

Practical Use of a Three Dimensional Online Training Platform for Residents and Fellows in Transcranial and Endonasal Skull Base Approaches



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Introduction

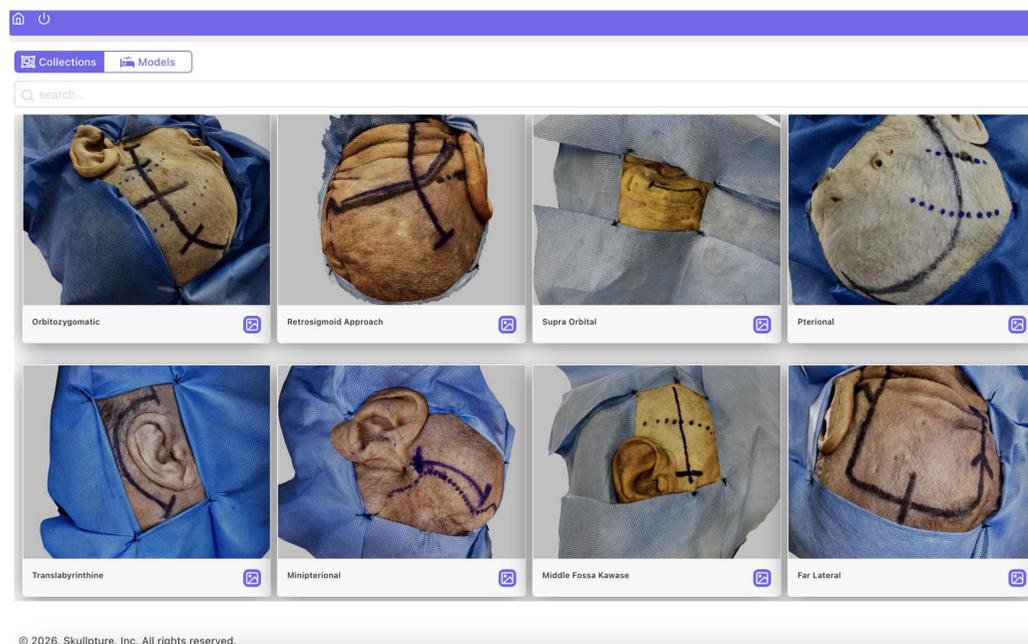
The skull base is among the most anatomically complex regions in the human body, containing critical neurovascular structures and requiring surgical execution through narrow corridors. Mastery of both transcranial and endonasal skull base approaches depends on a detailed understanding of three-dimensional anatomical relationships and the ability to conceptualize stepwise surgical technique. Despite the importance of these skills, skull base approaches are often underrepresented in residency and fellowship training due to time limitations, limited access to cadaveric laboratories, and the logistical challenges of providing consistent, reproducible educational experiences. While cadaveric dissection remains the gold standard for hands-on learning, increasing restrictions in availability and cost have driven interest in alternative educational tools. In this context, interactive 3D digital platforms may provide scalable, reproducible, on-demand training opportunities.

Methods

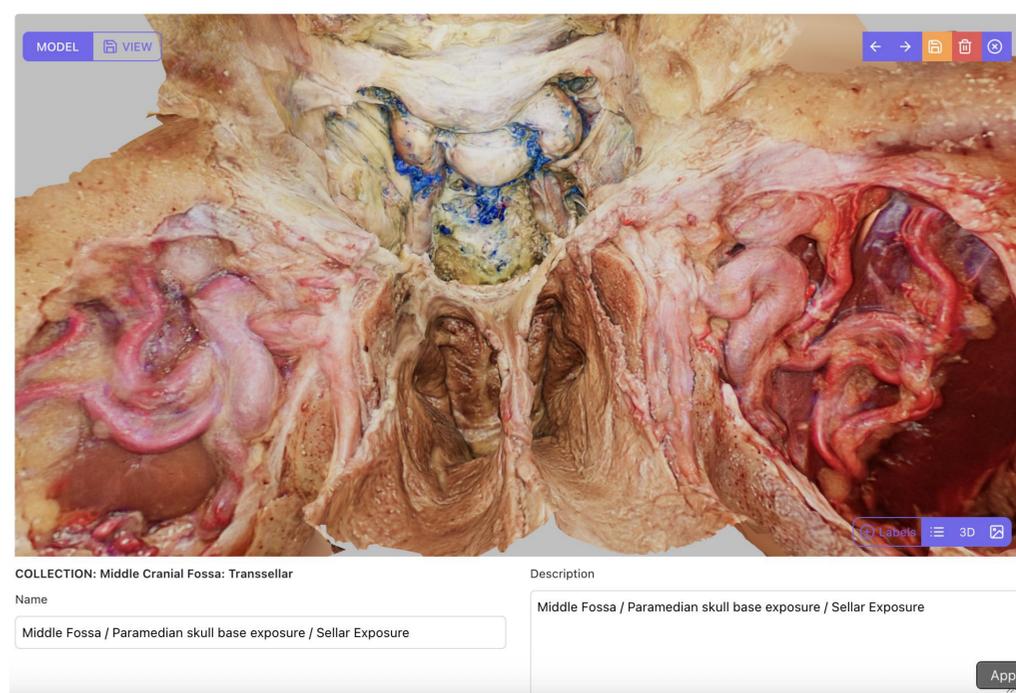
Cadaveric dissections were performed in the ALT-VISION laboratory to illustrate major transcranial and endonasal skull base approaches. These dissections were recorded, reconstructed into high-fidelity three-dimensional models, and integrated into an interactive online platform (<https://skulpture.mycarejs.com>). The platform includes anatomical labeling and stepwise visualization designed to reinforce surgical flow and approach planning. Pilot testing was conducted with neurosurgery and otolaryngology residents and fellows, with structured feedback collected using the Michigan Standard Simulation Experience Scale (MiSSES), focusing on usability, realism, and educational value. Pre- and post-use assessments were planned to evaluate changes in anatomical knowledge and procedural confidence. Data collection and analysis remain ongoing.

Results

Initial feedback from 17 residents and fellows across both specialties was strongly positive. Participants reported improved understanding of skull base anatomy, greater clarity regarding stepwise surgical technique, and increased confidence in approach planning. Interactive platform features, particularly toggleable anatomical labels and sequential visualization of procedural flow, were frequently identified as valuable for independent learning and repeated review. Although early qualitative feedback has been encouraging, structured evaluation and knowledge assessment data collection remain in progress.



Example of available Surgical approaches.



Example of 3D View of Endonasal Approach.

Conclusion

Early experience suggests that an immersive three-dimensional online skull base training platform is feasible and provides meaningful educational value for neurosurgical and otolaryngology trainees. Formal validation is underway to determine its long-term role as an adjunct to traditional training and its impact on preparedness for complex skull base procedures. While the platform does not replace cadaveric laboratory experience, it may be particularly valuable for training programs without access to cadaveric dissection laboratories and in settings where financial and logistical barriers limit hands-on skull base education.