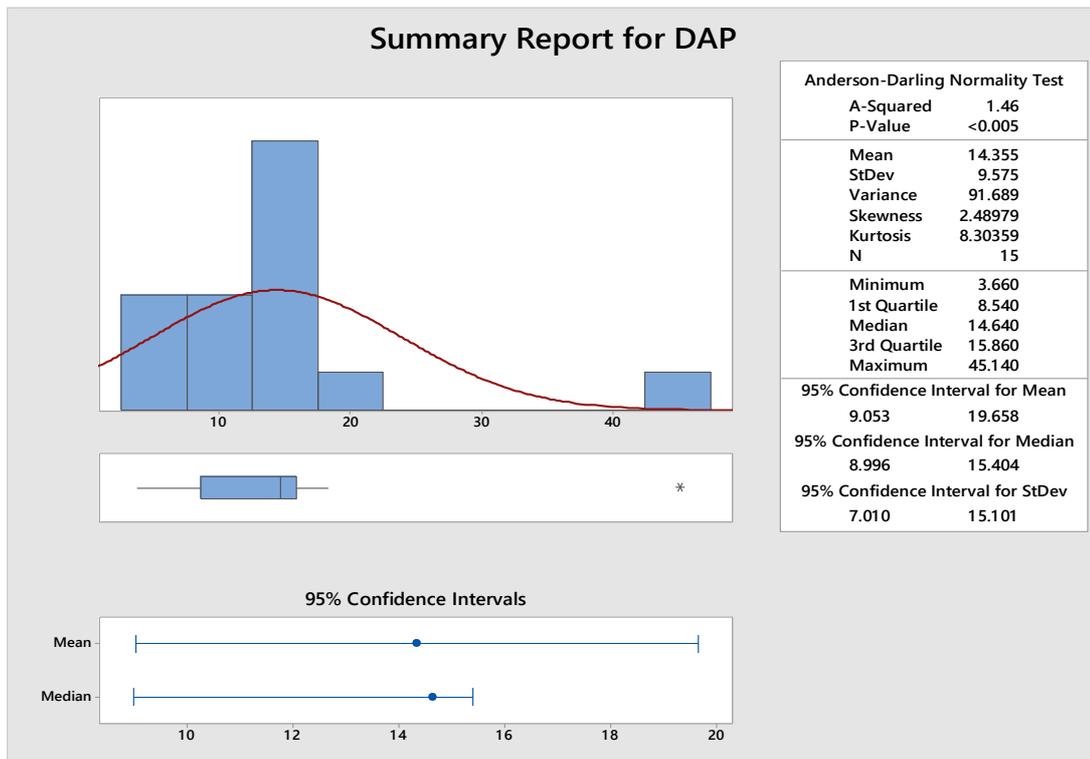


Fig 1 : Summary report of DAP for 2-7 years age group

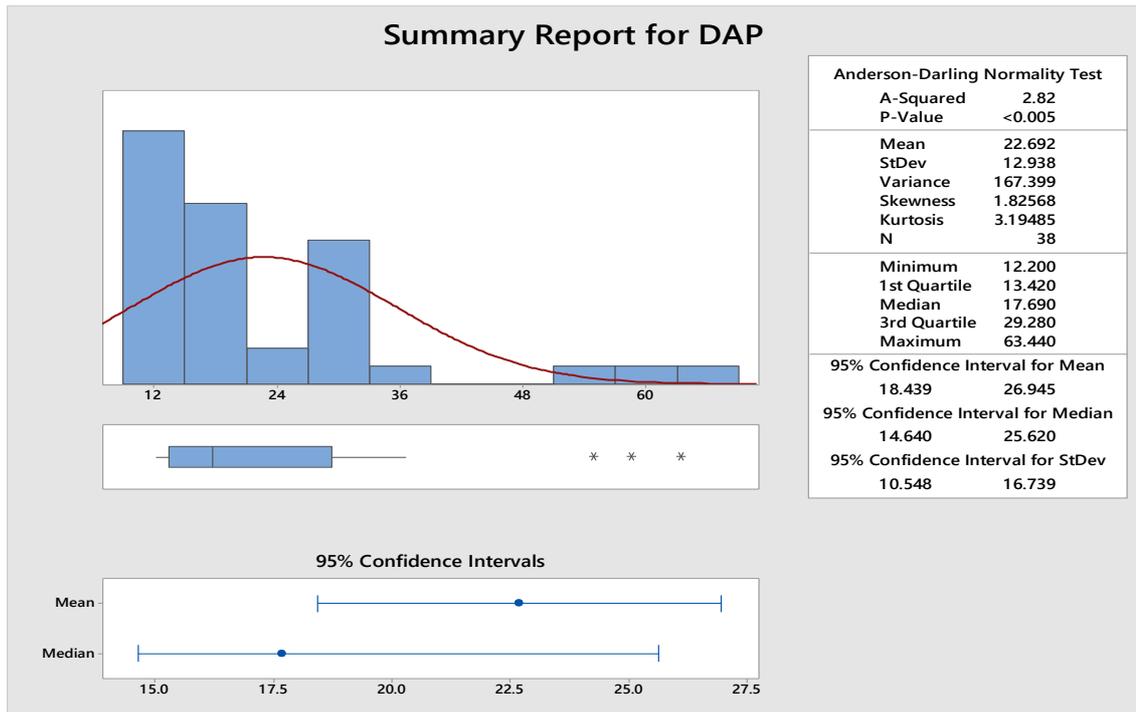


Fig 2 : Summary report of DAP for 8-12 years age group

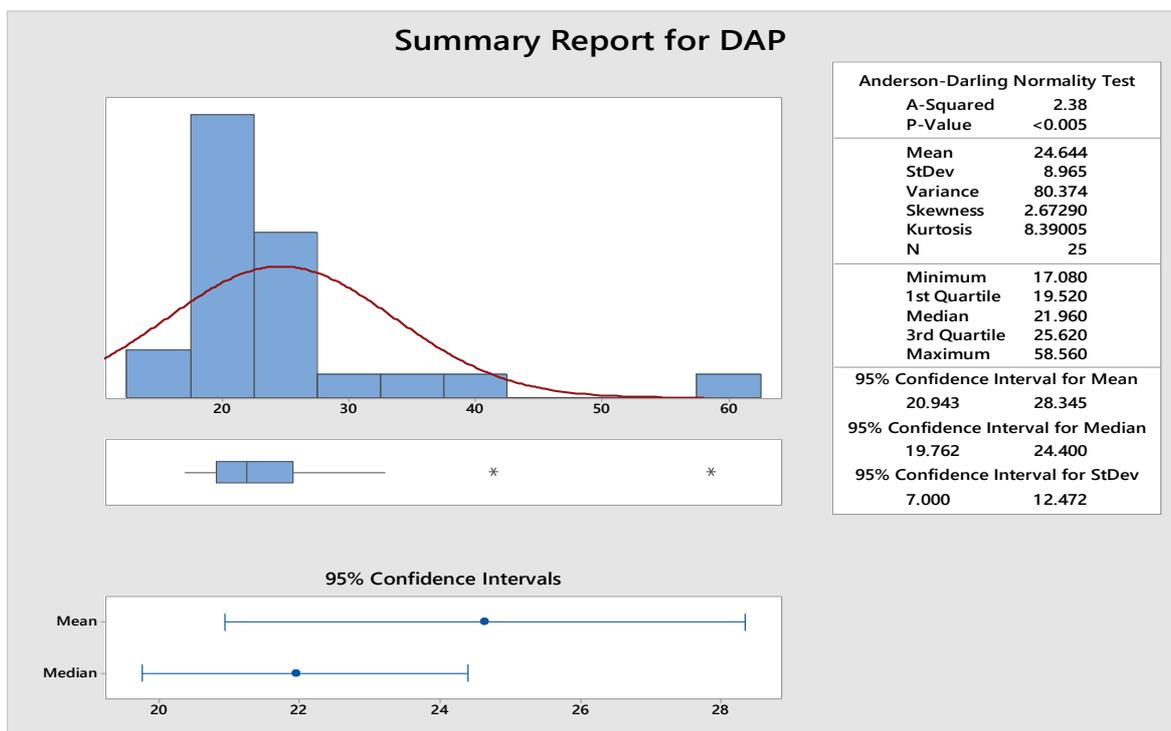


Fig 3 : Summary report of DAP for 13-18 years age group