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ECR 2026 / C-29441

Integrating Three-Dimensional Printing into Radiology Practice: Workflow, Performance, and Clinical Impact

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Purpose

To evaluate the feasibility, performance, and workflow integration of three-dimensional printing within a radiology department, assessing imaging acquisition parameters, segmentation software, printing technologies, material selection, costs, and staff perception across multiple anatomical regions [Fig 1].

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Methods and materials

Three-dimensional printing (3DP) is increasingly recognized as an extension of radiology, transforming volumetric imaging data into tangible, patient-specific anatomical models for clinical planning, education, and interdisciplinary communication. The accuracy and utility of these models are highly dependent on imaging quality, segmentation workflows, and printing technologies, positioning radiology departments as central hubs for medical 3DP. Despite growing interest, standardized workflows and evidence-based implementation strategies within radiology departments remain limited.[Fig 2] .[Fig 3]A retrospective analysis of 59 anonymized CT and MRI examinations across multiple anatomical regions was...

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Results

A total of 59 anonymized CT and MRI examinations were successfully converted into printable three-dimensional anatomical models, covering a wide range of anatomical regions including bone, vessels, nerves, soft organs, and hollow organs. This demonstrates the technical feasibility and reproducibility of integrating 3D printing into routine radiology workflows.Imaging PerformanceComputed tomography (CT) was identified as the most suitable modality for osseous and calcified structures, with thin slice thickness (≤1 mm) and high matrix resolution (≥512×512) receiving the highest suitability ratings (mean scores ≈ 4.8 and 4.6,...

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Conclusion

This study demonstrates that three-dimensional printing is a feasible, scalable, and clinically valuable extension of radiological practice when integrated into a structured workflow led by the radiology department. Optimized CT and MRI acquisition protocols —particularly thin-slice CT and isotropic volumetric MRI—are critical for achieving accurate segmentation and high-fidelity anatomical models.Both open-source and commercial segmentation platforms were capable of producing reliable printable models, with open-source solutions offering a cost-effective alternative when supported by structured training. Fused deposition modelling (FDM) using affordable polymers enables routine implementation for educational...

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Personal information and conflict of interest

J. Pinheiro: Nothing to disclose L. P. V. Ribeiro: Nothing to disclose A. D. M. Ribeiro: Nothing to disclose H. Boeiro: Nothing to disclose E. Seiça: Nothing to disclose M. Gonçalves: Nothing to disclose R. Gonçalves: Nothing to disclose L. Luz: Nothing to disclose J. Paulo Sousa: Nothing to disclose

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Kim GB, Lee S, Kim H, Yang DH, Kim YH, Kyung YS, et al. Three-dimensional printing: Basic principles and applications in medicine and radiology. Korean J Radiol. 2016;17(2):182–197. doi:10.3348/kjr.2016.17.2.182. Mitsouras D, Liacouras P, Imanzadeh A, Giannopoulos AA, Cai T, Kumamaru KK, et al. Medical 3D printing for the radiologist. Radiographics. 2015;35(7):1965–1988. doi:10.1148/rg.2015140320. Rengier F, Mehndiratta A, von Tengg-Kobligk H, Zechmann CM, Unterhinninghofen R, Kauczor HU, et al. 3D printing based on imaging data: Review of medical applications. Radiographics. 2010;30(4):1221–1232. doi:10.1148/rg.304075020. Haleem A, Javaid M, Suman...

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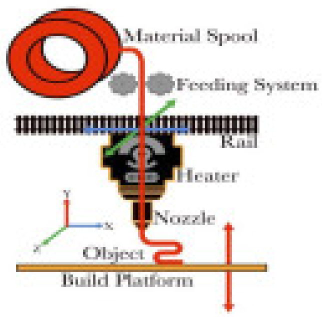

Fig 1: *Printer schematics*

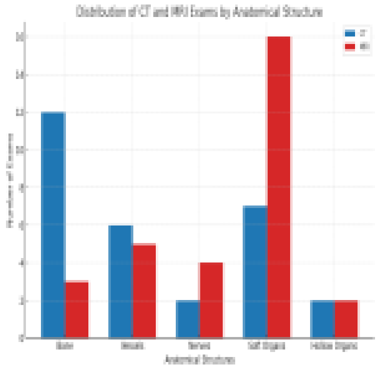

Fig 2: *Exam distribution*

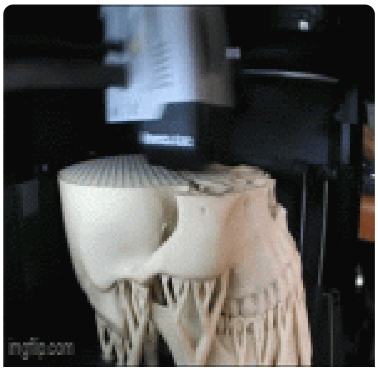

Fig 3: *Skull Printing*

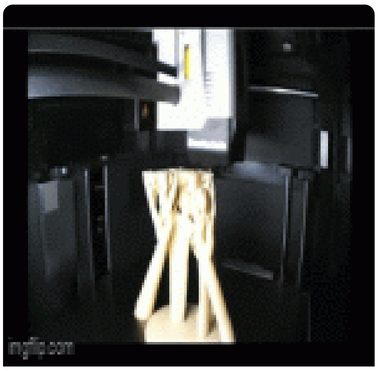

Fig 4: *Wrist with fracture*

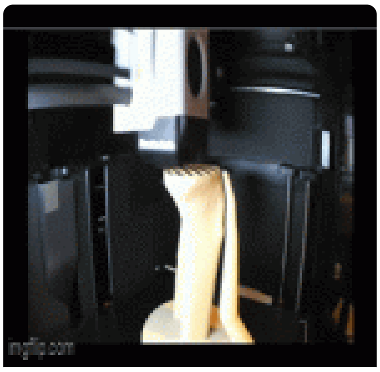

Fig 5: *Knee Printing*

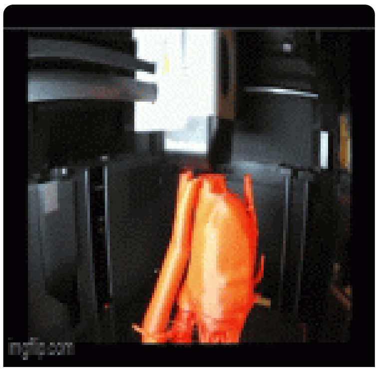

Fig 6: *Abdominal Aortic Aneurism Printing*

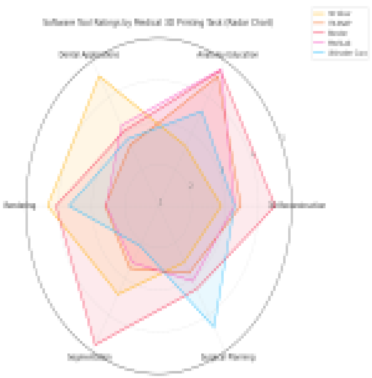

Fig 12: *Software Rating*

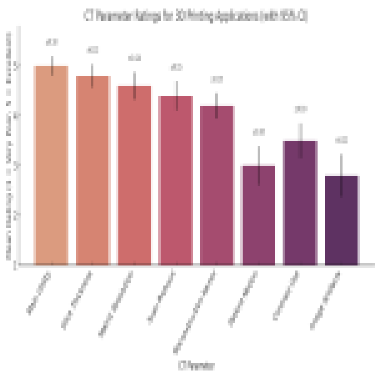

Fig 13: *CT Parameters according to influence on 3D print.*

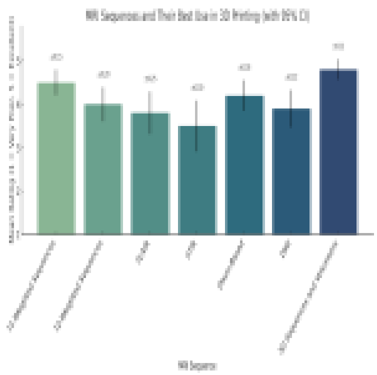

Fig 14: *MR Parameters according to influence on 3D print.*

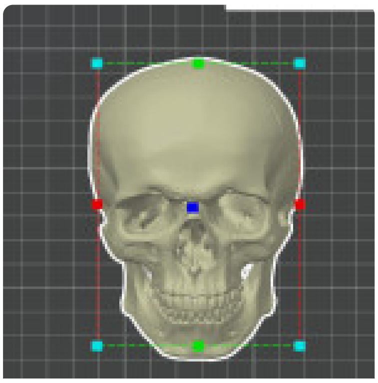

Fig 7: *Segmentation and printing preparation example (Skull)*

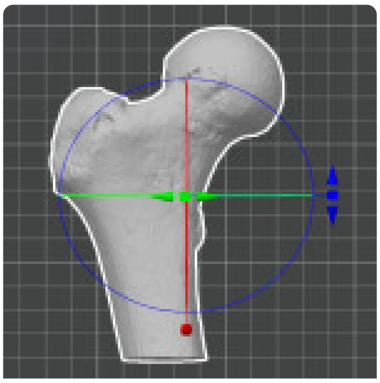

Fig 8: *Segmentation and printing preparation example (Proximal Femur)*

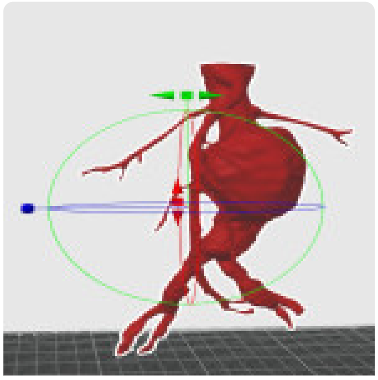

Fig 9: *Segmentation and printing preparation example (Aortic Aneurism)*

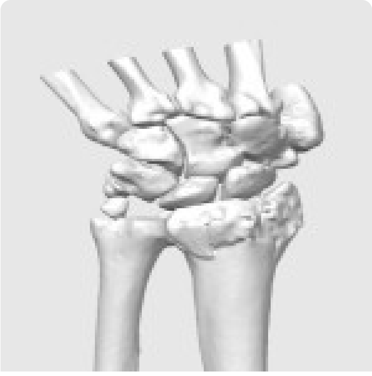

Fig 10: *Segmentation and printing preparation example (Wrist)*

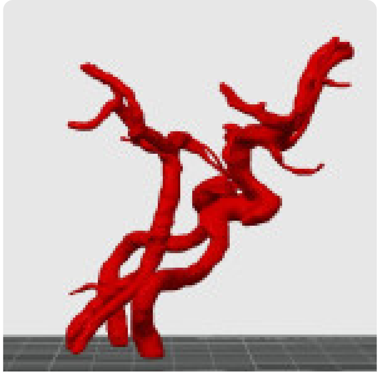

Fig 11: *Segmentation and printing preparation example (P.Willis)*