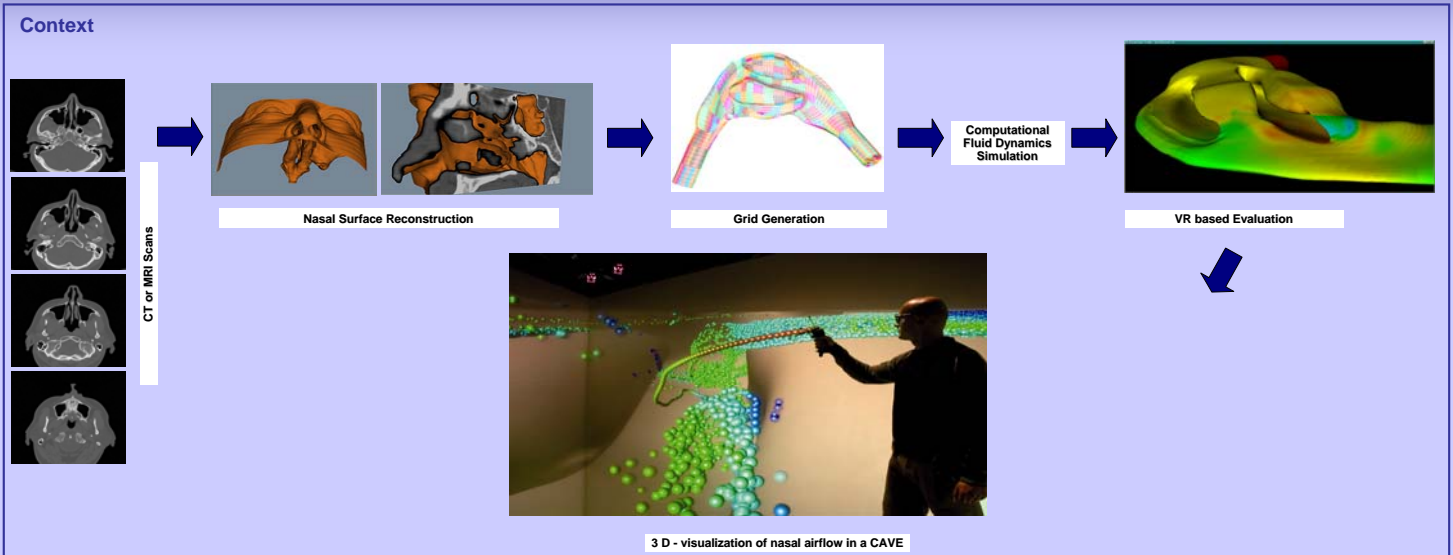


3D-MRI-visualization of nasal allergen challenge with and without Mometasone furoate nasal spray

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Study Purpose

In this study nasal allergen challenge tests have been performed with high resolution MR-imaging of the head, as a basis for 3D-visualization of the spatial distribution of mucosal swelling in the nasal cavity. The purpose of this investigation was to document the protective effect of Mometasone furoate nasal spray (MFNS) on exposure to allergens.

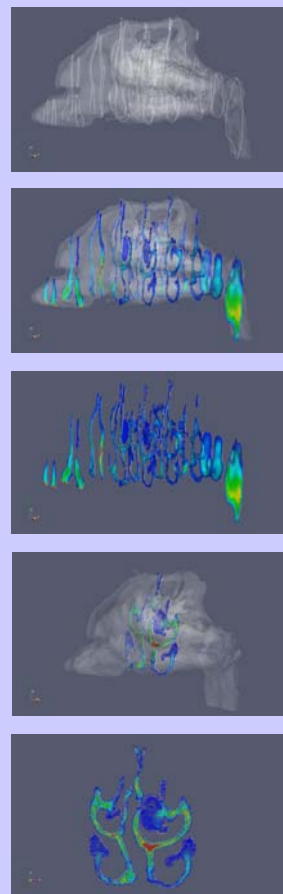
Methodes

One subject with a history of allergic rhinitis proven by skin prick tests and specific IgE underwent nasal challenge tests¹ before and after two weeks of treatment with MFNS, two puffs per nostril OD. Both tests were conducted during the symptom free winter season, however a "minimal persistent inflammation" could be assumed. MR-imaging was used to capture, visualize and process the geometrical data of the nasal cavity immediately following the challenge tests. Additionally, a baseline MRI was conducted without prior allergen provocation. The MRI-data was finally transformed into CFD-models in order to compute the nasal air flow. The results of the CFD model i.e. the streamlines and the pressure distributions of the associated flows were visualized in 3D.^{2,3,4} Rhinomanometry and acoustic rhinometry were used to validate the results.

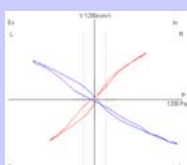
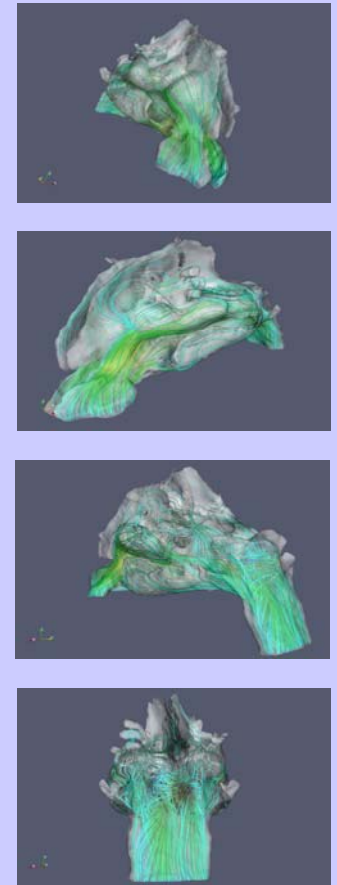
Results

At baseline the nasal airflow, as calculated from the CFD-model and measured by rhinomanometry, was within the normal range. 20 minutes after the first allergen challenge nasal symptoms were pronounced with a significant reduction of the nasal flow of 35% of the baseline value due to a widespread mucosal swelling in the nasal cavity, as documented in the 3D-MRI-model. After 14 days of treatment with MFNS, the baseline nasal flow was again within the normal range and decreased only slightly by 18% of the baseline flow after allergen challenge. This can be attributed to the anti-inflammatory effect of MFNS that prevents the nasal mucosa from swelling, even after provocation with high local allergen concentrations. The spatial distribution of mucosal thickness documented by MRI-data shows that this anti-obstructive effect is not limited to areas which had been directly exposed to the spray.

Pressure distribution in the nasal cavity

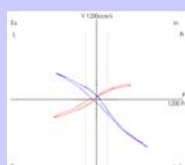


Nasal airflow in 3D- model



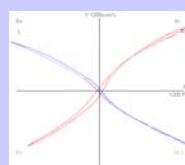
Baseline rhinomanometry

Flow at 150 Pa: 385 ml/s



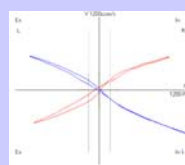
Rhinomanometry after allergen challenge

Flow at 150 Pa: 252 ml/s
Reduction: 35%



Baseline rhinomanometry after 14 days of treatment

Flow at 150 Pa: 393 ml/s



All challenge rhinomanometry after 14 days of treatment

Flow at 150 Pa: 324 ml/s
Reduction: 18%



Cross sectional MRI - reconstruction of congested nose (left) and uncongested nose (right)

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