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Comparison of X-Ray Absorption in Mandibular Tissues and Polymeric Tissue-Equivalent Materials Using PHITS Monte Carlo Simulations

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Brief Report

X-ray absorption in mandibular tissues is a critical factor in diagnostic imaging and treatment planning in dentistry and maxillofacial applications. To improve the accuracy of simulations and experimental models, tissue-equivalent polymeric materials are often used as substitutes for biological tissues. This study aims to compare the X-ray absorption characteristics of mandibular tissues and these polymeric materials using PHITS Monte Carlo simulations. Monte Carlo simulations provide a detailed and precise approach to modeling X-ray interactions with matter. Using PHITS, we simulated X-ray absorption in mandibular tissues, including bone and soft tissue, and compared these with commonly used polymeric substitutes. The simulation incorporated realistic energy ranges relevant to dental radiography, taking into account tissue composition and density.

The results revealed that polymeric tissue-equivalent materials exhibit absorption properties that closely match those of actual mandibular tissues, particularly within the diagnostic X-ray energy range. However, slight variations were observed in the absorption coefficients, influenced by differences in elemental composition and density. These discrepancies highlight the importance of selecting the appropriate polymeric materials for specific applications to ensure accurate dosimetric and imaging outcomes. This comparison underscores the utility of Monte Carlo simulations in validating and optimizing tissue-equivalent materials for medical and dental applications. The findings provide valuable insights for developing more accurate models in radiological research and clinical practice. Further studies are recommended to explore the behavior of these materials under varying conditions and energy ranges to enhance their applicability. The integration of advanced simulation tools like PHITS offers a pathway for improving the precision of diagnostic imaging and therapeutic interventions in dentistry and beyond [1,2].

Keywords: X-ray absorption; Polymeric materials; Maxillofacial applications

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None.

Conflict of Interest

None.

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