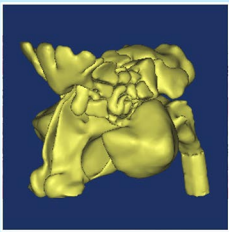




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Computationally Rendered Model
of Nasal Airway and Sinuses

Variation in Nasal Morphology Affects Particle Deposition and Air Conditioning

Pharmaceuticals delivered via nasal spray have only generic use instructions. Because topical drug delivery varies with sprayer position and nasal anatomy, ethnic-based study of nasal spray delivery will provide important information on how drugs can best be administered in the future. Additionally, it is not known what features of nasal morphology contributes most significantly to humidification. We hypothesized that nasal morphology affects spray particle deposition to the sinuses and air conditioning in the nasal passage. To test this hypothesis, we created 3D reconstructions of the nasal passageway of 16 patients: 2 males and 2 females for each of the following four ethnicities: Caucasian, African American, Latino/Hispanic, and Asian American. ICEM was used to modify the 3D renditions created from CT scans using Mimics software. Then particle simulation and water vapor and heat simulations were carried out in Fluent computationally, and analyzed using Fieldview. To quantify humidification, we calculated the mass fraction of water vapor as a function of distance into the nose. We found no difference among ethnic groups for humidification of inspired air across the whole nose until the back of the septum. Our data suggest that it is possible localized differences in humidification result from position of the inferior turbinate in the nasal cavity. The graphical representation of our results revealed that there are distinct trends between and within ethnic groups. When reorganized by gender we did not see a consistent trend. However, we will next consider if the upsurge in water vapor mass fraction corresponds to a specific anatomical feature. Our results will provide new insights into the optimal delivery of drug via the nose, and may suggest treatments of nasal dysfunction. Overall, they may shed new light on evolutionary pressures arising from different geographical areas of origin.