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Issue **Article**

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RECENT ADVANCES IN THE USE OF PLASTINATED SPECIMENS IN ANATOMY EDUCATION: A NARRATIVE REVIEW

Abstract: *This narrative review examines published evidence (2010–2025) on the educational utility of plastinated specimens in anatomy teaching. Recent systematic review and meta-analysis (2024) and empirical studies (2019–2023) were included. Findings show plastination remains a valuable complementary tool. Students report positive perceptions; learning outcomes appear comparable to other modalities. Evidence does not support plastinates as superior to cadaveric dissection. High-quality comparative research remains limited.*

Key words: *Plastination, Anatomy Education, Medical Training, Cadaver, 3D Models, Teaching Methods.*

Language: *English*

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Introduction

Anatomy remains central to medical education and clinical training. Cadaveric dissection continues to be the gold standard for understanding structural relations and anatomical variation, and for developing psychomotor skills. Resource constraints, facility limitations, and increasing student numbers have driven the adoption of supplementary tools. Plastination replaces tissue fluids with polymer compounds to create durable, dry specimens, reducing chemical exposure, lowering maintenance requirements, and allowing repeated handling. Since 2018, additional empirical studies and systematic reviews have examined plastination's role. This review integrates those newer findings.

Methodology

Search Strategy Structured search of PubMed, Scopus, Web of Science, ERIC, CINAHL using terms: plastination, plastinated specimens, anatomy education, anatomy teaching. Search window: 2000–July 2022, supplemented with manual identification of 2023–2025 studies.

Inclusion Criteria - Peer-reviewed empirical studies or systematic reviews/meta-analyses - Published in English - Focus on educational use of plastinated specimens

Data Extraction and Analysis Extracted: authors, year, context, sample size, study design, comparison method, outcomes (perceptions, test scores, skills), key findings. Narrative synthesis due to heterogeneity.

Recent Evidence (2019–2025)

Systematic Review & Meta-Analysis (2024) - Compared plastinated specimens vs other instructional methods. No significant difference in post-test scores (SMD=0.08; 95% CI [-0.36, 0.52], p=0.73). - Qualitative analysis showed benefits: ease of use, improved spatial understanding, increased motivation, and preference in self-study.

Comparative Study vs 3D Models - Randomized crossover study: plastinated vs multicolor 3D-printed models for cardiac/neck anatomy. - Both improved knowledge (~30% from baseline); no significant difference in post-test scores.

Students' Perceptions and Humanistic Values - Validated instrument: plastinated specimens promoted realism, respect, and empathy. - 3D models preferred for conceptual learning and ease of use.

Use in Undergraduate Education (Saudi Context) - 268 medical students: plastinates preferred for feasibility, structural clarity, complex structures; cadavers preferred for clinical relevance.

Use in Veterinary Education - 58.4% of students found plastinated organs equivalent to formalin-fixed organs; 88% noted a lack of formaldehyde odor.

Use in Physical Therapy Curriculum (2025) - Improved anatomical understanding, visibility, and lower maintenance costs. - Drawbacks: less discovery and emotional connection than cadaver dissection.

Use in Musculoskeletal Injury Education - Plastinated injury models helped palpation and diagnostic skills; 95% found them useful for 3D learning.

Synthesis - Plastinated specimens provide durability, repeated usability, odorless handling, and clear structures. - Knowledge acquisition is comparable to cadavers, 3D models, or digital tools. - Qualitative data show plastinates maintain some realism and humanistic value. - Practical in hybrid or resource-limited curricula.

Discussion: Plastinated specimens address logistical challenges: cost, preservation, and maintenance. Applications: - Pre-lab orientation - Large-group sessions - Reference collections - Self-directed study - Hybrid curricula (medicine, physical therapy, veterinary) Limitations: Cannot replace cadaveric dissection for developing tactile skills, exploring anatomical variation, or surgical training. Learning outcomes are similar to other modalities; best used as complementary resources.

Recommendations for Lab Setup - Use plastinates for demonstration, reference, orientation, and repeated handling. - Maintain access to cadaveric specimens for tactile and dissection skills if feasible. - Integrate 3D-printed or digital tools for complex structures. - Include plastinates in hybrid teaching models. - Use validated instruments to assess perceptions, satisfaction, skills, and humanistic attitudes. - Periodically evaluate educational outcomes: knowledge retention, clinical relevance, skills performance.

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