

## Abstracts

### **Correlation between self estimation, score of identification and results of active anterior rhinomanometry**

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Nasal congestion and loss of smell are important symptoms in many diseases of the upper airways. The aim of this study was to investigate the relationship between olfaction and nasal flow as determined by active anterior rhinomanometry (AAR) in patients with septum deviation.

One hundred patients with nasal septal deviation were included in this series. Measurements were performed preoperatively of septoplasty. Patients' histories and self estimation of smelling ability were documented from 1 to 4 points (1 normosmia, 2 hyposmia, 3 anosmia, 4 hyperosmia) with questionnaires. Olfactory identification ability was tested using 16 item smell identification subtest of sniffin` sticks test battery, the unilateral flow with 150 Pa was recorded by AAR. Statistical analyses was done using Spearman's correlation test.

Results: There were no correlation between smell identification test score and unilateral AAR score, bilateral AAR test score and AAR score of the worst side. We found a weak but significant correlation between olfactory self estimation and smell identification test score.

### **Diagnosis and treatment of olfactory disorders in German speaking countries**

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*Introduction:* Olfactory disorders are common, but epidemiological and therapeutical data lacking in the current literature. The aim of this study was to evaluate the current numbers of patients with olfactory dysfunction, their causes, and the diagnostic and therapeutic methods applied of ENT departments in German-speaking countries.

*Methods:* In a survey on smell disorders 2010, all ENT departments in Germany, Austria and Switzerland were contacted. By using a two-page questionnaire, data of the number of patients with olfactory disorders, their underlying causes and the treatments were surveyed. The data were analyzed descriptively and compared with the results of a previous survey in 2000.

*Results:* The return rate of questionnaires was 66% in Germany, 74% in Austria and 100% in Switzerland, respectively. On average, 25 patients were treated per ENT department per month with olfactory disorders. As most common causes for olfactory dysfunction were stated sinonasale diseases with 68% and post-viral smell loss with 12%. The Sniffin`Sticks-test was applied most commonly for olfactory testing (85%); 15% used the so called "Börnstein smell test", and 5% applied either the smell diskettes (Zurich ~) or the smell-powders. Overall, Steroids were used as preferred pharmacological treatment, applied nasally by 83% or systemically by 78% of surveyed ENT departments. The duration of steroid treatment varied for the local application from 2 weeks to one year, and for the systemic administration from 4 to 56 days, respectively. About 20% of respondents used antibiotics, vitamin B complex for the treatment of various olfactory disorders. Smell training was applied by over 30% of ENT departments. In contrast, acupuncture was used only occasionally. Over 80% of hospitals perform surgical procedures (e.g. septoplasty, turbinectomy, functional endoscopic sinus surgery) to treat the underlying sinonasal pathology.

*Discussion:* A total of 67.500 patients with olfactory dysfunction were treated per year in ENT departments of Germany, Austria and Switzerland. Olfactory dysfunction is induced most frequently by sinonasal diseases. The current treatment strategies are poorly standardized.

**Assessment and Evaluation of Smell Disturbance caused by industrial plants**  
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According to the The German Federal Immission Control Law (Bundes-Immissionsschutzgesetz) a substantial odor annoyance is prohibited. This issue has an increasing relevance to get a governmental permission for running some factories. Some regulations like The German Technical Instructions for Clean Air (TA Luft) and The Guideline for Odor Immissions (Geruchsimmissions-Richtlinie) are used to measure or calculate odor immissions and to distinguish between substantial and insubstantial annoyance. A few technical guidelines for the measurement of odors exist. A short overview to this special German system of assessment and evaluation is given.

**Neuroanatomical correlates of olfactory performance.**

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We investigated associations between olfactory function and gray matter thickness in 46 healthy young subjects by means of an automated technique for measuring cortical thickness. We used an extended version of the Sniffin' Sticks test to assess olfactory function, including odor threshold, concentration discrimination, quality discrimination, and odor identification. We observed a correlation between olfactory performance and cortical thickness of structures involved in earlier and later stages of chemosensory processing such as right medial orbitofrontal cortex, right insula, and adjacent cortex. Furthermore, we found significant bilateral correlations of olfactory performance with cortical thickness of areas around the central sulcus bilaterally, structures responsible for voluntary respiration and sniffing. In addition to expected general sex effects on cortical thickness, we observed areas, such as the entorhinal cortex, occipital cortex, intraparietal sulcus and insula (all in the right hemisphere), where the correlation between higher order olfactory functions and cortical thickness differed between women and men. These data demonstrate, for some neuroanatomical structures, a link between cortical thickness and olfactory function, in that thicker cortex is usually associated with better performance, but not always. This association between anatomy and olfactory performance suggests a possible biological explanation for the high degree of individual differences and sex effects observed in higher order olfactory tasks.

**Mono- and birhinal stimulation of the nasal cavity**

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The central nervous processing of olfactory and chemosomatosensory stimuli to the olfactory system has been subject to many studies. But only few studies investigated differences in the processing between monorhinal and birhinal stimulation. The present investigation aimed to look at the integration of birhinal olfactory and chemosomatosensory stimuli in the central nervous olfactory system and how intensity, lateralisation as well as parameters of olfactory and chemosensory event-related potentials (ERP) differ from monorhinal stimulation.

Thirty-four healthy subjects participated in the study. Olfactory function was tested using "Sniffin' Sticks" tests. Handedness was obtained using the Edinburgh Inventory. ERP to the olfactory stimulant phenyl ethylalcohol and the chemosomatosensory stimulant CO<sub>2</sub> were recorded. Stimuli were present in 7 classes with different concentrations to either the left or right nostril or to both nostrils simultaneously.

The values for the lateralization of chemosensory perception match results from previous work, in that olfactory stimuli cannot be localized while it was possible to localize trigeminal stimuli. For the perception of birhinal olfactory stimuli a super additive effect was found in comparison to monorhinal olfactory stimulation. These effects were found for both the psychophysical data as well as in the electrophysical data.

### **Treatment of olfactory dysfunction via pulsed-pressure corticosteroid inhalation** **Önder Göktas, Larissa Lau, Franca Fleiner**

Olfactory dysfunction (OD) is frequent in humans, with about 5% of people suffering from anosmia and about 19.1% of an OD in general. OD can be of sinusal aetiology due to mechanical obstruction and altered intranasal air flow. In German-speaking countries, 72% of patients treated with OD have a sinusal aetiology. The aim of this investigation was to evaluate the benefit of a topical corticosteroid treatment via pressure-pulsed inhalation in comparison to the benefit of the well established and efficacy-proven systemic corticosteroid treatment in the therapy of OD of sinusal aetiology. 16 patients received topical corticosteroid pressure-pulsed inhalation and 15 receiving systemic corticosteroid. Both treatments were comparable with regard to their participants' age, distribution of gender and aetiology.

*Local treatment:* After initial intervention, Olfactory function (OF) increased from 17.4 ±9.4 to 19.2 ±9.3 TDI points (p=0.44). During the follow-up period, OF decreased again to 16.63 ±8.6 after 2 months and to 16.30 ±9.7 after 6 months.

*Systemic treatment:* OF increased from a mean TDI score of 17.37 ±9.4 to 19.23 ±9.3 points (p=0.44) after initial intervention. After 2 months of follow-up period, the mean TDI score increased to 21.04 ±10.0 points (p=0.09) and after 6 months, it changed to 18.5 ±8.1 points (p=0.06).

Since OF decreased 2 months after the end of topical corticosteroid treatment via pressure-pulsed inhalation, it would be advisable to repeat treatment after 2 months in order to maintain OF. This should be further investigated in a two-center investigation (Dresden-Berlin).

### **Taste function after stapes surgery - a prospective study**

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*Background:* During the surgical therapy of stapes ankylosis, a manipulation of chorda tympani nerve (CTN) is necessary. The aim of this prospective study was to assess the gustatory sensitivity before and after stapedotomy depending on the degree of intraoperative

manipulation of the chorda tympani and the postoperative treatment with corticosteroids. Age and sex-related normative values of the taste function were considered for evaluation.

*Methods:* 17 patients with isolated unilateral stapes footplate ankylosis were included. Patients who underwent tonsillectomy, operation of third molar or middle ear surgery of the contralateral ear were excluded. 13 females and 4 males were included (age range from 30 to 62 years;  $45 \pm 10$  years). Taste and olfactory function was measured 1 day before stapes surgery, 3 days, and 3 months after surgery. Besides a questionnaire, regional chemical taste tests (liquid solutions and electrogustometry), and Sniffin' Sticks olfactory tests were used. Age and sex-related normative data exist for both, chemical taste tests with liquid solutions, and for the Sniffin' Sticks test.

In order to protect the inner ear function, 9 of 17 patients were intravenously treated with 1 g cortisone for 3 days. The degree of intraoperative CTN manipulation was considered.

*Results:* 16 of the 17 patients revealed preoperative age and sex-related normative values for the taste function on both sides. In 5 patients higher gustatory thresholds were found on the ipsilateral 2/3 of the anterior tongue (chemical taste test) 3 days after surgery ( $p < 0,05$ ). Taste qualities "sour" and "salty" were most affected. Electrogustometric thresholds were elevated in 10 of 17 patients. The factors "cortisone medication" and "manipulation of CTN" did not have a significant effect on the postoperative gustatory measures ( $p > 0,05$ ).

*Conclusion:* Despite an intraoperative CTN protection during stapes surgery, regional taste disturbances can be measured on 2/3 of the ipsilateral tongue side. Most patients did not notice the taste disturbances. If so, patients indicated numbness on the tongue and/or a metallic taste. The recommendation to preserve the CTN instead of cutting the nerve during surgery results from the small incidence of regional taste disturbance after stapes surgery in which the CTN was protected and preserved.

### **The impact of traumatic brain injury on olfactory function**

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*Background:* Traumatic brain injury (TBI) can cause damage to the olfactory signal pathway and result in olfactory loss. *Methods:* The aim was to determine the prevalence of olfactory loss among 81 patients who were hospitalized because of TBI. *Results:* 60, 17, and 4 patients had TBI of I°, II°, and III°, respectively. Olfactory function was significantly better ( $p < 0.001$ ) in patients with TBI I° compared to individuals with TBI II° and III°. The main site of the impact of the trauma (frontal, occipital, to the vertex or temporal) did not show a significant impact on odor identification or on odor threshold in the studied patients. In conclusion, patients with TBI I° have an 18% chance to exhibit smell loss, whereas this figure is 57% in patients with TBI II° and III°.

### **Coping with isolated congenital anosmia**

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Isolated congenital anosmia (ICA) is characterized by the lack of the sense of smell since birth in otherwise healthy people. Although this phenomenon is known among clinicians, there is only little knowledge about how these people cope with this serious handicap.

Questionnaires of 32 patients with ICA (aged 18-46 years) were analyzed. ICA was diagnosed using detailed medical history, psychophysical examination, electrophysical measurements, and magnetic resonance imaging. Forty healthy participants (aged 18-57 years) served as controls.

The smell disorder was noted first at the age of 11 years; mean age at the medical diagnosis was 20 years. About one-third of the patients avoid talking about the disorder. If they could, many of them would like to smell food (35%), perfume (23%), their spouse (16%), or "nature" (12%). Both groups did not differ significantly in weight, height, Body Mass Index, or eating behavior. However, almost all of the controls named preferred food with only one component, while ICA-patients significantly more often named preferred food with more than one component. ICA-patients reported more household accidents than healthy controls. ICA-patients also reported more worries about social situations than controls. There was no significant difference between both groups in the partnership status or satisfaction with their partnership. However, ICA-patients reported to have had significantly less sexual partners than controls. Finally, ICA-patients exhibited higher scores in the Depression Inventory compared to controls.

Overall differences between the two groups are relatively subtle. ICA seems to be a handicap patients can cope with very well.

### **Fallbeispiele aus der Riechsprechstunde**

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Mit Kasuistiken möchten wir auf die Bedeutung der Dresdner olfaktologisch/gustologischen Spezialsprechstunde hinweisen. Im Rahmen dieser Sprechstunde wurden Patienten mit Riechstörungen unterschiedlichster Genese HNO-ärztlich untersucht. Nach dem Ausfüllen eines standardisierten Fragebogens erfolgt die ausführliche olfaktologisch/gustologische Anamneseerhebung. Danach erfolgt die HNO-ärztliche, insbesondere die nasenendoskopische Untersuchung. Hieran anschließend wird eine eingehende psychophysische Riechprüfung mit Hilfe der "Sniffin' Sticks" bzw. Spezialuntersuchungen zum retronasalen Riechen bzw. der gustatorischen Funktion durchgeführt und ggf. werden olfaktorisch evozierte Potentiale (OEP) abgeleitet. Hierauf folgt eine eingehende Beratung des Patienten gemeinsam durch den HNO-Arzt und dem Olfakto- und Gustologen, ggf. mit Therapieentscheid. Ausgewählte Kasuistiken werden vorgestellt.

### **Patients with chronic nasal obstruction have a decreased intranasal trigeminal function**

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*Introduction:* The intranasal trigeminal function has been shown to contribute to the perception of nasal patency. Trigeminal stimulation (e.g. menthol inhalation) enhances the feeling of free nasal breathing whereas anesthesia of the nasal valve region gives the feeling of a blocked nose. The goal of the present study was to investigate the intranasal trigeminal function in patients with chronic nasal obstruction.

*Methods:* We investigated 37 patients with chronic nasal obstruction and 62 healthy subjects. All patients had side by side testing of olfactory and intranasal trigeminal function. The olfactory testing was done with Sniffin' Sticks discrimination task and the intranasal trigeminal function was tested with the eucalyptol lateralization technique. All patients further underwent anterior rhinomanometry and rated their perceived nasal patency and olfactory function.

*Results:* Compared to healthy subjects, the patients with chronic nasal obstruction had significantly worse intranasal trigeminal function but normal olfactory function ( $p < 0.01$ ). Similarly patients also rated nasal patency to be significantly worse ( $p < 0.001$ ).

*Conclusion:* The present data suggest that intranasal trigeminal function, which is decreased in patients with chronic nasal obstruction, could be a further element contributing to the symptoms of nasal obstruction.

#### **Olfactory neuroblastoma: Our 10-year experience**

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The olfactory neuroblastoma is a malignant neuroectodermal tumor thought to originate from the olfactory membrane of the sinonasal tract. It is uncommon, representing approximately 2-3% of sinonasal tract tumours, with a bimodal age distribution. The main presenting symptoms are unilateral nasal obstruction and epistaxis; less common manifestations include anosmia, headache, pain, excessive lacrimation and ocular disturbances. Craniofacial resection followed by radiotherapy is considered the gold standard of the treatment. It is actually recognized the feasibility of the endoscopic endonasal resection, eventually associated to a craniotomic approach, with respect of the oncological criteria of radicality. From 1999 to 2009, 30 patients were treated for olfactory neuroblastoma at the University Hospital of Varese and Brescia (Italy). 27 patients underwent a pure endoscopic endonasal resection, whereas 3 patients were treated with cranioendoscopic technique. Adjuvant radiotherapy was performed in 60% of cases. Overall Survival, Disease Free Survival e Recurrence Free Survival after 5 years are respectively of 100%,  $93,7\% \pm 6,05\%$  and  $75,6\% \pm 11,0\%$ . Rate of complications is about 16,6%. These results are comparable to the ones reached with the standard craniofacial resection and allow us to carry on our experience in performing the endoscopic technique for the treatment of olfactory neuroblastoma. Larger and longer studies are needed.

*Reference:* Castelnuovo P, Bignami M, Delù G, Battaglia P, Bignardi M, Dallan I: Endonasal endoscopic resection and radiotherapy in olfactory neuroblastoma: our experience. *Head & Neck Sep;29(9):845-50, 2007.*

**Assessment of gustatory function with “Taste Strips“ including umami taste**  
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Assessment of gustatory function is a central part in the diagnosis of patients with chemosensory dysfunctions. The taste of monosodium glutamate (MSG) was described as umami taste a century ago by Ikeda. The aim of the study was to extend a validated taste test of sweet, sour, salty, bitter taste with four concentrations of MSG. Taste function was assessed by four concentrations of sweet, sour, salty, bitter and umami taste and compared to results obtained in a control group without the presentation of MSG. The results yielded no differences between the two groups with regard to the sum of correctly identified tastants. Test-retest data from the extended version revealed acceptable correlation of score results. The present results indicate the clinical usefulness of the newly investigated test.

**Olfactory and gustatory function in MS patients, correlated with MRI**  
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*Introduction:* Some studies reported olfactory dysfunction in MS patients. There is no agreement about the most suitable testing method. We wanted to explore possible reasons for olfactory dysfunction in MS patients with MRI.

*Materials and Methods:* Olfactory bulb (OB) and olfactory brain volume was assessed within 34 MS patients (24women, 10men, 22-65 years, mean duration of disease 6 years) by manual segmentation and related to the plaque load. Six patients with optic neuritis (ON) were tested. Olfactory testing was performed using the Threshold-Discrimination-Identification test (TDI). Gustatory function was tested with the Taste Strips Test (TST).

*Results:* 41% of 34 MS patients displayed olfactory dysfunction (8% of the control group) and 83% of 6 patients with ON. 16% of the patients displayed gustatory dysfunction (5% of the control group). 71% of patients with a decreased OB volume and 83% with a decreased olfactory brain volume displayed hyposmia. There was a correlation between the OB volume and the number of MS lesions in the olfactory brain ( $r=-0.34$ ,  $p<0.05$ ) and their volume ( $r=-0.37$ ,  $p<0.05$ ). Olfactory brain volume correlated with the volume of lesions in the olfactory brain ( $r=-0.33$ ,  $p=0.05$ ) and the EDSS score ( $r=-0.37$ ,  $p<0.05$ ). The TST score correlated with the number of MS lesions in the olfactory brain ( $r=-0.48$ ,  $p<0.05$ ) and their volume ( $r=-0.52$ ,  $p<0.05$ ).

*Conclusions:* OB and olfactory brain volume may provide valuable information about OF in MS patients. The correlation between a higher number and volume of lesions in the olfactory brain with a decreased BO and olfactory brain volume could help to explain olfactory

dysfunction in MS patients. Hyposmia seems to appear more frequent in patients with ON. Longitudinal studies are needed.

### **Influence of the mode of application of local steroids on olfactory function**

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*Introduction:* Systemic steroids can significantly influence olfactory function of patients with chronic rhinosinusitis, but the effect is not only temporary. Long term application of local steroids is possible, but the effect on olfactory function is inferior compare to systemic ones. The squirt system was developed to enable the medicament to reach the olfactory region in the nasal cavity. The goal of the study was to compare influence of the mode of application of local steroid (fluticasone propionas) using standard nasal spray and squirt system on olfactory function.

*Patients and methods:* We included 30 patients with chronic rhinosinusitis (24 subjects with polyposis and 6 without polyposis) of average age 52,7 (SD=14,6). 15 patients used standard application of steroids into the nasal cavity and 15 patients used squirt system. The olfactory function was evaluated prior the application, after finishing the application (2 weeks) and 4 weeks later using Sniffin' Sticks test (threshold and identification).

*Results:* There was slight improvement of olfactory function in both groups. Patients also improved olfactory function and nasal patency when evaluating it on Visual Analogue Scale. However these differences were not statistically significant except subjective evaluation of olfactory function in group using standard application. There was no statistical difference in the mode of application on olfactory function.

*Conclusion:* The mode of application of local steroids has little influence on olfactory function in patients with chronic rhinosinusitis.

### **Parosmia in lateralised posttraumatic disorders**

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Parosmia is most commonly known to be present in postinfectious olfactory disorders even though it can present in cases of posttraumatic disorders as well. The fact whether parosmia is associated with side differences in olfactory function has been a matter of debate. We report four cases of severely lateralized posttraumatic disorders (anosmia on one side, slight hyposmia / normosmia on the other side) presenting with the symptom of parosmia alone. None of the subjects had realized the lateralized smell deficit. Magnetic resonance imaging revealed morphologic changes of the affected side in all cases. The importance of lateralized testing in subjects presenting with parosmia alone, especially in posttraumatic cases is discussed.