Comparative Analysis between Intranasal Volume and Olfactory Function Using 3-D Reconstruction of PNS CT; Focus on the Airway around the Turbinates

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Objectives
To identify the relationship between the volumes around the turbinates and olfactory function.

Methods
32 nostrils of 16 patients, waiting for septal surgery, aged from 18 to 65 (15 men and 1 woman), were studied that had no history of head trauma, septal or sinus surgery and allergy, and no upper respiratory infection. PNS HRCT scans were reconstructed to 3-D images with V-works software. Volumetric boundaries for imaginary air pathways were set up using septum, each turbinate and the floor and the roof of nasal cavity. According to these boundaries, Volsup, Volmid, Voltot were defined (Fig.1, Fig.2, and Fig.3). Additionally, Volmidsup, Voltotalsup and Voltotmid were calculated (Volmidsup = Volmid - Volsup, Voltotalsup = Voltot - Volsup, and Voltotmid = Voltot - Volmid). Acoustic rhinometry was checked for evaluation of nasal obstruction and nasal valve area was measured by reformatted cross sectional image orthogonal to imaginary air pathway at the anterior end of inferior turbinate (Fig.4). Butanol test and CC-SIT were done for evaluation of nasal air pathway at the anterior end of inferior turbinate (Fig.4). Nasal cavity was subdivided into 22 segments and significant correlations was described between some anterior segments and olfactory function (Damm et al., 2002). But, we focused the spaces around the turbinates which might more influence the olfactory function than the others and more per-fectly calculated the volumes of the spaces by means of 3-D reconstruction software. Results of our study show that cer-tain volumes around the turbinates are significantly correlated with olfactory threshold. From this, we can think that the spaces around the turbinates are more important for olfactory function than the others. Unlike the results of Damm’s study, the volumes around inferior turbinate and nasal valve are not significantly correlated with olfactory threshold. Unlike olfactory threshold, olfactory identification is not signifi-cantly correlated with each volume. One possible explanation may be that nasal airflow has a weaker impact on higher olfactory functions such as odor discrimination (Hummel et al., 1991).

Results
Olfactory threshold was significantly correlated with each volume except for Volmidsup (Fig.5, Fig.6, Fig.7, Fig.8, Fig.9, and Fig.10). However, no significant correlation was found between each volume and olfactory identification. Volume of nasal valve area was not significantly correlated with olfactory threshold and identification.

Discussion
Already, nasal cavity was subdivided into 22 segments and significant correlations was described between some anterior segments and olfactory function (Damm et al., 2002). But, we focused the spaces around the turbinates which might more influence the olfactory function than the others and more per-fectly calculated the volumes of the spaces by means of 3-D reconstruction software. Results of our study show that cer-tain volumes around the turbinates are significantly correlated with olfactory threshold. From this, we can think that the spaces around the turbinates are more important for olfactory function than the others. Unlike the results of Damm’s study, the volumes around inferior turbinate and nasal valve are not significantly correlated with olfactory threshold. Unlike olfactory threshold, olfactory identification is not signifi-cantly correlated with each volume. One possible explanation may be that nasal airflow has a weaker impact on higher olfactory functions such as odor discrimination (Hummel et al., 1991).

Conclusions
The spaces around the turbinates are closely associated with olfactory function. So, in the septal, turbinate or sinus surgery, the correction of pathology and the conservation of normal structures in these spaces may influence olfactory function. In the future, we should study the correlation between volumetric changes of these spaces and the changes of olfactory function.