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The Role of Augmented Reality in the Operating Microscope in Endodontics: an investigation

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ABSTRACT

Introduction: Augmented reality enhances visualization and procedural accuracy in dentistry. In endodontics, integrating augmented reality into operating microscopes creates new opportunities to support clinicians and improve dental education.
Objectives: This study aims to evaluate whether an augmented reality-integrated microscope enables inexperienced individuals to perform endodontic access cavities on artificial molars with a quality level comparable to that of a fifth-year dental student (control group).
Methodology: This experimental, single-blinded observational study included 50 participants without clinical experience (experimental group) and one trained dental student (control group). Ethical approval was obtained from the Ethics Committee of University Fernando Pessoa. Cavities were performed on artificial molars using a Leica operating microscope integrated with an augmented reality system supported by the Microscope Connect Application. The control student performed procedures for comparison and provided real-time and video guidance. Outcomes were blindly evaluated by an experienced endodontist using predefined criteria assessing cavity continuity, cavity size, cavity positioning, and canal visualization. Data were analyzed using the Shapiro-Wilk test and the Mann-Whitney U test.
Results: The experimental group achieved a median score of 23.9, compared with 24.2 in the control group. Statistical analysis revealed no significant differences between groups (p=0.377), indicating comparable performance quality of endodontic access cavities. Canal visualization was achieved in all procedures in the experimental group. Augmented reality guidance enabled standardized execution, resulting in high clinical compliance scores across both groups.
Conclusion: Augmented reality integrated into operating microscopes reduces the experience gap and ensures procedural quality, supporting its implementation in dental education.

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