Application of surface mapping to visualize wall shear stress and particle deposition in realistic human nasal cavities

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Nasal cavity is an important component of respiration system for the various physiological functions (Elad et al., 2008; Lee, 2010). Due to its complicated geometry, flow patterns are difficult to visualize inside 3D spaces. By adopting the ISOMAP algorithm (Tenenbaum et al., 2000) implemented in Matlab, the surface of a nasal cavity, together with characteristic lines serving as visual markers were unwrapped into a normalized *uv*-domain (where u and v are coordinates of a 2D space) to present a complete view of an entire wrapped surface, therefore to be analyzed with better precision and to allow direct comparisons among different nasal cavities.

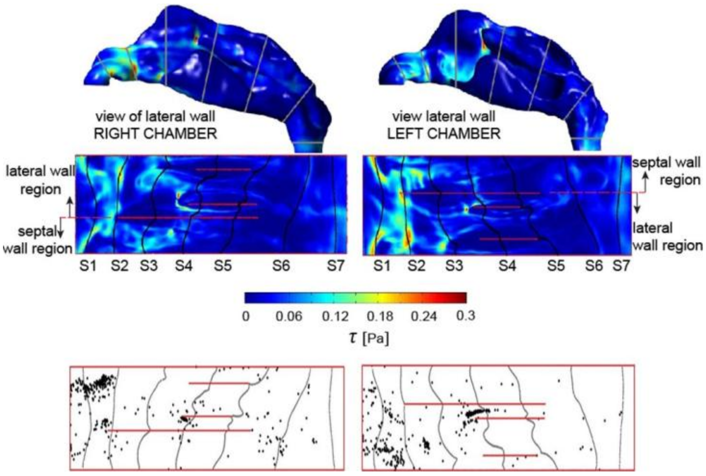

Figure 1.WSS distributions and particle deposition patterns across left and right chambers.

Pressure distribution, wall shear stress (WSS) distribution and concentration of particle deposition during steady laminar inhalation were projected to the *uv*-domain. According to the unwrapped image, high resistance regions showed in the left nasal chamber are susceptible to impediment to flow. High WSS observed in high curvature regions lead to undesirable mechano-physical responses in the epithelium cells. Particle deposition patterns indicate the likelihood of toxicology responses to inhaled particles.

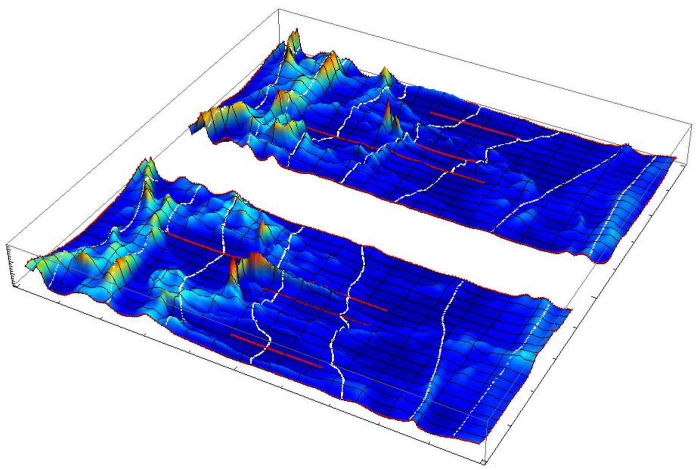

Figure 2.Peaks indicate high WSS leading to undesirable mechano-physical responses in the epithelium cells.

Keywords: nasal cavity, *uv*-mapping, CFD

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