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## Reliability and validity of the Turkish Nose Obstruction Symptom Evaluation (NOSE) scale

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**Background/aim:** The aim of this study was to validate the Turkish Nasal Obstruction Symptom Evaluation (T-NOSE) scale.

**Materials and methods:** The NOSE scale was translated into Turkish. A prospective study was conducted involving adult subjects with nasal obstruction and a control group. The patients were divided into three groups, namely nasal septum deviation (NSD), septoplasty, and control groups. Internal consistency, test-retest reliability, validity, responsiveness, and the magnitude of the effect of surgery were all investigated.

**Results:** In total, 253 subjects were enrolled in the study. Cronbach's alpha was 0.938 and 0.942 upon test and retest, respectively, which proved good internal consistency. The mean kappa value was 0.82, indicating a high level of reproducibility. The difference between postoperative and control groups was not statistically significant ( $P < 0.05$ ). The T-NOSE score of the NSD group was  $65.67 \pm 16.77$ , while it was  $10.75 \pm 12.25$  for the control group ( $P < 0.01$ ). The mean score improved following septoplasty ( $P < 0.001$ ). The magnitude of the effect of surgery was considered high. The correlation between the visual analogue scale and NOSE scores was 0.948.

**Conclusion:** The T-NOSE scale is a valid instrument with good internal consistency, reliability, reproducibility, validity, and responsiveness.

**Key words:** NOSE, Turkish NOSE, validation

### 1. Introduction

Nasal obstruction is a common symptom, which is often reported as a feeling of blockage or insufficient air flow through the nose, and it has a multifactorial origin (1,2). The medical or surgical treatment of nasal obstruction is very common in rhinology practice (3–6). The clinical diagnosis of nasal airway obstruction (NAO) is usually based on the patient's subjective feelings and the physician's assessment. Since the objective evaluation of nasal obstruction frequently does not correlate strongly with the patient's subjective feelings of patency, physicians and researchers alike have increasingly focused on patient reported outcome measures to determine the efficacy of treatment (7). However, due to controversies concerning objective methods of evaluation, quality of life (QOL) measurements have become increasingly important and they have been used to assess the severity of NAO over several years (8). The QOL measures provide an opportunity to determine a patient's subjective feelings specific to the NAO, and they can also be used as an outcome measurement tool in nasal surgery.

The Nasal Obstruction Symptom Evaluation (NOSE) scale was designed by Stewart et al. (3) in 2004 and it has already been validated in French (4), Portuguese (5), Italian (6), and Greek (9). The scale was intended to provide an opportunity to determine the patient's subjective feelings. The original study on the NOSE scale reported good internal consistency and adequate reliability, and it suggested that the scale could be a useful tool for assessing the impact of nasal obstruction on patients' QOL, as well as for assessing the outcomes of research in rhinology (3). The NOSE scale is a simple, frequently used, and well-validated QOL instrument specific to NAO. It consists of five nasal obstruction-related items that can easily determine the severity of a patient's complaints over the past month. All items are scored using a five-point Likert scale and they are scaled to a total score of 0–100, with higher scores indicating greater nasal airway obstruction.

To the best of our knowledge, no specific QOL tool for measuring nasal airway obstruction has previously been validated in Turkish. The present study is therefore intended to address this research gap. The main purpose of this study was to adapt and evaluate a Turkish version

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of the NOSE scale (T-NOSE) and then to assess its internal consistency, reliability, and clinical validity.

## 2. Materials and methods

A prospective instrument validation study was carried out involving patients with nasal obstruction associated with nasal septum deviation (NSD) and a control group consisting of healthy volunteers. The study was conducted in the Otolaryngology, Head, and Neck Surgery Department of Gülhane Military Medical School between 5 February 2015 and 5 May 2015. The subjects were divided into three groups, namely the septoplasty group, the NSD group, and the control group. In the septoplasty group, septoplasty was performed to correct the NSD. In the NSD group, the subjects did not receive any surgical intervention and/or medical treatment during the test-retest period. All subjects completed the T-NOSE scale and a visual analogue scale (VAS) regarding the severity of nasal obstruction. All data were collected prospectively and each subject enrolled in the study provided written informed consent. The study was carried out in accordance with the requirements of the Declaration of Helsinki and it was approved by the review board of Gülhane Military Medical School.

### 2.1. Translation

The original NOSE scale was translated into Turkish by ten otorhinolaryngologists and one professional translator. It was then translated back into English by two native English

translators. The final text was prepared by an evaluation committee composed of two professional translators. The Turkish version of the Nose Obstruction Symptom Evaluation (T-NOSE) scale is provided in Table 1.

### 2.2. Inclusion/exclusion criteria

Only adult patients with NSD who complained of nasal airway obstruction were recruited. After recording the patient's detailed medical history, a complete otorhinolaryngological examination was performed, including a nasal endoscopy after decongestion. Each patient completed the T-NOSE questionnaire prior to and 3 months after the surgical procedure. The exclusion criteria were: age younger than 18 years old, revision septoplasty, septorhinoplasty, septoplasty combined with sinus or sleep apnea surgery, septoplasty performed to access other sites, septum perforation, nasal valve collapse, history or clinical evidence of chronic rhinosinusitis according to the European Position Paper on Rhinosinusitis and Nasal Polyps (EPOS) criteria (10), inflammatory or infectious sinus disease, adenoid hypertrophy, head and neck radiotherapy, sinonasal malignancy, acute facial trauma or fracture in the past three months, craniofacial syndromes, sarcoidosis, Wegener's granulomatosis, uncontrolled asthma, pregnancy, and illiteracy.

### 2.3. Test-retest study

The test-retest reliability was checked for the NSD and control groups by employing the NOSE scale twice during routine patient visits by two different physicians. Patients

**Table 1.** Turkish version of the Nose Obstruction Symptom Evaluation (T-NOSE) scale.

| Over the past month, how much of a problem were the following conditions for you? |  |               |                   |                  |                    |                |
|---|--|---------------|-------------------|------------------|--------------------|----------------|
| <i>Son bir aydır aşağıdaki şikayetler sizin için hangi düzeydeydi?</i>            |  |               |                   |                  |                    |                |
| Please circle the most appropriate response.                                      |  |               |                   |                  |                    |                |
| <i>Lütfen size göre en doğru seçeneği işaretleyin.</i>                            |  |               |                   |                  |                    |                |
|   |  | Not a problem | Very mild problem | Moderate problem | Fairly bad problem | Severe problem |
|   |  | Sorun değil   | Çok hafif         | Orta dereceli    | Kötü               | Çok kötü       |
| 1   | Nasal congestion or stuffiness<br><i>Burunda şişkinlik veya dolgunluk</i>                                    | 0             | 1                 | 2                | 3                  | 4              |
| 2   | Nasal blockage or obstruction<br><i>Burun tıkanıklığı</i>  | 0             | 1                 | 2                | 3                  | 4              |
| 3   | Trouble breathing through my nose<br><i>Burundan nefes almada güçlük</i>                                     | 0             | 1                 | 2                | 3                  | 4              |
| 4   | Trouble sleeping<br><i>Uyumada güçlük</i>  | 0             | 1                 | 2                | 3                  | 4              |
| 5   | Unable to get enough air through my nose during exercise or exertion<br><i>Eforla yeterli nefes alamamak</i> | 0             | 1                 | 2                | 3                  | 4              |

who had any treatment and/or acute changes in symptoms due to a common cold/influenza/respiratory tract infection during the test-retest period were excluded from the study.

#### 2.4. Control study

The control group was composed of members of the medical staff, residents, hospital staff, students, and accompanying persons/relatives of patients who volunteered to participate. The volunteers were asked if they had ever been diagnosed with any nasal pathologies accompanied by NAO, undergone a nasal surgery, or used a nasal medication in the past three months. An otorhinolaryngological examination, including a nasal endoscopy, was performed for all control group subjects. They were excluded from the study if they exhibited any nasal pathology or gave a positive response to any of the items given above. The NOSE scores of the control group were compared to those of the NSD group and the postoperative scores of the septoplasty group.

#### 2.5. Preoperative/postoperative evaluation

The septoplasty group consisted of patients with NSD who underwent septoplasty. These patients were evaluated twice using the T-NOSE questionnaire, once prior to surgery and then again 3 months postoperatively. The postoperative T-NOSE scores were compared with those of the control group.

#### 2.6. Statistical analysis

The internal consistency and the test-retest reliability of the T-NOSE scale were analyzed. Cronbach's alpha was used to represent and evaluate the internal consistency of ordinal responses. The minimum acceptable value was 0.7. Pearson's test and the kappa test were used for the test-retest reliability analysis.

ANOVA testing was used for comparison of multiple groups and the Bonferroni test was also used as a post hoc test. They were used for correcting for multiple comparisons of the T-NOSE scale between control and study groups.

The responsiveness of the questionnaire was assessed by comparing the NOSE scores before and after surgery. After using the Kolmogorov-Smirnov test in order to assess the normality of the distribution, the Wilcoxon signed-rank test was used to compare two related and dependent samples and to measure the magnitude of the effect for the statistical evaluation.

All statistical analyses were performed using SPSS 17 statistical software.

### 3. Results

The total number of subjects enrolled in the study was 253. There were 168 test subjects (85 subjects in the NSD group and 83 subjects in the septoplasty group) and 88 healthy subjects in the control group. All participants completed the questionnaire by themselves without the assistance

of medical health professionals and no questions arose concerning how to answer the questions in the translated scale. There were 171 male (67.6%) and 82 female (32.4%) participants. The mean age was  $28.6 \pm 8.4$  (range: 18–63) years. Only one patient was not available for retesting. Two participants in the NSD group had an acute respiratory tract infection and hence they were excluded from the study. A total of 82 subjects from the NSD group therefore completed the study.

#### 3.1. Test-retest study

The test-retest evaluation was completed for 170 (NSD group and control group) subjects. The mean time between the test and retest evaluation was  $15.4 \pm 4.2$  days (range: 12–24) in all groups. The mean T-NOSE scores were  $38.52 \pm 14.49$  (range: 0–100) at the initial test and  $37.85 \pm 14.23$  (range: 0–100) at the retest.

The Cronbach's alphas for the total T-NOSE scores were 0.938 and 0.942 at the initial test and the retest, respectively, with both values suggesting very good internal consistency within the T-NOSE scale.

The mean kappa value was 0.82. The kappa value for the first test item was 0.77, for the second item 0.88, the third item 0.86, the fourth item 0.83, and the fifth item 0.80. The kappa results indicated substantial agreement (Table 2).

The mean T-NOSE score in the NSD group was  $65.67 \pm 16.77$ , while the mean T-NOSE score was  $10.75 \pm 12.25$  in the control group. The difference was statistically significant ( $P < 0.01$ ).

The Pearson correlation for the NSD group between the test and retest scores was 0.948, which was significant ( $P < 0.01$ ).

##### 3.1.1. Control study

The control group consisted of 88 asymptomatic volunteers, 45 males (51.1%) and 43 females (48.9%), with a mean age of  $28.26 \pm 10$  (range: 18–56) years. The mean T-NOSE score was  $10.97 \pm 10.75$  in the control group.

The T-NOSE scale was assessed twice for the test-retest study. The Pearson correlation between the first and second T-NOSE scores in the control group was 0.968 and the correlation was significant ( $P < 0.01$ ).

##### 3.2. Preoperative/postoperative evaluation

The septoplasty group consisted of 83 subjects, 76 males (91.6%) and seven females (8.4%), with a mean age of  $27.5 \pm 6.2$  (range: 20–48) years. All patients were operated on by the two senior authors of the present study (ÖK, SK). The preoperative and postoperative T-NOSE scores were compared. The mean preoperative T-NOSE score was  $72.62 \pm 16.42$ , while the mean postoperative NOSE score was  $10.97 \pm 10.75$ . Statistically significant differences appeared between the two groups by the Wilcoxon test results ( $P < 0.05$ ) (Table 3). Furthermore, ANOVA testing was used to assess the relationships between NSD, postoperative

**Table 2.** T-NOSE scores, VAS scores, and kappa values of all groups.

| T-NOSE               | Test mean value (NSD, n: 82) | Retest mean value (NSD, n: 82) | Test mean value (preoperative, n: 83) | Test mean value (postoperative, n: 83) | Test mean value (control group, n: 88) | Retest mean value (control group, n: 88) | Kappa value (n: 170) |
|----------------------|------------------------------|--------------------------------|---------------------------------------|--|--|--|----------------------|
| Q1                   | 2.35 ± 1.11                  | 2.43 ± 1.07                    | 2.61 ± 1.03                           | 0.53 ± 0.67                            | 0.44 ± 0.65                            | 0.4 ± 0.63                               | 0.771                |
| Q2                   | 2.97 ± 0.73                  | 2.93 ± 0.79                    | 3.20 ± 0.72                           | 0.65 ± 0.68                            | 0.54 ± 0.72                            | 0.51 ± 0.71                              | 0.884                |
| Q3                   | 2.87 ± 0.77                  | 2.82 ± 0.75                    | 3.18 ± 0.73                           | 0.57 ± 0.7                             | 0.43 ± 0.7                             | 0.38 ± 0.63                              | 0.867                |
| Q4                   | 2.36 ± 1.14                  | 2.36 ± 1.12                    | 2.81 ± 0.93                           | 0.18 ± 0.38                            | 0.38 ± 0.63                            | 0.32 ± 0.58                              | 0.839                |
| Q5                   | 2.59 ± 1.15                  | 2.52 ± 1.1                     | 2.69 ± 0.97                           | 0.24 ± 0.53                            | 0.43 ± 0.72                            | 0.40 ± 0.72                              | 0.804                |
| TOTAL SCORE × 5/MEAN | 65.85 ± 16.79                | 65.48 ± 16.75                  | 72.59 ± 16.33                         | 10.97 ± 10.75                          | 11.19 ± 12.08                          | 10.22 ± 11.71                            | 0.82                 |
| VAS                  | 6.9 ± 1.85                   | 6.7 ± 1.58                     | 7.95 ± 1.03                           | 1.2 ± 0.99                             | 1.09 ± 1.12                            | 0.97 ± 1.15                              |                      |

**Table 3.** Wilcoxon test results of the preoperative and postoperative T-NOSE and VAS scores.

|                            | Mean    | N  | Std. deviation | P        | Z         |
|----------------------------|---------|----|----------------|----------|-----------|
| Preoperative T-NOSE score  | 72.6220 | 82 | 16.42840       | P: 0.003 | Z: -7.872 |
| Postoperative T-NOSE score | 10.9756 | 82 | 10.75654       |          |           |
| Preoperative VAS score     | 7.9512  | 82 | 1.04116        | P: 0.002 | Z: -7.933 |
| Postoperative VAS score    | 1.2073  | 82 | 0.99055        |          |           |

T-NOSE, and control group scores and the Bonferroni post hoc test was carried out to reveal the source of the difference. The difference between postoperative and control groups was not statistically significant ( $P < 0.05$ ).

### 3.3. Association between the VAS score and T-NOSE items

The association between the VAS score and the items of the T-NOSE scale was investigated using the Pearson correlation test in the NSD and control groups (n: 170). The patients in the surgery group could not be included in the correlation test because their preoperative and postoperative scores changed dramatically (preoperative T-NOSE score: 72.62, postoperative T-NOSE score: 10.97, Pearson correlation score: 0.19). The correlation between the VAS and NOSE scores was 0.948, which was significant ( $P < 0.01$ ; two-tailed).

Among the included subjects, age was not significantly correlated with the overall T-NOSE score or with each of its items. The mean total T-NOSE score for females was  $47.92 \pm 29.2$ , while for males it was  $49.08 \pm 31.7$ .

## 4. Discussion

The use of disease-specific questionnaires provides valuable and practical information for the assessment of the impact of nasal obstruction on individuals, especially in rhinology practice. To the best of our knowledge, no specific QOL tool for nasal obstruction has previously

been adapted into Turkish. In this study, all of the subjects were easily able to fully complete all the questions. Hence, this evaluation method can be described as a handy and easily self-administered instrument.

The T-NOSE scale's internal consistency was analyzed and it appeared to be very good, with an overall Cronbach's alpha coefficient value of 0.938 and 0.942 at the initial and retest examination, respectively. Internal consistency refers to the way in which the items within an instrument relate to each other (11). In the original study by Stewart et al. (3), the overall Cronbach's alpha coefficient was 0.785, while in Marro et al.'s (4) and Mozzanica et al.'s (6) studies it was 0.86 and 0.81, respectively.

The reliability of the test-retest scores of the T-NOSE scale was a concern and so it was evaluated statistically with Pearson's test and the kappa test. The Pearson test values ranged from 0.948 to 0.968, which was considered good for all groups' comparisons and individual measurements over time. In the original study (2), the test-retest correlation coefficient was 0.702, while in Bazerra et al.'s (1) and Mozzanica et al.'s (6) studies it was 0.776 and 0.73, respectively.

We evaluated each item of the T-NOSE scale with the kappa test, which represents the questionnaire's reproducibility (12). The mean value was 0.82, indicating substantial agreement. In other words, a high level of

reproducibility was obtained for the Turkish questionnaire.

The measurement of validity concerns the capacity of the utilized questionnaire to distinguish differences between patients who have or do not have the disease being studied (4,11). In this study, the difference between the NSD patients and the control group was statistically significant. Additionally, the relationship between the postoperative mean T-NOSE scores of the septoplasty and control groups was significantly meaningful.

The correlation between the VAS and NOSE scores was 0.948, which was significantly similar to that found in the original study (3).

Responsiveness concerns the capacity of the questionnaire to detect clinical changes over time and it

can describe the size of the effect (7). We used a paired t-test to evaluate responsiveness by comparing the scores before and after surgical treatment. The NOSE scores before and after surgery were significantly different, which was similar to the results of previous studies (3–6).

As a limitation of the present study, since it was conducted in a military hospital, there was a predominance of male subjects (171 males (67.6%) vs. 82 females (32.4%)).

In conclusion, our study proves that the T-NOSE scale has satisfactory internal consistency, reliability, reproducibility, validity, and responsiveness in adult Turkish patients. It is therefore a valid and useful instrument for assessing nasal obstruction in daily practice.

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