

Calculation of Effective Dose for Intraoral Dental Radiography using Monte-Carlo Simulation in Korea

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Introduction

Increasing number of intraoral dental radiography

- Intraoral dental radiography is an important imaging tool in modern dentistry.
- Intraoral dental radiography is the most frequently used among dental radiography, and its usage is increasing every year.
- About 20 million intraoral dental radiography examinations were reported to Korea national health insurance service in 2015.

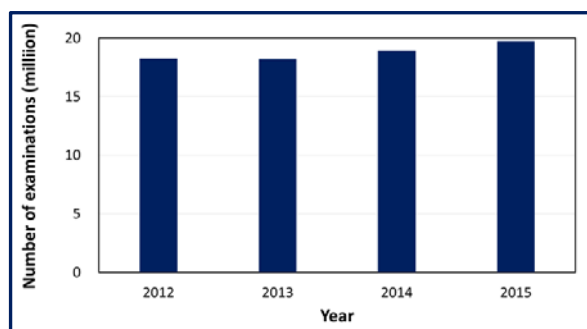


Fig.1. Number of intraoral dental radiography (2012-2015)

Necessity of patient dose management for intraoral dental radiography

- The increasing usage of radiation examinations may result in an increase of radiation exposure.
- The increasing radiation dose is of concern from the aspect of radiation safety and public health.
- Therefore, it is necessary to manage patient radiation dose in intraoral dental radiography.

Objective

Calculation of effective dose for intraoral dental radiography using Monte Carlo simulation in Korea

- To investigate technical settings commonly used for intraoral dental radiography
- To calculate organ doses and effective dose using MCNPX code and phantom

Materials and Methods

Investigation of technical settings commonly used for intraoral dental radiography

- To calculate effective dose for intraoral dental radiography, technical settings of dental radiography were investigated.
- The average tube voltage, tube current, and exposure time were 63 kVp, 1.8 mA, and 0.3 sec, respectively.
- The average entrance air kerma (EAK) was 1.3 mGy and dose area product (DAP) was 37.1 mGy·cm².
- The commonly used collimator diameter was 6 cm and focus-skin distance (FSD) was 20 cm.

Calculation of organ doses and effective dose using MCNPX code and phantom

- To calculate organ doses, MCNPX code was used that using Monte-Carlo methods.
- Organ doses were calculated using this MCNPX code and phantoms simulating exposure situation.

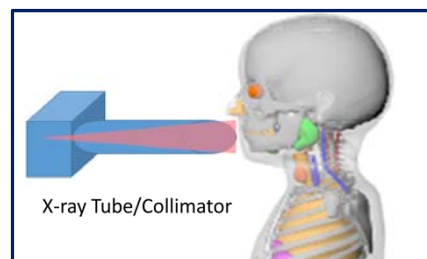


Fig.2. Simulation of exposure situation using MCNPX

Results and Discussion

Effective dose for intraoral dental radiography

- The organ doses for oral mucosa (0.06 mGy) and salivary glands (0.04 mGy) were relatively higher compared to other organs and tissues.
- Effective dose was finally calculated based on ICRP 103 tissue weighting factors with the calculated organ doses.
- As results, effective dose was calculated as about 0.002 mSv.

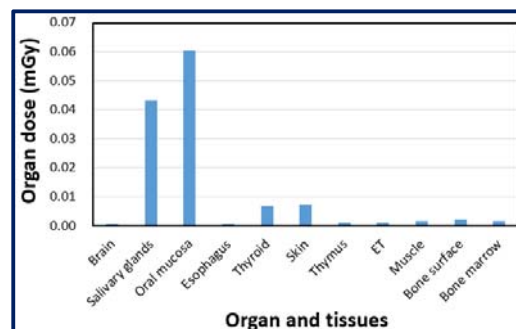


Fig.3. Organ doses for intraoral dental radiography

Conclusion

- We calculated effective dose for intraoral dental radiography using Monte Carlo simulation in Korea.
- Average technical settings (91Vp, mAs, EAK) was used to calculate effective dose.
- Organ doses for oral mucosa and salivary glands were 0.04, 0.06 mGy, respectively. Effective dose was about 0.002 mSv.
- This study results can contribute to manage patient dose and to optimize intraoral dental radiography for radiation protection.

Acknowledgement

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