Using Computational Fluid Dynamics to Model Functional Outcomes of Rhinoplasty in ENT Surgeries

Dr. Rajesh Bhaskaran
Collaboration with: SUNY-Upstate Otolaryngology, Drs Kellman and Villwock

Nasal airway obstruction (NAO) is a common condition leading to a poor quality of life. A variety of surgical therapies such as Rhinoplasty have been developed to ameliorate this condition. Unfortunately, between 25-50% of current patients will ultimately be unsatisfied with their surgical results. Part of the problem is a current inability to reliably correlate subjective and objective measures of NAO. While tools such as acoustic rhinometry have been used to objectively assess the airway, they have not been found useful for pre-operative planning. More recently, computational fluid dynamics (CFD), in combination with anatomically accurate 3D CAT scan and MRI data, has been used to study nasal airflow and resistance with some success.

The objective of this research is to use the ANSYS FLUENT CFD software to better predict the functional outcome of rhinoplasty and aid in selection of the best possible surgical procedure based on a patient’s individual anatomy. 3D meshes created from CAT scans and MRI data will be deformed in ANSYS FLUENT to mimic surgical changes. CFD simulations will then be run to model aspects of the nasal airway post this “virtual surgery.”

In addition to virtual surgery using CFD, Drs Kellman and Villwock will be performing actual surgery on cadavers. Since cadavers do not heal and post-surgical scarring is a non-issue, multiple surgical procedures – from least invasive to most invasive – will be performed on the same specimen. CAT scans will be obtained pre- and post-surgery. CFD will again be used to model changes in the nasal airway. We will also correlate CFD data with objective data from the cadavers using acoustic rhinometry and/or rhinomanometry.