Computational dosimetry in a pediatric iCAT procedure using a virtual antropomorphic phantom

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The craniofacial structure is three-dimensional, generating images overlapping in several scenarios. This makes it difficult to correctly view a given structure within such images [1]. In the 1970s, Computed Tomography was developed, which increased Radiology's results. Currently, it is the most commonly used test, even though being a high-cost procedure, leading to increased exposure to ionizing radiation [1]. As a consequence, studies in dosimetry are necessary, since it is fundamental to take into account that the germ located within the developing teeth is sensitive to the radiations, having several studies indicated it to be the possible responsible for Agenesis (a hypoplastic anomaly marked by the absence of one or more teeth) [2]. In addition, there are several other radiosensitive structures in the head and neck, such as thyroid, crystalline and salivary glands. There is an overall consensus regarding the exposure of pediatric patients to ionizing radiation, with recommendations being that the procedures must occur with the shortest exposure time as possible, and it is only prescribed when they are effectively necessary. During the procedures, radiation effects are difficult to be measured. The use of either TL or OSL dosimeters can create artifacts within the images, and the positioning of a large number of dosimeters, necessary for the correct dose evaluation, is not feasible when it comes to a pediatric patient. Because of this reason, the use of virtual anthropomorphic phantoms [3] became an important tool. Its use ensures accurate results, and does not require radioactive sources, minimizing any risk. Radiation doses can be determined in more than 140 organs and tissues, through its use. In the present work, a multidisciplinary study was carried out, grouping researchers from both Medical Physics and Dentistry, seeking to adjust the effective doses of radiation in iCAT, when used in children at the age of 10 with developing teeth. The results pointed out that the eye lens, salivary glands and thyroid received the highest doses.

Keywords: Monte Carlo simulation, iCAT, pediatric dosimetry

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