The Craniosynostosis Puzzle: New Simulation Model for Neurosurgical Training

João Paulo Mota Telles, Gisele Coelho, Nicollas Nunes Rabelo, Lina Adani, Dario Cecilio-Fernandes, Fabiano Carvalho, Fernando Gomes Pinto, Nelci Zanon, Manoel J Teixeira, Eberval Gadelha Figueiredo
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I acknowledge my continuing obligation to disclose to AANS/NREF/NPA, promptly and in writing, any change in my circumstances. I further acknowledge that if there is any case where my private interest conflict with the interests of AANS/NREF/NPA, I will indicate that I may have a conflict and abstain from any vote, speaking engagement, planning related to that issue.
Neurosurgical training requires long hours on hands-on procedures, making it difficult for the inexperienced surgeons to learn quickly and in an error-proof environment. Objective: To propose a new model for neurosurgical education, a puzzle that simulates craniosynostosis correction (scaphocephaly type) using Renier’s H technique. A model of an 3D anatomical simulator for craniosynostosis training will be presented and evaluated.
Methods

The cranial model was created using 1-mm CT scan images from patients with scaphocephaly in the DICOM format. This information was processed using an algorithm to generate a three-dimensional (3D) biomodel in resin. The puzzle and its variable training model were assessed qualitatively by a team of expert neurosurgeons. Next, the model was applied in residency training and was assessed using specific questionnaires.
Experts and trainees evaluated the model. The mean of attempts without errors was 2.3 (SD:0.675), for one error was 2.2(SD:0.918) and for two errors 1.3 (SD 0.707). The mean of the score of the simulator was 9.2 (SD:0.421). Twelve residents (second evaluation) answered the questionnaire with positive evaluation of diagnosis capabilities, appropriateness of the model, time commitment, adequate environment, reliable 3D reconstruction and teaching method. Participants average of using 3D simulator was 1.5, and the note given to the simulator was averaging 9.9.
Results
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Conclusions and Summary Points

- The puzzle can be a complementary tool for surgical training.
- It allows several degrees of immersion and realism, offering symbolic, geometric and dynamic information, with 3D visualization.
- It provides additional data to support the practice of complex surgical procedures without exposing real patients to undue risk.