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INPLASY

Use of Gray Scale Values in CBCT in Published Dental Research: A Literature Review

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ADMINISTRATIVE INFORMATION

Support - None.

Review Stage at time of this submission - Completed but not published.

Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 28 November 2025 and was last updated on 28 November 2025.

INTRODUCTION

Review question / Objective P : Patients or structures imaged in dental and maxillofacial CBCT scans, including bone, dental materials, and oral pathologies.
I: Use of cone-beam computed tomography (CBCT) gray values (GVs) for quantitative or semi-quantitative assessment.
C :Hounsfield units (HUs) from medical CT, other CBCT units/scanners, visual/morphologic assessment, known reference materials or histopathologic diagnosis.
O :Assessment of how CBCT GVs are used to: estimate bone density, evaluate dental materials, detect or characterize oral pathology, identify limitations and variability affecting accuracy.
S :Studies published from January 2010 to September 2025 including: observational studies, experimental/phantom studies, comparative imaging studies, systematic reviews.

Condition being studied The condition being studied is the reliability and diagnostic usefulness of CBCT gray values (GVs) in dental imaging. Specifically, it examines how GV variability affects the evaluation of bone density, dental materials, and oral pathologies.

METHODS

Search strategy A structured electronic search was conducted in PubMed and SciELO to identify full-text studies published between January 2010 and September 2025 that analyzed gray values (GVs) obtained from CBCT imaging. Search terms included combinations of “CBCT,” “gray scale,” “gray value,” “voxel value,” “bone density,” “dental materials,” and “oral pathology,” using Boolean operators AND/OR. Only English and Spanish articles meeting the inclusion criteria were selected for screening.

Participant or population The population of the study consists of CBCT scans used in dental and

maxillofacial imaging, including evaluations of bone, dental materials, and oral pathologies.

Intervention The intervention of the study is the use of cone-beam computed tomography (CBCT) gray values (GVs) as a quantitative or semi-quantitative tool. Specifically, the included studies apply GV analysis to assess bone density, dental materials, and oral pathologies.

Comparator Some studies in the review compare CBCT gray values GVs with other reference standards, like Hounsfield units (HUs), different CBCT machines, visual/morphological assessment, or histopathologic diagnosis.

Study designs to be included Structured literature review.

Eligibility criteria The eligibility criteria for this review included studies published between January 2010 and September 2025 that were available in full text and written in English or Spanish. To be included, studies had to analyze GVs obtained from CBCT imaging and apply GV assessment to at least one of the following areas: maxillary or mandibular bone density evaluation, dental material assessment, or the detection and characterization of oral pathology. Studies were excluded if they did not analyze GVs, letters, or opinion papers, or were duplicate publications or secondary analyses of previously included data.

Information sources PubMed and SciELO.

Main outcome(s) The main outcomes of the review were how CBCT GVs have been used in published dental research, specifically their effectiveness and limitations in evaluating bone density, assessing dental materials, and detecting or characterizing oral pathologies. The review also highlighted factors that affect their reliability and clinical usefulness.

Quality assessment / Risk of bias analysis This study did not perform a formal risk of bias or quality assessment, as it is a structured literature review.

Strategy of data synthesis The strategy for data synthesis in this review was descriptive and narrative. The included studies were grouped according to the three main areas of interest bone density evaluation, dental material assessment, and pathology characterization and their findings were summarized qualitatively. The review compared themes, trends, and limitations across studies to describe how CBCT GVs have been applied in dental research and to highlight factors influencing their reliability.

Subgroup analysis No subgroup analysis.

Sensitivity analysis No sensitivity analysis.

Country(ies) involved United States, Peru.

Keywords CBCT; gray value; voxel value; maxilla; mandible; bone density; dental materials; oral pathology.

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