Gustatory Function After Tonsillectomy

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Objective: To assess taste function before and after tonsillectomy (TE).

Design: Prospective study.

Setting: University hospital.

Patients: Sixty-five patients (42 females, 23 males; mean age, 28 years).

Main Outcome Measures: Taste function was investigated before TE with 4 concentrations each of sweet, sour, salty, and bitter quality, respectively, on both sides of the anterior and posterior areas of the tongue. Self-assessment of gustatory function was performed by visual analogue scales. Thirty-two patients were retested 64 to 173 days after TE. Thirty-three patients could not be retested after TE but were interviewed by telephone.

Results: Self-assessed taste function significantly decreased (P = .001). Yet, none of the subjects reported taste dysfunction. Tonsillectomy had no major effect on taste test scores (P > .27).

Conclusion: Persisting taste dysfunction seems to be rare after TE.

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Together with olfaction and oral trigeminal sensitivity, the sense of taste contributes considerably to flavor perception during eating and drinking and thus plays a major role in the enjoyment of foods and beverages. Other important physiological properties of gustation include the regulation of salt and energy intake and the detection of potential toxins during mastication. Consequently, damage to the gustatory system might lead to considerable dietary changes.

The sense of taste depends on 3 cranial nerves (VII, IX, and X) innervating both sides of the oral, lingual, and pharyngeal mucosa (for a detailed anatomical review, see Witt et al). It is a rather robust system that shows little deterioration of suprathreshold sensitivity during aging. Nevertheless, disease and/or medication might contribute to a clinically relevant loss of taste sensitivity. Other possible causes of taste dysfunction include iatrogenic damage (eg, damage to the chorda tympani during middle ear surgery, tonsillectomy [TE], dental or oral surgery), or radiation to the head and neck that involves major parts of the salivary glands.

Tonsillectomy is the most frequently performed otolaryngologic operation. The occurrence of taste disorders after TE has been reported in the literature mainly in case reports. Only a few attempts have been made to investigate the occurrence of taste disorders after TE, with some of the published reports based on nonvalidated or relatively crude testing devices. Consequently, to our knowledge, the actual frequency of damage to the gustatory system after TE has not been elucidated. However, this information would be useful, especially in light of an increasing number of medicolegal claims involving such damage. In particular, patients who rely on their sense of taste (eg, cooks, food specialists, sensory experts) need to be provided with more detailed information regarding the potential risk of damage to the gustatory system during TE.

To obtain data on the frequency of gustatory loss after TE, we investigated the sense of taste before and after TE using a well-validated test of gustatory function.

Methods

The investigation was conducted at the Department of Otorhinolaryngology at the Medical University of Vienna, Vienna, Austria, according to the guidelines of the Declaration of Helsinki on biomedical research involving human subjects. Sixty-five patients (42 females and 23 males) were included (mean [SD] age, 28.0 [9.1] years; range, 13-68 years). Written consent was obtained from all patients after information about the purpose and method of the investigation had been provided. After their medical history was taken, the patients rated their acuity of smell and taste using visual analog scales (VAS); patients with diseases affecting gustatory sensitivity (eg, xerostomia, depression, diabetes mellitus, or renal failure) were not eligible for the study. The scores...
ranged from 0 (no sense of smell and taste) to 100 (excellent sense of smell and taste). A full otorhinolaryngologic examination was performed in all patients to rule out diseases of the middle ear and the oral cavity that might affect taste sensitivity.6 Gustatory testing (see the following subsection) was performed in all patients the day before TE. Patients were asked not to eat or drink anything except water 1 hour prior to testing, not to smoke, and not to brush their teeth. The TE was performed under general anesthesia using a McIvor retractor (Medical Development and Engineering, Frittlingen, Germany) (fixing the tongue with a plate in the midline) and bipolar electric coagulation to stop bleeding. The operations were performed by multiple surgeons, including those who were experienced and those beginning their training. However, the surgical technique was similar in all patients. Tonsillectomy was performed to treat chronic tonsillitis in all patients.

Gustatory testing after TE was performed in 32 patients (20 females and 12 males) (mean [SD] age, 27.1 [7.8] years; range, 15-44 years) 105.0 (28.5) days (range, 64-173 days) after the operation. (Values are given as mean [SD] throughout the text.) Again, taste sensitivity was rated using VAS. Moreover, patients were asked to report any changes in taste sensitivity immediately after the operation and at the time of retesting. The time point of postoperative taste testing was chosen to rule out alterations caused by wound healing or pain after surgery. Thirty-three patients (22 women and 11 men) aged 28.8 (10.4) years (range, 18-68 years) who could not be tested psychophysically after the operation were interviewed by telephone to find out if any loss or changes in gustatory function had occurred. Moreover, patients rated gustatory function on a scale ranging from 0 (no taste) to 10 (excellent taste). Twelve of 77 initially tested patients could not be reached for postoperative assessment of gustatory function and were excluded from the data analysis.

GUSTATORY TESTING

The assessment of taste function was performed by a well-validated test of gustatory function using taste strips made of filter paper that had been dried after impregnation with taste solutions.15 The taste strips were presented in a pseudorandomized sequence starting with the lowest concentrations. Sixteen taste strips (4 concentrations each of sweet, sour, salty, and bitter quality) 8 cm in length and with an impregnated area of 2 cm² were presented at the tongue’s posterior area (innervated by the glossopharyngeal nerve) and the anterior area (innervated by the chorda tympani nerve) on both sides, resulting in a maximum taste strip score of 16 for each of the 4 tested sites. None of the subjects had an insuppressible gag reflex during testing of posterior tongue sites. The tested portions of the tongue are indicated in Figure 1.

STATISTICAL ANALYSIS

Results were submitted to analysis of variance for repeated measures, using the within-subject factors “before TE” and “after TE.” Age was used as a covariate, and sex was used as a between-subject factor. In addition, t tests for paired samples were used to compare results of the anterior vs posterior areas of the tongue and for ratings of gustatory sensitivity. We used SPSS statistical software (version 12.0 for Windows; SPSS Inc, Chicago, Illinois) for analyses. The α level was set at .05.

RESULTS

Taste strip results of all tested sites of the tongue before and after TE are presented in the Table. Ratings of smell function showed normal results in all patients for the VAS (62.0 [20.7]).

Results indicated that there was a difference between taste scores obtained in the back vs the front areas of the tongue ($t_{15}=3.56, P=.001$). However, TE had no major effect on taste scores as indicated by nonsignificant ef-

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**Table. Results From Taste Testing**

<table>
<thead>
<tr>
<th>Tongue Area</th>
<th>Before TE</th>
<th>After TE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posterior tongue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td>11.9 (3.2)</td>
<td>12.5 (3.3)</td>
</tr>
<tr>
<td>Left</td>
<td>11.8 (3.2)</td>
<td>12.3 (2.9)</td>
</tr>
<tr>
<td>Total</td>
<td>23.7 (6.0)</td>
<td>24.8 (5.9)</td>
</tr>
<tr>
<td>Anterior tongue</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Right</td>
<td>13.4 (2.7)</td>
<td>13.7 (2.5)</td>
</tr>
<tr>
<td>Left</td>
<td>13.7 (2.6)</td>
<td>14.1 (1.8)</td>
</tr>
<tr>
<td>Total</td>
<td>27.1 (4.9)</td>
<td>27.8 (4.1)</td>
</tr>
</tbody>
</table>

Abbreviation: TE, tonsillectomy.

*a Using the taste strips of those 32 patients who were tested before and after TE, separately for the anterior and posterior portions of the tongue. Data are given as mean (SD). See “Methods” section, “Gustatory Testing” subsection.
fecteds of the factors “before TE” and “after TE” (P > .27).
In addition, neither sex nor age had a significant effect on taste scores (P > .18). In contrast to the results from measured gustatory sensitivity, ratings indicated a decrease of gustatory function after TE (VAS before TE, 62.3 [18.3]; after TE, 51.1 [14.5]) (t13=3.77, P = .001). The results are graphically presented in Figure 2.

The VAS ratings before TE in the patients who were not tested after surgery yielded scores indicating gustatory function in the reference range: 65.0 (19.8). Self-rating of gustatory function after TE by the 11-point scale yielded scores of 7 to 10 (9.0 [0.9]), again showing normal gustatory function.

None of the patients reported persisting gustatory dysfunctions at the time of retesting or requestioning. However, 15 of the 65 patients (23%) remembered the presence of dysgeusia shortly after the operation.

**COMMENT**

The major findings of the present study were that (1) psychophysical taste testing showed no change in gustatory function after TE in either the anterior or posterior areas of the tongue, although ratings exhibited an overall decrease (C). In general, taste scores obtained in the back vs the front of the tongue were lower.

Most authors10,11 hypothesize that taste dysfunction after TE is caused by surgical injury of the lingual branch of the glossopharyngeal nerve (LBGN), which carries the gustatory fibers from the rear third of the tongue. In a number of subjects, this nerve seemed to adhere to the inferior pole of the tonsil. According to an anatomical study by Ohtsuka et al16 of 83 human cadavers, in only 23% was the palatine tonsil continuously separated from the LBGN by the pharyngeal constrictor muscles. In 55% the muscle layer was partially lacking, and in 22% a large space between the pharyngeal constrictor muscles could be demonstrated. In the latter cases, the LBGN adhered to the tonsillar tissue, separated only by loose connective tissue that was 1 to 2 mm thick. According to that study,10 approximately 20% of the patients could be expected to exhibit decreased gustatory function on the back of the tongue. However, the present data indicate that TE does not result in a lasting functional damage of the LBGN in a large percentage of patients. Obviously, the presence of the LBGN in proximity to the field of operation does not necessarily mean that it will be damaged during surgery.

The results of the present study show that permanent taste disturbances after TE constitute a rare adverse effect of the surgery. None of the patients reported persisting changes or loss of gustatory function at a mean time point of approximately 100 days after TE. Congruently objective results of taste testing with taste strips revealed no statistically significant differences of regional gustatory sensitivity before and after TE.

Results of self-assessment of gustatory function using VAS showed a slight but statistically significant decrease (P = .001) at the time of retesting after TE, although measured gustatory sensitivity remained unchanged, and, most important, the subjects did not...
report persisting taste loss. This raises the question of whether taste ratings also depend on attentional factors. Thus, it may be hypothesized that the patients’ ratings of taste function were influenced by the presence of postoperative pain, oral discomfort, or wound healing during the first days and weeks after TE. This may be supported by the fact that 15 patients reported dysgeusia immediately after TE, which resolved within days and weeks. However, temporal hypoguesia might also have been caused by the lingual pressure exerted by the gag during surgery.

A number of case reports and a few systematic investigations of patients experiencing taste disorders after TE have been published. Uzun et al described a patient who experienced impairment of sweet taste on the left side of the posterior tongue persisting at 10 months after TE. Goins and Pitovski described a patient who had undergone unilateral right TE and experienced loss of taste function in the right posterior area as well as phantom taste on the left side. Electrogustometric testing revealed a detection threshold out of the range of the capacity of the electrogustometer on the posterior right side of the tongue. Moreover, no taste solution of sweet, sour, salty, or bitter quality could be detected at this site with spatial taste testing at 6 months after TE. The taste loss was attributed to injury of the LBGN owing to considerable tissue removal at the inferior pole of the right tonsil. Similarly, Collet et al attributed 1 patient’s taste concerns after TE to damage to the LBGN of the left side. The electrogustometric threshold of the left posterior side was reported to be 50% higher than on the right side. Moreover, a bitter solution was not perceived at this site by the patient. The taste concerns still remained at retesting 18 months after TE.

Only a few systematic studies have investigated gustatory function after TE. In accordance with the present results, an investigation by Arnhold-Schneider and Bernemann detected no loss of gustatory function in 150 patients during repeated testing 7 days after TE. However, the method of taste testing was not reported in detail, and no taste score results were presented for the tested sites of the tongue. In an investigation conducted by Tomofuji et al., 3 of 35 patients reported taste disturbances a few days after TE. In only 1 patient could abnormal electrogustometric thresholds be obtained, and these returned to reference range 11 days after TE. Subjective taste sensitivity remained diminished for 25 days. Taste function of all 3 patients recovered within 1.5 months.

How are patients found to have taste loss after TE in clinical routine? In a retrospective analysis of 3583 outpatients of a specialized taste disorder clinic over a 15-year period, only 11 patients could be identified as having taste disorders after TE. In 3 patients, gustatory loss was attributed to disturbance of the LBGN, whereas the other causes included adverse effects of drugs, zinc deficits, or remained unknown. Compared with the present prospective data, these data indicate the rare occurrence of taste disorders after TE.

In conclusion, owing to the close anatomical relationship of the LBGN to the tonsillar bed, damage or tearing and stretching of this nerve seems to be possible, resulting in taste disorders. However, based on the present results, taste loss after TE seems to be a rare complication.

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Author Contributions: Drs Mueller, Landis, and Temmel and Mr Khatib had full access to all the data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Mueller, Temmel, and Hummel. Acquisition of data: Khatib. Analysis and interpretation of data: Mueller, Landis, and Hummel. Drafting of the manuscript: Mueller and Hummel. Critical revision of the manuscript for important intellectual content: Khatib, Landis, Temmel, and Hummel. Statistical analysis: Landis and Hummel. Obtained funding: Mueller. Administrative, technical, and material support: Mueller, Khatib, and Temmel. Study supervision: Mueller, Temmel, and Hummel.

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**REFERENCES**