



Analysis of permanent first molar crown dimensions in digital study models: cross-sectional study

Carolina Leite ¹  0009-0006-9495-8093
Viviana Macho ²  0000-0002-9936-2612
Cristina Cardoso Silva ^{2,3}  0000-0003-3757-596X
Rita Rodrigues ²  0000-0002-7640-6993

¹ Faculty of Health Sciences, Fernando Pessoa University, Porto, Portugal

² FP-I3ID, FP-BHS, Faculty of Health Sciences, Fernando Pessoa University, Porto, Portugal

³ CEISUC, Centre of Investigation in Technologies and Centre for Health Studies and Research of the University of Coimbra, Portugal

ARTICLE INFO

Received 29 April 2026
Accepted 06 July 2026

Keywords:

first permanent molars
dental dimensions
sexual dimorphism
permanent dentition

Corresponding Author:

Carolina Borges Oliveira Leite da Silva; Fernando Pessoa University - Faculty of Health Sciences, Porto, Portugal; 41301@ufp.edu.pt

DOI: 10.62741/ahrj.v3iSuppl.2.181

This article is licensed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License.

ABSTRACT

Introduction: The use of digital models obtained through intraoral scanners has been transforming dental morphometric analysis, providing fast, reliable, and non-invasive measurements.

Objectives: To assess the mesiodistal, buccolingual/palatal dimensions and crown height of permanent first molars in a group of children aged 7 to 13 years, using images obtained from intraoral scanners (iTero). To analyze whether there are significant differences in these measurements based on variables such as sexual dimorphism, right-left asymmetry within the dental arch, and differences between the maxillary and mandibular arches.

Methodology: A cross-sectional study was conducted using STL files obtained from intraoral scans of a convenience sample of 100 Portuguese children aged 7–13 years. Only erupted permanent first molars without restorations and developmental defects were included. The mesiodistal and buccolingual/palatal dimensions, as well as crown height, were measured on three-dimensional digital models using 3D Builder software. Statistical analyses were performed using SPSS software. All measurements were performed by a single examiner and independently verified by a second examiner.

Results: Significant sexual dimorphism was observed, with boys presenting significantly larger crown dimensions than girls in six of the nine variables assessed ($p < 0.05$). Homologous permanent first molars showed a high degree of bilateral symmetry, with no significant differences within the same dental arch. In contrast, significant differences were observed between the maxillary and mandibular arches for most crown dimensions ($p < 0.05$). Positive correlations of weak-to-moderate strength were identified between selected crown measurements. Most crown dimensions differed significantly between the two age groups.

Conclusion: This study contributes to a deeper understanding of the dimensions of permanent first molars in the pediatric population, highlighting relevant differences across sex, dental arches, and age groups, thereby supporting the optimization of clinical practice.

Contributions: Conceptualization: CLS and RR; Data curation: CLS and RR; Formal Analysis: CLS; Funding acquisition: not applicable; Investigation: CLS and RR; Methodology: CLS; Project administration: RR and CCS and VM; Resources: CRM and CCS; Software: not applicable; Supervision: RR and CCS; Validation: RR; Visualization: CLS; Writing – original draft: CLS; Writing – review & editing: RR.

Please cite this article as: Gonçalves JP, Macho V, Silva CC, Rodrigues R. Analysis of permanent first molar crown dimensions in digital study models: cross-sectional study. *Athena Health & Research Journal*. 2026; 3(Suppl. 2). doi: 10.62741/ahrj.v3iSuppl.2.181