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Reflections on the American Academy of Oral and Maxillofacial Radiology and the American Dental Association Guidelines for Patient Shielding During Dentomaxillofacial Radiography

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Dear Editor:

In 2013 an ATA (American Thyroid Association) policy statement included an endorsement of the use of thyroid collars to shield the gland during imaging during dental practice.¹ In 2021 three of the authors of this letter reviewed the subject and concluded "...the use of thyroid shielding should be the default decision for all dental radiology." Recently, as summarized in Supplementary Table S1, that policy is no longer unanimously endorsed by all organizational guidelines calling the endorsement of shielding in dental radiology into question.

Radiation and Thyroid Cancer Shielding Pro and Con Factors

Considering the newly diverse guidance from dental organizations, we sought to understand the basis of the new guidance and determine whether previous ATA policy should be amended. The evidence used by the AAOMR (American Academy of Oral and Maxillofacial Radiology) to support abandoning thyroid shielding (eTable 2 in their publication²) and adopted in full by the ADA (American Dental Association) is found in Supplementary Table S2 (eTable 2) in their publication.² The evidence contained in this table supports the generally accepted benefit of thyroid collars reducing the dose of radiation absorbed by the thyroid from dental radiation procedures. The apparent paradox of the AAOMR/ADA recommending discontinuation of thyroid shielding despite the above evidence relies on an assumption of a radiation dose threshold, i.e., a dose below which there is no additional excess risk of thyroid cancer. However, current epidemiologic studies are compatible with a linear relationship at low radiation doses, which implies that all dose levels carry some additional thyroid cancer risk.³ While epidemiologic studies can never definitively identify a

true threshold radiation dose, studies estimate that if a non-zero threshold exists, with 95% confidence the threshold does not exceed 0.040 Gy. These studies reaffirm linearity of the dose response as the most plausible relationship for "as low as reasonably achievable (ALARA)" assessments for pediatric low-dose radiation-associated thyroid cancer risk."³ In other words, epidemiologic studies give no support for a threshold and do support following the ALARA principle.

The disadvantages of providing thyroid shielding during dental procedures are less clear. According to the AAOMR/ADA statement,² the "use of these shields during radiography-based diagnostic imaging may obscure anatomic information or interfere with the automatic exposure control of the imaging system."² However, there is little, if any empirical data on the magnitude of this potential problem, both its frequency in practice and the magnitude of its effect. What has been studied with some care, and what is extrapolated to dental practice, is gonadal/fetal shielding in women from abdominal radiography. Further studies in this area of dental radiology would be useful. Until then, the literal interpretation of ALARA appears to be justified.⁴

Dosimetry Factors

There are limitations of unknown magnitude in the published thyroid dose estimates, but these need to be considered. eTable² does not consider the wide variety of instruments available to dentists, as well as other factors such as field of view. Ludlow *et al.*⁵ noted for CBCT (cone beam computed tomography), "Large exposure ranges make CBCT doses difficult to generalize." Additionally, reported dose estimates are observed in ideal conditions: the patient (phantom) does not move and is of a fixed size and the dentist (researcher) is an expert. Actual patients may move, if

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even slightly, they come in a wide range of sizes, and the dentists (and technicians) will have varying experience and expertise. In fact, according to Yepes, *et al.* children under 18 years of age saw general dentists far more often than pediatric dentists (2,077 VS 103 derived from their review of insurance claims) and for children less than 5 years old, general dentists “were somewhat less likely to follow guidelines.”⁶

Age-Specific Dose Analyses

A second area of consensus is that the highest thyroid cancer radiation risk is present in those of youngest age (i.e., in children).⁷ The expanded pooled low dose analysis limited to <100 mGy indicated that there was little or no diminution of the radiation effect 40 or more years since irradiation.^{3,7,8} This result adds particular importance to the consequences of the enhanced radiation effects of childhood exposures.

It is possible that there is no thyroid cancer risk above a certain age. However, the magnitude of dentistry-related thyroid radiation for children is much less studied. This is especially important for the less frequently used imaging procedures such as CBCT. Of the 30 entries in the AAOMR’s table cited above, only three list estimates for children.

Dose estimates for children must consider their growth over time. For some procedures the thyroid may be completely or partially in the X-ray field depending on age and size. The dose certainly depends on the settings and equipment, for example intraoral bitewing rectangular versus round collimation, used for an exam. As seen in Supplementary table S2, few dental dosimetry studies focus on or include children.

Lifetime Dental Thyroid Dose vs. the Thyroid Dose from Individual Procedures

The conclusion of the AAOMR and ADA to pivot away from the use of thyroid shielding relies on observations listed in eTable of the AAOMR paper but does not take into account the likelihood that an individual, especially young ones, would have multiple procedures over time.² It is generally accepted that the thyroid cancer risk increases with cumulative dose, but whether this is linear or non-linear is not clear. The recommendation for periodic dental examinations in pediatric dentistry was revised in 2022 and published in 2023 by the AAPD (American Academy of Pediatric Dentistry).⁹ Separately, in 2021 the AAPD published a revision of its guidelines as follows: “Because the effects of radiation exposure accumulate over time, every effort must be made to minimize the patient’s exposure [including] use of protective aprons and thyroid collars. . .”.¹⁰ Also, exposure from other examinations, e.g., chest X-ray or head and neck CTs contribute to the lifetime dose.

Conclusion

The AAOMR statement:² “*With dose-reduction efforts in place, as summarized in the following section, radiation doses from dentomaxillofacial imaging carry negligible risk*” may be correct. However, this statement does not reflect a state of “no risk.” Thus, while a blanket change to recommend no thyroid shielding seems excessive, better data confirming the lack of benefits of thyroid shielding, especially in children, and

improved evidence of reduced imaging efficiency, could shift the recommendation.

We believe that for now, it would be appropriate for dentists to continue to offer thyroid shielding to all patients, especially children, if it does not interfere with image quality. Additionally, as with all medical applications of ionizing radiation, exposure should be limited in keeping with the ALARA principle.

Authors’ Contributions

A.B.S.: Study conception and initial review of the literature. A.B.S., J.H.L., M.M.K., and D.V.M.: Interpretation of the data and article preparation and approval.

Author Disclosure Statement

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Supplementary Material

Supplementary Table S1
Supplementary Table S2
Supplementary Data S1

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