The Influence of Distractors on Odor Identification

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**Objective:** To investigate the impact of the use of more contrasted distractors on correct odor identification in patients with olfactory loss.

**Design:** Randomized, cross-over study.

**Setting:** University clinic.

**Patients:** Thirty patients with olfactory deficits.

**Interventions:** The olfactory function of the patients was evaluated by means of the “Sniffin’ Sticks” test battery.

**Main Outcome Measures:** The distractors of the Sniffin’ Sticks odor identification test (classic test) were modified, and more contrasted distractors were used (contrasted test), while the applied odorants were the same. All patients performed both the classic and the contrasted odor identification tests in a randomized sequence.

**Results:** Eighteen patients were hyposmic, and 12 were functionally anosmic. Odor identification was significantly better in the hyposmic patients than in the anosmic patients (P < .01). As predicted, hyposmic patients demonstrated a significant increase in correct odor identification in the contrasted test, while anosmic patients did not.

**Conclusion:** The use of more contrasted distractors in cued odor identification tasks can contribute to better discrimination of anosmic and hyposmic patients, which is highly valuable in a clinical context.


**METHODS**

The study was performed according to the Declaration of Helsinki on Biomedical Research Involving Human Subjects. Thirty patients with smell deficits were included in the study. All patients exhibited olfactory loss according to the threshold, discrimination, and identification measures (TDI score) obtained with the Sniffin’ Sticks test. Twelve patients (6 women and 6 men; mean [SD] age, 55 [17] years) were functionally anosmic (TDI score ≤ 15.0), and another 18 patients (10 women and 8 men; age, 63 [8] years) were hyposmic (TDI score > 15.0-30.5 points).

Olfactory function was obtained in all patients by means of the Sniffin’ Sticks test kit, which comprises 3 tests of olfactory function: odor threshold, odor discrimination, and odor identification. Odor thresholds were determined for phenylethyl alcohol using a 3-alter-
native forced-choice task. Three pens were presented to the patients in a randomized order: one containing the odorant at 1 of 16 possible dilutions, and the other two containing solvent only. The patient’s task was to find out which of the 3 pens smelled of the odorant, which had been presented at the beginning of the test as the highest of the 16 concentrations. A staircase paradigm was used to present triplets of pens to the patients every 20 to 30 seconds to avoid olfactory desensitization. The patients were blindfolded to prevent visual identification of the odor-containing pens. Correct identification of the pen that contained the odorant in 2 successive trials triggered a reversal of the staircase to the next lower odorant concentration, whereas a single incorrect identification triggered the reversal of the staircase to the next higher concentration. From a total of 7 reversals, the mean of the last 4 staircase reversal points was used as threshold estimate.7 The test of odor discrimination was performed using 16 triplets of odorants. The patients were presented with 3 pens: two containing the same odorant, and one containing a different odorant. Each patient’s task was to identify the pen that smelled different; therefore, a 3-alternative forced-choice task test design was reapplied. The patients were again blindfolded to prevent visual detection of the target odor pens. They were allowed to sample each odor only once. The interval between presentations of odor triplets was at least 30 seconds. The interval between presentations of individual odor pens was approximately 3 seconds. For odor identification, 16 odors were presented in a randomized sequence. The patients were free to sample the odors as often as necessary in order to identify them from a list of 4 distractors. The experimenter presented odor pens separated by an interval of at least 30 seconds to prevent olfactory desensitization.8,9 Hereafter, this menter presented odor pens separated by an interval of at least 30 seconds to prevent olfactory desensitization. Hereafter, this test will be called the contrasted odor identification test. The test interval between the classic odor identification test and the contrasted identification test was at minimum 30 minutes. Whether the classic or the contrasted odor identification test was performed first was randomly determined.

TABLE. Odors and Distractors in the Classic and the Contrasted Odor Identification Tests

<table>
<thead>
<tr>
<th>Odor</th>
<th>Classic Odor Identification Test</th>
<th>Contrasted Odor Identification Test</th>
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<tbody>
<tr>
<td></td>
<td>Distra...</td>
<td>Distra...</td>
</tr>
<tr>
<td>Orange</td>
<td>Blackberry</td>
<td>Strawberry</td>
</tr>
<tr>
<td>Leather</td>
<td>Smoke</td>
<td>Glue</td>
</tr>
<tr>
<td>Cinnamon</td>
<td>Honey</td>
<td>Vanilla</td>
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<tr>
<td>Peppermint</td>
<td>Chives</td>
<td>Fir</td>
</tr>
<tr>
<td>Banana</td>
<td>Coconut</td>
<td>Walnut</td>
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<tr>
<td>Lemon</td>
<td>Peach</td>
<td>Apple</td>
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<tr>
<td>Licorice</td>
<td>Gummi bear</td>
<td>Chewing gum</td>
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<tr>
<td>Turpentine</td>
<td>Mustard</td>
<td>Rubber</td>
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<tr>
<td>Garlic</td>
<td>Onion</td>
<td>Sauerkraut</td>
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<td>Coffee</td>
<td>Cigarette</td>
<td>Wine</td>
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<tr>
<td>Apple</td>
<td>Melon</td>
<td>Peach</td>
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<td>Cinnamon</td>
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<td>Pineapple</td>
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<td>Chamomile</td>
<td>Raspberry</td>
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<tr>
<td>Anise</td>
<td>Rum</td>
<td>Honey</td>
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<tr>
<td>Fish</td>
<td>Bread</td>
<td>Cheese</td>
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</tbody>
</table>

Data were analyzed using SPSS 12.0 for Windows (SPSS Inc, Chicago, Illinois) and repeated-measures analysis of variance (within-subject factor classic/contrasted; between-subject factors anosmia/hyposmia and sex). Patient age was used as a covariate to account for age-related differences between groups. The α level was set at 0.05.

RESULTS

Hyposmic patients demonstrated better odor identification than anosmic patients ($F_{1,25} = 15.0; P = .001$). The hyposmic patients scored 3.2 (3.1) mean (SD) points higher in the contrasted odor identification test than in the classic odor identification test. Functionally anosmic patients exhibited only a minimal increase (0.2 [2.6] points) ($F_{1,25} = 7.93; P = .009$). The factor sex had no significant effect ($F_{1,25} < 0.01; P = .99$).

COMMENT

Our findings showed that (1) odor identification was influenced by the distractors that were provided, and (2) the use of contrasted distractors resulted in a significant increase in correct odor identification in hyposmic patients but not in anosmic patients, both in absolute terms. Odor identification has been shown to be influenced whether it is performed as a cued or a free identification task.11 Even the color of the odorant has an impact on the verbal identification of the odor.12 Whether an odor is presented together with a verbal identifier or a photograph/pictogram that would show a graphical representation of the odor source13,14 also appears to make a difference. Therefore, it seems to be obvious that the choice of distractors in cued odor identification tasks may make correct odor identification more or less difficult. However, to our knowledge, none of the studies we reviewed involved patients with olfactory loss, and none...
of them systematically tried to exploit these effects for the improvement of olfactory diagnostics.

The use of more contrasted distractors led to an increase in correct odor identification. As hypothesized, this effect was significant in hyposmic patients but negligible in functionally anosmic patients. This result is apparent because the use of more contrasted distractors makes it easier for patients with incomplete olfactory loss to select the correct item. In contrast, odor identification in anosmic subjects does not seem to benefit from the use of contrasted distractors. In fact, odor identification scores in anosmic patients did not change in relation to the difficulty of the task. The use of more contrasted odor identification tests could help to differentiate between hyposmic and functionally anosmic patients. This distinction seems to be of great clinical value, as patients with some olfactory function have a higher chance for recovery than patients with complete anosmia.  

In conclusion, the selection of distractors in cued odor identification tasks influences the results of the tests. This effect can be used to better differentiate between hyposmic and anosmic patients.

Submitted for Publication: November 7, 2007; final revision received April 1, 2008; accepted April 21, 2008.

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Author Contributions: Dr Gudziol had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Gudziol and Hummel. Acquisition of data: Gudziol. Analysis and interpretation of data: Gudziol and Hummel. Drafting of the manuscript: Gudziol and Hummel. Critical revision of the manuscript for important intellectual content: Hummel. Statistical analysis: Gudziol and Hummel. Obtained funding: Hummel. Administrative, technical, and material support: Hummel. Study supervision: Hummel.

Financial Disclosure: None reported.

Additional Contributions: Monika Roesner and Silvia Wolf-Stephan helped in collecting the data for this study.

REFERENCES