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Research

Translation and determining the validity and reliability of the nordic orofacial test-screening in children with and without orofacial dysfunction

Horia Hosseini[1], Parisa Babajanzade[1], Shamim Ghazi[2]*, Tabassom Azimi[1], Soraya Khafri[1]

[1] Department of Speech Therapy, School of Rehabilitation Sciences, Babol University of Medical Sciences, Babol, Iran; [2] Department of Speech Therapy, School of Rehabilitation Sciences, University of Social Welfare and Rehabilitation Sciences, Tehran, Iran

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Background

Orofacial skills include vital activities such as breathing, chewing, swallowing, social interactions and speech, which have a significant impact on people's quality of life. Nordic Orofacial Test-Screening (NOT-S) is a tool for evaluating speech, chewing and swallowing problems in children over 3 years old.

Objective

The aim of the present study is to investigate the psychometric characteristics of the NOT-S.

Methods

A descriptive-analytical design is used in this study, which is a foundation method type. The oral-facial evaluation tool NOT-S was translated and equated into Persian. Based on expert opinion, the content and form validity of this tool were determined. To investigate test-retest reliability and internal consistency, the test was conducted on 25 children with orofacial dysfunction and 30 children without orofacial dysfunction aged 3 to 6 years, with an average age of 4.98±±1.42 from the city of Babol. Impact score, content validity index (CVI), content validity ratio (CVR), Cronbach's alpha, and intracluster correlation coefficient were calculated.

Results

In face validity check, the impact score of all items was higher than 2.52. In content validity, the CVI of each item was higher than 81% and the CVR of all items was higher than 50%. The intra-cluster correlation coefficient was estimated at 0.998 and 0.948 in the interview and evaluation sections, respectively, which is statistically significant according to Landy and Koch's classification. The Cronbach's alpha coefficient of the whole instrument was 0.77.

Conclusions

We thus found that the Persian version of the orofacial abilities assessment tool is acceptable in terms of validity and reliability for Persian-speaking children with and without orofacial dysfunction.

PLAIN LANGUAGE SUMMARY

This study shows that the Persian version of the NOT-S is a valid and standardized tool for assessing orofacial function. This test can be used by therapists and researchers to assess, diagnose orofacial problems, and accurately and quickly refer to specialists for treatment planning, as well as for research in the field of orofacial dysfunction.

*Corresponding author: shamimghazi1997@gmail.com

INTRODUCTION

The integration of multiple processes, such as planning, decision-making, memory, intention, motivation, and goal, is necessary for motor development (McAllister and Lundeborg 2013). Motor milestones are frequently used to evaluate gross motor development, but fine motor skills, like oral-facial skills, have been neglected (Kumin 2015). Orofacial skill is the ability to move facial muscle structures, including lips, jaw, tongue, and mouth (Chu et al. 2016). The neuromuscular system's complex and integrated activities are what cause oral movements (Arvedson et al. 2019). Factors that impact them include muscle tone, muscle strength, range of motion, speed, coordination, and motor differentiation (Miller 2009). Quality of life is greatly impacted by these movements as they are essential for activities like breathing, eating/swallowing, and social interactions like speech, facial expressions, and emotional communication (Kakodkar and Schroeder, 2013).

The nervous system and orofacial structures develop rapidly during the early years of life (Carrau et al. 2016). Orofacial dysfunction can often occur in many genetic and congenital disorders, or it may result from trauma or disease (Groher and Crary, 2015). The impact of orofacial dysfunctions on vital and communication activities and the quality of life make it imperative to evaluate and determine the appropriate treatment method (Miller 2009; Kakodkar and Schroeder, 2013; Bakke et al. 2007).

Thus it is crucial to have a tool to evaluate oral-motor skills to diagnose and treat people with this kind of dysfunction (Murry et al. 2020). Bakke et al. (2007) developed the Nordic Orofacial Test-Screening (Not-S) in 2007 with the help of dental professionals and speech-language pathologists as a comprehensive screening tool for orofacial dysfunction. The function of trigeminal, facial, glossopharyngeal, and sublingual nerves is evaluated by this test, which records speech problems and chewing and swallowing skills in persons older than 3 years of age (Bergendal et al. 2014)). Additionally, it identifies orofacial dysfunction resulting from functional damage and distinguishes those with disabilities of various severities from healthy individuals (Lundeborg 2009). Furthermore, it can be employed to evaluate the result and progress of treatment following adenoid surgery (Bueno et al. 2015). This test is advantageous also because it can determine the most appropriate treatment for any type of orofacial defect (Bakke et al. 2007).

Leme et al. (2012) conducted a translation of this test into the Brazilian language and assessed the oral-facial performance of 197 Brazilian girls and 135 boys between 8 and 14 years. This version of the NOT-S test was found to be suitable for use in Brazilian children. Gonçalves et al. conducted the test on 64 children and adults aged 4 to 19 years, 31 of whom had cerebral palsy, and 33 of whom were normal, as a control group, after translating it into Latvian to verify its psychometric properties (Gonçalves et al. 2017). The items had a favorable internal consistency (α=0.8), inter-rater agreement, and stability type reliability (test-retest) (Gonçalves et al. 2017; Coughran & Sidell, 2023). The construct validity of the two groups was validated by a statistically significant difference between the control group and the research group (Gonçalves et al. 2017). The NOT-S test has also been examined in adults with progressive neurological disorders, finding that in patients with moderate to advanced severity of Parkinson's disease, chewing skills and orofacial function are damaged (Bergendal et al. 2014; Bakke et al. 2007). As the disease progressed, orofacial and dental problems became more noticeable, leading to a higher overall score of NOT-S, increasingly considered to be a standard tool for evaluating oral-facial dysfunction (Bergendal et al. 2014; Bakke et al. 2007; Strini et al. 2011). Not-S is thus a comprehensive tool for screening oral function that can be implemented quickly and without special tools by specialists.

However, it is currently not widely used in Iran. Thus the purpose of the present research project was to create a Persian version of Not-S and determine its validity, reliability, and psychometric traits.

METHODS

The current study utilized a descriptive-analytical approach to examine the validity and reliability of a Persian version of Not-S in children aged 3-6. The participants included 25 children with oral-facial disorders aged 3 to 6 who were referred to the rehabilitation department of Shafizadeh Amirkola Children's Hospital who met the conditions for entering the study, and 30 normal children aged 3-6 from kindergartens in the city of Babol.

This research includes three main parts: translation, validity, and reliability of the test. After preparing the test and receiving approval from the author, translation and re-translation were performed according to the translation and equivalence protocol of IQOLA (International Quality of Life Assessment Project) (Aaronson et al. 1992). The process involved translating into Persian, quality assessment, back translation, modification, and comparison of the original version with the Persian version, and coordination based on the content. Two translators, who were fluent in Farsi and had the necessary knowledge to translate English texts, independently translated the English version of the test for this purpose. The emphasis during this stage was on the conceptual similarity of the words, phrases, and sentences in the test. A Persian version of NOT-S was found to be appropriate and approved after a meeting with the translators and researchers of the study. An independent translator translated the Persian version back into English. During several meetings with the researcher and translators, it was confirmed that the obtained English version was the same conceptually as the original English version.

To determine validity, it was necessary to examine both the formal and content validity of the test. The quantitative determination of face validity was accomplished by asking 9 speech and language pathologists, 4 dentists, and 3 nurses to rate each question/item on a 5-point scale. An effect score of above 1.5 indicates that the item has strong face validity and is easy to comprehend, simple, expressive, and fluent for the sample group. Items with effect scores that were higher than 1.5 were retained, while those with effect scores lower than 1.5 were adjusted and reviewed again to reach the minimum score.

The purpose of content validity is to verify the representation, relevance, and comprehensiveness of the

measured concept. The use of content validity index (CVI) and content validity ratio (CVR) was based on the opinions of the aforementioned experts to quantitatively prepare content validity. The CVI was checked by these experts by examining the criterion of relevance in a 4-point Likert spectrum. The experts were asked to rate each item's relevance based on the relevant subcategory. They were given the questionnaire to score the items according to how necessary it was to include them in the tool so that the content validity ratio could be calculated. Based on the Likert scale, the scores for this section were determined, and the responses included either 1-- It is necessary, 2-- It is useful, but not necessary, or 3-- It is not necessary.

If the number resulting from the calculation of the content validity ratio (CVR) for each item, based on the number of experts in the sample group (16 people), was equal to or greater than the number in the Lawshe Table (0.49), the presence of the item with a statistical significance level of 0.05, was considered essential and important in this tool. The reliability of the test was evaluated using test-retest (testing the same 3-6 year old participants twice with a one-week interval following the first test) and internal consistency.

The inclusion criteria for the study included: 1) age range of 3-6 years; 2) absence of mental problems, acquired, genetic, congenital disorders, and chronic diseases. After receiving written informed consent from the children's parents and verifying the inclusion and exclusion criteria of the study, the test was carried out on 3 to 6-year-old children with orofacial and normal developmental disabilities who were eligible to participate in the study.

The NOT-S test is divided into two sections: structured interview and clinical assessment, with each section containing 1 to 5 items that demonstrate the complexity of specific performance. The field of structured interview encompasses sensory function, breathing, habits, chewing and swallowing, drooling, and dry mouth. Clinical evaluation encompasses facial expression, masticatory muscle and jaw function, and function. The interview questions were orally read and explained by the speech and language pathologist prior to the clinical evaluation portion of the test. This test was executed with the help of parents or anyone who was fully aware of the child's condition. When an assignment question has the criterion of impaired performance, the item is recorded as 'yes'. The total score was between zero and 12, and if several questions were given positive scores in one section, the highest score was one. The interview segment for parents took around 10 minutes, while the clinical assessment segment for healthy children took 5-10 minutes, and the assessment segment for children with oral-facial disorders took 10-15 minutes. Data analysis was conducted using SPSS version 24. Cronbach's alpha coefficient and intra-cluster correlation (ICC) were employed as the statistical methods.

All participants had given their written consent to participate in the study, and the data collection procedure was approved by the Ethics Committee of Mashhad University of Medical Sciences (IR.BUMS.REC.9705130).

RESULTS

This research, there were 55 children between the ages of 3 and 6, with 30 orofacial dysfunction subjects (28 boys and 2 girls), and 25 orofacial dysfunction subjects (10 girls and 15 boys), with an average age of 98.4.4, and a standard deviation of 1.42.

Orofacial dysfunction participants were divided into 7 groups: Down syndrome, cerebral palsy, adenoid disorder, microcephalic, developmental delay, ectodermal dysplasia, and Opert syndrome. The demographic information of the participants according to the type of disorder is shown in Table 1.

Table 1. Demographic information of the participants according to the groups with different disorders and without disorders

Groups	Number	Average age (standard deviation)	Gender	
			Girl	Boy
Without disorders	30	4.5 ± 1	2	28
Down syndrome	5	5 ± 0.7	2	3
Cerebral palsy	5	4/4 ± 1.1	1	4
Adenoid disorder	4	6 ± 1.15	2	2
Developmental delay	5	6.4 ± 2.07	4	1
Microcephalic	4	7 ± 1.82	1	3
ectodermal dysplasia	1	4	-	1
Opert syndrome	1	4	-	1

In order to investigate the face validity in a quantitative way, 9 speech and language pathologists were asked to rate each item from 1 to 5 based on importance. Then the effect score of each item was calculated. The results showed that the effect score of all items is higher than 2.52.

The CVI values of each item were higher than 81%. (The acceptable limit of individual CVI for each item should be above 79%). The CVR values of all items were found to be above 50%, values above 49% being acceptable according to the Lawshe Table. Therefore, the presence of all items with a statistical significance level of 0.05 in this tool is necessary.

To check internal consistency, we first used Cronbach's alpha coefficient, which was 0.77 for the whole test, 0.71 for the clinical evaluation subscale, and 0.56 for the interview subscale. All of these values are within the desired range, and considering that the total test coefficient is higher than 0.7, the questionnaire has acceptable reliability.

Second, we repeated the test to one group of subjects a week later. Table 2 shows the test-retest reliability results.

As shown in Table 2, the intra-cluster correlation (ICC) of the interview section was 0.998 and the evaluation section was 0.948. Also, the lower limit of the confidence interval of this coefficient in the interview and clinical evaluation section was calculated as 0.99 and 0.91, respectively, which according to Landy and Koch's classification, is in the range (excellent) (P=0.0001).

Table 2. The results of the intra-cluster correlation coefficient according to the two subscales of the Nordic Orofacial Test-Screening interview and clinical evaluation of the in children aged 3-6 in Babol city.

Subscale	Measurement steps	Internal correlation (ICC)	Confidence interval 95%		Degree of freedom 1	Degree of freedom 2	*p* value
			upper limit	lower limit			
Interview	In one step by averaging repeated measurements	0.998	0.999	0.997	54	54	0.000
Clinical assessment	In one step by averaging repeated measurements	0.948	0.97	0.911	54	54	0.000

DISCUSSION

As in other fields, evaluation methods in the field of speech and language are best done by means of standardized tools. In order to prepare such tools, researchers have always been looking for the construction or translation of tools that have been proven to be suitable. The purpose of this research was to investigate the validity and reliability of the Persian version of the Nordic Oral-Facial Screening Test. The NOT-S test includes two fields of structured interview and clinical evaluation, each field has 6 sections and each section contains 1 to 5 items. The field of structured interview includes parts of sensory function, breathing, habits, chewing and swallowing, drooling and dry mouth, and the field of clinical evaluation includes face at rest, breathing through the nose, facial expression, masticatory muscle and jaw function, function. It is a verbal movement and speech. Many evidences in the world have shown that this test is a standard tool for evaluating oral-facial function in different age and gender groups and in all types of oral-facial disorders. This tool can accurately identify oral-facial problems and is considered standard in the field and should be followed by timely referral to relevant specialists (McAllister and Lundeborg, 2013; Bergendal et al. 2014; Lundeborg et al. 2009; Leme et al. 2012; Bakke et al. 2011; Strini et al. 2011; Gonçalves et al. 2017). Currently, there is no valid test for examining oral-facial problems in the country, and therefore, the need for such a test is felt to evaluate and diagnose patients with oral-facial problems, as well as research in this field. We have tested a translation of this tool into Farsi In the present study, the standardization of this test was done in three stages: translation, checking the validity and checking the reliability of the translated version. The translation of the test was based on the translation and equivalence protocol of IQOLA (International Quality of Life Assessment Project), which included translation into Persian by two translators, quality assessment, back translation by a translator, modification and comparison of the original version with the Persian version and Coordination was based on content. Finally, a Persian version of the test was prepared with satisfactory translation quality. The next step included checking the form and content validity of the test. In order to determine the face validity in a quantitative way, 9 speech and language pathologists, 4 dentists and 3 nurses were asked to rate each question (item) in terms of importance based on a 5-point scale. The minimum score of the desired effect was 1.5, and the effect score of all items was estimated to be higher than 2.52. To determine content validity quantitatively, two methods of content validity index (CVI) and content validity ratio (CVR) were used with reference to the opinions of the above experts. In order to check the content validity index (CVI), the relevance of each item to the whole test in a 4-part Likert scale, and to calculate the content validity ratio, the necessity of each item in a 3-part Likert Scale was scored by experts. The results showed that the CVI values of each item were higher than 81% (the acceptable limit of individual CVI for each item is higher than 79%) and the CVR values of all items were higher than 50%. According to the values in the Lawshe Table, values higher than 49% are acceptable; and it can be concluded that the presence of all items with a statistical significance level of 0.05 in this tool is necessary.

After checking the form and content validity, the reliability of the test was determined by two test-retest methods (the test was administered twice on the same 3 to 6-year-old participants with a time interval of one week after the first administration) and internal consistency was determined. The test was performed on 25 children with orofacial dysfunction and 30 normal children aged 3 to 6 who met the conditions for entering the study. In order to check the test-retest reliability, the intracluster correlation coefficient statistical method was used, and Cronbach's alpha was used to check the internal homogeneity. The ICC of the interview scale was 0.998 and the clinical scale was 0.948. It can be concluded that this test has good stability.

In the reliability analysis of internal consistency, the Cronbach's alpha coefficient of the whole test was 0.77, the alpha coefficient of the clinical evaluation subscale was 0.7, and the interview subscale was 0.56. Therefore, considering that the coefficient of the whole test was estimated to be higher than 0.7, it can be concluded that this test has good internal consistency. The results obtained from the present study are consistent with the results of other studies in other languages (Bakke et al. 2007; Leme et al. 2012).

One of the limitations of this research is the limitation of the number of participants of each type of orofacial dysfunction. It is suggested that in future research, this test should be performed on a wider range of types of orofacial dysfunction and on a larger number of participants. In order to increase the validity of this test and complete the standardization process of this tool, it is suggested that in future studies, the construct validity of this tool should be checked through the statistical methods of exploratory factor analysis, confirmatory factor analysis and differential validity.

CONCLUSION

The aim of the current research was to translate and examine the psychometric characteristics of the NOT-S. This research was carried out in three stages: translation, validity determination, and then test reliability. The results of this research showed that the Persian version of the NOT-S is a valid and standard tool for examining the orofacial dysfunction in children with facial oral dysfunction. This test can be used by therapists and researchers to evaluate and

diagnose orofacial dysfunction and make accurate and quick referrals to specialists for treatment planning as well as research in the field of orofacial dysfunction.

AUTHOR CONTRIBUTIONS

SG: Conceptualization, Methodology, Supervision, Writing - Review & Editing. HH: Data Curation, Formal Analysis, Visualization. PB: Investigation, Writing – Original Draft. TA: Resources, Data Curation. SK: Project Administration, Writing - Review & Editing. All the authors read and approve the final version for publication.

CONFLICT OF INTEREST

The authors declare that they have no other potential conflicts of interest.

DATA AVAILABILITY STATEMENT

All data generated or analyzed during this study are included in this article [and/or] its supplementary material files. Further inquiries can be directed to the corresponding author.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES IN SCIENTIFIC WRITING

Nothing to disclose.

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