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ORIGINAL ARTICLE

The reliability and validity of the Turkish version of the Facial Disability Index

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ABSTRACT

Purpose: To translate and cross-culturally adapt the Turkish version of the Facial Disability Index (FDI) and evaluate its psychometric properties, including reliability and validity.

Methods: Translation of the original FDI was followed by international guidelines. Paralysis classification was evaluated with House-Brackman Rating System (HBGS). Patients completed Short Form-36 (SF-36) along with the Turkish version of the FDI and refilled the Turkish FDI one week later. Internal consistency and test–retest reliability were analyzed using Cronbach's alpha coefficient and intraclass correlation coefficient (ICC), respectively. Construct validity was assessed by calculating the Spearman's correlation coefficient. Also, exploratory factor analysis was carried out by identifying the factor structure of the scale.

Results: After the pre-test of the Turkish FDI, there was no need for linguistic and cultural adaptation. The internal consistency of the physical function subscale was high (0.82). The social/well-being subscale's Cronbach alpha (0.63) was within the acceptable range. Test–retest reliability was excellent (ICC of physical function = 0.91 and social/well-being = 0.93, $p < 0.05$). The physical function subscale was correlated with the PF subscale of SF-36 and HBGS ($r = -0.837$ and 0.292, respectively; $p < 0.05$). Besides, the social/well-being function subscale was correlated with HBGS and all subscales of SF-36, except RP ($p < 0.05$). Factor analysis results of the Turkish FDI were similar to the other version studies.

Conclusion: The Turkish version of the FDI is a valid and reliable questionnaire in patients with peripheral facial paralysis.

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KEYWORDS
Facial Disability Index; facial paralysis; reliability; Turkish version; validity

➤ IMPLICATIONS FOR REHABILITATION

- The Turkish version FDI is the first Turkish tool translated cross-culturally adapted for specific assessment of facial paralysis.
- The Turkish version of the FDI is a valid and reliable questionnaire and can be used in all native Turkish speaking patients in peripheral facial paralysis.
- This assessment tool can be used in clinical routine and research settings to evaluate facial paralysis.

Introduction

Peripheral facial paralysis is caused by lower motor neuron paralysis due to lesion in any of the facial nerves and its pathways. This may result, total or partial, sensory, and motor loss of the facial muscles [1,2]. The most common form of the pathology is "Bell's palsy." Bell's Palsy is an idiopathic and acute peripheral facial paralysis that usually affects one side of the face. The clinical condition varies due to the course of the lesion on the facial nerve across the muscle [3]. Epidemiological studies have shown that the annual incidence ranges from 11.5 to 53.3 per 100 000 people according to data obtained from individuals in different age groups [4]. It is seen equally among women and men. Also, it is more common in middle-aged and elderly individuals [5].

Peripheral facial paralysis brings various functional and social limitations along with facial cosmetic problems [6–8]. Physical symptoms such as contracture, spasm, eye irritation, excessive lacrimation and facial pain may occur [3,9]. In addition to the carrying out of vital activities such as eating and drinking, there are disabilities in the use of communication forms such as speaking, mimic and emotional self-expression [7,10]. As a result of negative symptoms such as facial asymmetry and synkinesis, individuals' social communication becomes inadequate and their participation in daily life activities and other activities is affected. As a result, quality of life decreases, anxiety and depression may occur with social isolation [11–13]. When clinical symptoms are considered holistically, it is seen that all aspects of the quality of life of individuals are affected [14,15]. Given all these conditions in facial paralysis, subjective assessment of disability and quality of life with Patient-Reported Outcome Measures (PROMs) should be a questionnaire that will focus specifically on facial problems. In other words, this assessment tool should be capable of evaluating the individual in terms of facial symptoms both physically and socially [16,17].

A few assessment tools have been developed for the evaluation of peripheral facial paralysis [16,18,19]. Some of these tools subjectively assess the individual in terms of physical and social aspects and show how their pathology affects their quality of life. In 1996, Facial Disability Index (FDI) was developed by

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physiotherapists at the Facial Nerve Center at the University of Pittsburg. This questionnaire subjectively evaluates the limitations of individuals with facial palsy by a total of 10 questions. 1–5. questions address physical limitations and 6–10. questions assess social limitations [16].

FDI is one of the most frequently used questionnaires for the evaluation of patients with peripheral facial paralysis. The questionnaire was found to be reliable and valid as a functional evaluation tool in patients with facial neuromuscular system disorder. FDI has 6 version studies to date: French, German, Italian, Brazilian Portuguese, Spanish and Swedish [15,17,20–23]. Considering the lack of a Turkish PROMs that can be used in the subjective evaluation of facial paralysis patients, and also using such questionnaires without cultural adaptation is incorrect in terms of methodology, this study is of great importance. It has been emphasized that while using such PROMs the items must not only be translated well linguistically, but also must be adapted culturally to maintain the content validity of the instrument. This is an essential procedure for the level of evidence of the study [24]. A standardized tool for facial paralysis patients to provide a better quality of life assessment will provide communication between healthcare professionals and patients in the diagnosis and follow-up process. The aim of the study was to translate and culturally adapt the FDI into the Turkish language and to evaluate the psychometric properties of the translated questionnaire.

Materials and methods

Translation and adaptation process

The translation and adaptation process of Turkish FDI was created with international guidelines for translation and cross-cultural adaptation of outcome measures [24,25]. The written permission for the translation and adaptation for the Turkish version of FDI was obtained from the American Physical Therapy Association (APTA). The process first required the questionnaire to be translated from English to Turkish by at least two bilingual translators whose native language is Turkish. At this stage, translators give their opinions on the difficulties of the survey. If there are compelling statements or uncertainties, they prepare a justified written report about this. The English version of the questionnaire was translated into Turkish independently by the translation committee members consisted of four physiotherapist academicians whose native language was Turkish and who were fluent in English. One of the translators did not have a medical or clinical background. This procedure ensures that different interpretations of the items in the original questionnaire are detected with uncertain meanings. Following that, a panel of the forward translators held a meeting to discuss the discrepancies between the translations. These translated four versions were compared and evaluated by the committee members taking into account the Turkish socio-cultural and linguistic characteristics. As a result, they agreed upon a synthesized version of the Turkish FDI that was accurately representing the original English FDI. The scale was back-translated by a native English translator who was blind to the original version. The purpose of this back-translation phase of the translation process was to confirm equivalency in the meaning and concepts between the original FDI and translated Turkish FDI. Back translation is only one type of validity examination, highlighting mostly gross inconsistencies or conceptual mistakes in the translation. Finally, the original FDI and back-translated version were compared by examining correspondence to ensure that the Turkish version was conceptually equivalent and reflecting the same item content as the original version. The aim of this stage is to integrate all the versions of the questionnaire and develop what would be regarded as the pre-final version of the questionnaire for the pilot study. This version was tested on 20 randomly selected individuals whose native language was Turkish to identify comprehensibility. This process provides some quality measurement in terms of content validity. The participants were asked to score the intelligibility of the Turkish FDI on a 5-point Likert scale and were allowed to ask questions for clarification. Also, if there is a problem in terms of intelligibility for each item, they were specifically asked to indicate this. The translation committee then held a final meeting and addressed the necessary changes based on the feedback from the participants to produce the final Turkish FDI. It was agreed by the committee that there is no part of the questionnaire that needs to be adapted to Turkish culture. The last version was created (Appendix 1).

Sample size estimation

The sample size is determined by the general principles and recommendation of Altman used in comparison studies which require at least 50 data usage [26]. A total of 51 patients were included in the study. In order to examine test–retest reliability, 35 subjects were retested after a 1-week interval from the first test. The required sample size was calculated using the G*power 3.1 program based on an effect size of dz = 0.5, an error probability of 0.05, and statistical power of 0.80 [27,28].

Study design

Our study was carried out on 30 months period from June 2017 to December 2019 prospectively. The study was conducted in the Otolaryngology Polyclinic Clinic of Muğla Sıtkı Koçman University Training and Research Hospital with patients diagnosed with peripheral facial paralysis. The inclusion criteria of the study were; Turkish literate persons, age 18 years or older, and history of peripheral facial paralysis. The exclusion criteria of the study were; individuals with poor cognitive function or poor reading skills, individuals with primary facial dysfunction other than Bell's Palsy, and individuals who refuse to sign the consent form.

Socio-demographical, physical and clinical characteristics of the patients were recorded. Firstly, the Turkish version of FDI was tested for the initial assessment. One week after the first evaluation patients were asked to refill the Turkish FDI for the reproducibility analyses. FDI is a 10-item questionnaire: the first 5 items question physical function and the last 5 items assess social/well-being functions. The questionnaire has subscales of physical and social/well-being function. The physical subscale contains questions about eating, drinking, speaking, lacrimation and oral hygiene. The social/well-being subscale investigates problems related to social participation and sleep problems, as well as subjective views on anxiety, social isolation and irritation. Both subscales were scored with a 6-point Likert-type items. These response items range from the most severe disability to the absence of disability. Each sub-score obtained by the summing of these items is converted to 100-point scale. The physical function subscale scores between -25 (worst) and 100 (best), while the social/well-being subscale scores between 0 (worst) and 100 (best) [16].

Paralysis classification of patients was evaluated with House-Brackman Rating System (HBGS). In this 6-level grading system, the severity of facial paralysis ranged from 1 (no paralysis) to 6

Table 1. The characteristics of the patients.

	Total ($n = 51$)
Age (years, mean ± SD)	46.7 ± 17.1
Gender (*n*, %)	
Female	26 (51)
Male	25 (49)
PFP duration (months, mean ± SD)	3.53 ± 3.50
Education	
Primary school (*n*, %)	14 (27.5)
Middle school (*n*, %)	6 (11.8)
High school (*n*, %)	13 (55.5)
University or higher degree (*n*, %)	18 (35.3)
Residence	
Urban (*n*, %)	39 (76.5)
Rural (*n*, %)	12 (23.5)

SD: standard deviation; *n*: number of patients; PFP: Peripheral facial paralysis.

Table 2. Average values (standard deviation, min-max) for the Turkish FDI, HBGS and SF36.

$n = 51$	Mean ± SD	Range
T-FDI		
Physical subscale	51.84 ± 17.15	(24–80)
Social/well-being subscale	63.92 ± 20.83	(18–100)
HBGS	2.78 ± 1.04	(1–5)
SF-36		
Physical function (PF)	81.86 ± 24.33	(0–100)
Role limitations due to physical health (RP)	72.54 ± 41.60	(0–100)
Bodily pain (BP)	67.99 ± 28.69	(0–100)
General health (GH)	65.88 ± 19.53	(20–95)
Energy/Vitality (VT)	55.88 ± 23.27	(5–100)
Social function (SF)	77.00 ± 27.84	(0–100)
Role limitations due to emotional problems (RH)	64.70 ± 44.43	(0–100)
Emotional well-being (MH)	62.50 ± 23.15	(12–100)

SD: standard deviation; *n*: number of patients; T-FDI: Turkish version of FDI.

(total paralysis) [29]. All participants completed the Turkish version of SF-36 (Short Form-36) [30].

HBGS and the Turkish version of the SF-36 were chosen because they are generally used to assess FDI patients. HBGS is an internationally recognized grading system for the evaluation of facial function. Studies are showing that it is valid and reliable in both scales [29].

Statistical analysis

For all the statistical analyzes, SPSS for Windows v20.0 (SPSS Inc, Chicago, IL, USA) computer program was used. Quantitative variables were presented as mean ± standard deviation (X ± SD) and qualitative variables percent (%). The confidence interval of 95% was accepted. Minimum and maximum scores of individual items and the total value of the subscores were examined for possible floor or ceiling effect. If more than 15% of the participants achieved a minimum or maximum score, the presence of a floor or ceiling effect could be mentioned.

Reliability

Internal consistency was measured using the Cronbach's alpha coefficient. The Cronbach's alpha coefficient was calculated for the 2 subscore of the questionnaire (physical, social) separately. Also, the assessment of internal consistency demonstrated by the calculation of the inter-item and the corrected item-total correlations for the different FDI items, as well as the Cronbach's alpha coefficient. The intraclass correlation coefficient (ICC) was used to assess test–retest reliability. Two-way random-effect model single-measure reliability analysis was used. The ICC was calculated for each item and subscores.

Validity

Construct validity of the scale was assessed by calculating the Spearman's correlation coefficient between the subscores of the Turkish FDI with HBGS and subscores of the SF-36. For the analysis of convergent validity in the physical function subscale, the correlation between Turkish FDI's physical function subscore, HBGS, and SF-36's related subscores was examined. The analysis of convergent validity in the social/well-being function subscale, the correlation between Turkish FDI's social/well-being function subscore and SF-36's related subscores were considered. A high correlation coefficient for the convergent, and a low correlation coefficient for the discriminant validity were expected.

Exploratory factor analysis (principal component analyses with varimax rotation) was carried out to explore the construct validity of the Turkish FDI by identifying the factor structure of the scale. The Kaiser–Meyer–Olkin (KMO) test was used to measure sample adequacy and the Bartlett test of sphericity was used to examine the correlation matrix that the sample size is adequate for factor analysis.

Results

A total of 51 patients (46.7 ± 17.1 years) were included, 26 women (51%), 25 men (49%). The socio-demographic, physical and clinical characteristics of the patients are given in Table 1. The absolute values of the Turkish FDI, HBGS and SF36 scales are given in Table 2. No floor and ceiling effect were observed for the subscales of the Turkish FDI. In the pilot study for the Turkish version, all parts of the questionnaire were found to be intelligible. After the pre-test of the Turkish FDI, there was no need for linguistic and cultural adaptation.

Reliability

The Cronbach's alpha coefficient was calculated for the subscores of the questionnaire; Internal consistency of physical function of the Turkish FDI was high (0.82). The social/well-being subscale's Cronbach alpha (0.63) value was above 0.60 and was within the acceptable range [31]. Test–retest evaluation of the Turkish FDI was performed by calculating the ICC coefficient of two subscores of the scale. The ICC scores of the physical function and social/well-being subscales were 0.91 and 0.93, respectively. The ICC scores of all items (except item 10) were over 0.80. Test–retest reliability was excellent and both the subscales and items were suitable for reproducibility (Table 3).

Validity

Correlation coefficients between the subscores of the scales are given in Table 4. The physical function subscale was correlated with the PF subscale of SF-36 and HBGS ($p < 0.05$). Besides, the social/well-being function subscale was correlated with HBGS and all subscales of SF-36 except RP.

Construct validity was also examined using factor analysis. Sample adequacy was assessed before factor analysis. The Kaiser–Meyer–Olkin (KMO) measure of sampling was 0.883, and the significance level of Bartlett's Test of Sphericity was less than 0.001. Table 5 shows the Turkish FDI items and their factor loading on PCA-derived scales. The extraction communality values were moderate to reasonably high (except for "item 6" and "item 9") and ranged from 0.435 to 0.795. Two factors were extracted

Table 3. Test–retest reliability for the subscores and items of the Turkish FDI.

$n = 35$	Test (Mean ± SD)	Retest (Mean ± SD)	ICC (95% CI)
Item 1	3.48 ± 1.09	3.31 ± 1.10	0.86 (0.75–0.93)
Item 2	3.60 ± 1.11	3.57 ± 1.11	0.80 (0.64–0.89)
Item 3	3.97 ± 0.85	3.85 ± 0.84	0.84 (0.71–0.92)
Item 4	3.02 ± 0.98	3.05 ± 1.05	0.84 (0.71–0.91)
Item 5	3.40 ± 1.24	3.34 ± 1.18	0.88 (0.77–0.93)
Item 6	3.17 ± 1.59	3.17 ± 1.58	0.91 (0.84–0.95)
Item 7	4.85 ± 1.61	4.62 ± 1.53	0.86 (0.75–0.93)
Item 8	4.08 ± 1.63	4.00 ± 1.49	0.87 (0.77–0.93)
Item 9	3.68 ± 1.64	3.68 ± 1.62	0.89 (0.79–0.94)
Item 10	3.97 ± 1.31	3.85 ± 1.19	0.78 (0.60–0.88)
Physical function	62.42 ± 19.97	60.71 ± 20.36	0.91 (0.83–0.95)
Social/well-being function	59.08 ± 17.70	57.37 ± 17.59	0.93 (0.86–0.96)

n: number of patients; ICC: intra-class correlation coefficient; CI: confidence interval.

Table 4. Correlation between HBGS and SF-36 with T-FDI.

$n = 51$	Physical function (*r*)	Social/well-being function (*r*)
HBGS	−0.837**	−0.355*
SF-36		
Physical function	0.292*	0.378**
Role physical	0.049	0.154
Bodily pain	0.221	0.329*
General health	0.261	0.283*
Vitality	0.143	0.485**
Social function	0.336*	0.418**
Role emotional	0.071	0.449**
Mental health	0.232	0.580**

*$p < 0.05$; **$p < 0.01$. T-FDI: Turkish FDI.

Table 5. Factor loadings.

$n = 51$	Factor 1	Factor 2
Item 1	0.888	−0.080
Item 2	0.803	0.181
Item 3	0.631	0.192
Item 4	0.608	0.466
Item 5	0.752	0.038
Item 6	0.406	0.452
Item 7	0.293	0.609
Item 8	−0.002	0.858
Item 9	0.022	0.530
Item 10	0.698	0.338

n: number of patients; factor 1: physical subscale; factor 2: social/well-being subscale; extraction method: principal component analysis; rotation method: Varimax with Kaiser normalization.

with eigenvalues of 1 accounting for 55.06% of the variance: first factor (physical subscale) and the second one (social/well-being subscale). The last item (10) of the FDI, was loaded on factor 1. The other items (6–9) of the social/well-being subscale were loaded on factor 2. All items of the physical subscale were loaded on factor 1. This analysis confirmed that the items included in the physical subscale formed a homogeneous group, clearly apart from the social well-being subscale. Table 2 shows the separation between the first factor (physical subscale) and the second one (social/well-being subscale).

Discussion

In the present study, the Turkish version of the FDI was proved to be valid and reliable for the assessment of Turkish speaking patients with peripheral facial paralysis. The study was successfully completed in accordance with the purposes. Since the cross-cultural adaptation process was carried out by considering both linguistic and cultural factors, an essential questionnaire was introduced for a more efficient assessment process in Turkish speaking facial paralysis patients. This adaptation study has been a valuable study considering the absence of Turkish assessment tools to evaluate facial functions and the need in this field. The translation and adaptation of the FDI into Turkish is important in terms of enabling the native Turkish speakers who live in other European Union countries with a population of around three million, besides the people living in Turkey [32].

Specific instruments are needed to measure the health-related quality of life of patients with facial paralysis. In order to evaluate the facial function and its effects on social life accurately, scoring with questions regarding specific symptoms is essential in terms of qualifying the clinical status. SF-36, which is frequently used in the evaluation of facial paralysis patients, addresses the overall quality of life of patients. Considering that SF-36, which evaluates the patients comprehensively in 8 sub-dimensions, may not be able to examine the quality-of-life caused by disease-specific findings, the importance of disease-specific PROMs becomes apparent. We believe that translating and adapting such a questionnaire is important for demonstrating the quality of life and functional status of the Turkish speaking PFP patients, specifically. Besides, FDI has a 6-point Likert system that enables patients to respond to the questions easily. It also is practical in clinical routine.

In our pilot study, understanding and completion were tested. Our translated version did not require any modification. Pilot study results showed that the questionnaire was suitable for clinical use in terms of intelligibility and that patients could understand the items of Turkish FDI. Pilot studies have not been conducted only in German and Italian versions [22,23]. Similar to our study in the French, Swedish version, no change was carried out [15,17]. It is emphasized that some corrections are carried out in the third and ninth questions for the study of the Brazilian Portuguese version [21]. In the Spanish version, changes were made in item one and item four during adaptation procedures before pretest [20]. It is stated that the changes made in both Spanish and Brazilian Portuguese versions are conceptual minor corrections aimed at the patients to understand the questions better. In this way, they obtained fewer confusing items and expressed more clearly the physical disorder that they attempted to measure. However, considering only the small changes made in these two studies, it is seen that FDI is considered to be adequate in terms of ease of understanding and completion. These pilot studies are generally carried out with low sample sizes. There is no statistical analysis that takes into account the characteristics and socio-demographics of individuals. Also, considering the patient groups with different cultural levels living in the same country, we think that pre-test stage of the cultural adaptation can be evaluated more comprehensively with the multi-centered samples.

We performed our Turkish version study in patients with peripheral facial paralysis. Likewise, to our study, the original development study conducted with PFP [16]. Also, in French and Swedish version studies, PFP patients included in the study [15,17]. Italian, Brazilian Portuguese and German versions stated that facial paralysis patients were included [21–23]. In the Italian version, most patients were diagnosed with chronic facial paralysis and only 18% had acute involvement, while the Spanish version included individuals with facial paralysis after "superficial parotidectomy" [20,22]. Turkish FDI is suitable for the use of patients with peripheral facial paralysis evaluated and treated in neurology, otolaryngology, and physical therapy and rehabilitation clinics. Another validation study will be more normative for use in different types of facial paralysis as a central nerve origin or complication after specific surgery. Considering that different facial

neuromuscular disorders cause different sensory and motor symptoms and may affect different social functions indirectly, psychometric properties of the questionnaire should be examined in different case group and responsiveness to treatment should be evaluated with different methodological designs. Namely, it would be more appropriate to carry out a validation study in patients with central nerve affected facial palsy before using this questionnaire. In our study, no major floor or ceiling effect was observed for the minimum and maximum scores for the subscales of the Turkish FDI subscores. Similar results were found in the Italian and Swedish versions, where the effect of floor and ceiling were evaluated for both subscores of FDI [17,22]. 15% of the participants did not display the worst or the best possible scores, respectively. PROMs, sometimes cannot precisely evaluate patient progression and the functional and social improvements achieved with treatment due to the ceiling effect. No ceiling effect in FDI indicates that the evaluations will be more rational and therefore, a questionnaire that can be used more effectively for patient follow-up.

According to our analysis results, the internal consistency of the physical function of the Turkish FDI was high (Cronbach's alpha $>$ 0.80). This demonstrated that all the items on the Turkish FDI were strongly correlated to assess the symptoms, functional limitations associated with quality of life. Social/well-being subscale's Cronbach alpha value was above 0.60 and was within the acceptable range. Patients may be confused in these questions because these activities may be affected in different ways at different times due to both their psychological and physiological symptoms. Since the physiological and psychological symptoms can also affect functional and social influences in different ways, the Cronbach's alpha score of the social function may be slightly low. For this reason, it may be more beneficial for clinicians to make additional explanations about the 9th and 10th items to patients while completing the Turkish FDI. Considering the low number of items in the questionnaire (5 items for both subscores), it can be interpreted that the Cronbach's alpha level of social function was found to be sufficient for reliability. This result shows that the questionnaire is sufficient to compare the condition of a patient with facial paralysis and to monitor facial disability. In the German and Swedish versions, it was seen that both subscores were over 0.8 [17,23]. In the French version, it was observed that the social function score was 0.70 and similar to our study [15]. In the Spanish and Brazilian Portuguese version, the Cronbach's alpha value was calculated by if each item removed from the questionnaire. However, since the questionnaire did not have a total score, we did not find it appropriate to perform this analysis and analyzed the internal consistency for each subscale [20,21]. The original questionnaire development study and the Italian version study did not perform internal consistency analysis with Cronbach's alpha [16,22].

In our study, The ICC scores of the physical function and social/well-being subscales were 0.91 and 0.93, respectively. All studies except the German and Spanish versions were tested for repeat testing with ICC [20,23]. Test–retest reliability was excellent ($>$0.80) in most of the version studies of the FDI. It was seen that the scale was adequate in terms of reproducibility. The symptoms of patients with peripheral facial paralysis may change over time. For this reason, it is essential to evaluate the conditions of the patient more precisely and accurately. Therefore, test–retest reliability should be performed appropriately. If the time between test and retest is short, memory-related effects may occur, such as remembering the answers to the questions. However, if this time is too long, you could sometimes be measuring the actual change of the case instead of reliability. Accordingly, we repeated the tests with an interval of one week. The ICC values in the Brazilian Portuguese and Swedish versions were also calculated by the total score of the questionnaire [17,21]. We did not calculate the total score, hence made no statistical analyzes including total score. The reason for this is that there is no instruction about the total score calculation. As a matter of fact, some version studies were designed with a methodology similar to our study [15,17,22,23].

Construct validity was analyzed using factor analysis and correlation analysis in our study. Factor analysis confirmed that the items included in the physical subscale formed a homogeneous group, clearly apart from the social well-being subscale. Only the last item (10) of the FDI, was loaded on factor 1 (physical subscale). In our pilot study, although the ease of understanding of the 10th item (How often has your facial function kept you from going out to eat, shop, or participate in family or social activities?) was found to be excellent, our sample showed that the ICC score was below 0.80 and it was loaded on the physical function factor. This suggests that the individuals in our sample could not distinguish the question for physical function limitation and social function limitation, and may have been somewhat indecisive when answering. In general, Turkish FDI independently reveals the physical and social functions of facial paralyzed patients. Facial paralyzed patients may have both physical and social problems during the rehabilitation process. It is important for clinicians to address these issues independently and to observe their connection with each other. Because physical problems could be associated with social problems. The questionnaire's 9th and 10th items reveal this situation. For this reason, it may be clinically more beneficial to support Turkish FDI with a psychological assessment tool in practice that examines the psychological status of the patient more comprehensively. Factor analysis was performed in Spanish and Italian version [20,22]. There was a similarity of item loading except for the 10th in both studies.

In accordance with our hypothesis, the physical function subscale was correlated with the PF subscale of SF-36 and HBGS ($p < 0.05$). Besides, the social/well-being function subscale was correlated with HBGS and all subscales of SF-36 except RP. Considering social dysfunction is a combination of physical dysfunction and psychological problems, these results could be considered as expected and acceptable. Also, there was no "gold standard" questionnaire which has been cross-culturally adapted into Turkish to assess the quality of life in patients with facial disabilities. Therefore, the SF-36 was used as an alternative. Considering that SF-36 assesses the quality of life for the general body, a high correlation was not expected.

In contrast to the results of our study, there is no relationship between FDI subscores and HBGS in the German version. Also, both of the FDI subscores do not correlate with the mental and emotional subscores of SF-36 [23]. In the French version study, similar results were observed for correlation analysis with HBGS. Both subscores in the French version were correlated with all SF-36 subscores. The results of this analysis coincided with the results of our study [15]. In the Spanish version study, the correlation results were found to be consistent with our study. They performed comparisons with SF-36 and HBGS, likewise our study [20]. HBGS is a practical tool frequently used in the clinic for the rating of patients with facial paralysis. Therefore, it was an expected result to be compatible with the patient's functional status and quality of life. However, clinicians were able to depict the patient's status based only on stages with HBGS results. Since Turkish FDI is a tool that covers individual results more

comprehensively, it will provide an advantage for healthcare professionals who want to make detailed evaluations besides HBGS. In the Swedish version study, the degree of agreement was considered fair between the FDI subscores and the SF-36 subscores. Also, there was a correlation between the physical function subscale of the FDI with HBGS, but not in the social/well-being function subscale [17]. In Italian version study, Sunnybrook Facial Grading System (SFGS) and the 12-Item Short Form Health Survey (SF-12) were used for construct validity [22]. In the Brazilian Portuguese version, FDI and SF-36 subscores were found to be correlated between the similar mannered physical and social subscores [21]. We believe that the level of quality of life is a diverse concept in different societies with different cultures. Therefore, it is an acceptable result that different subscores were correlated with each other. The findings obtained from our study are generally conform with the literature examples given above confirms the construct validity of our study. We should also mention some limitations of the study. Responsiveness analysis was not performed in our study. Observing the change of HBGS with treatment, monitoring how FDI will respond to this treatment, as well as the correlation of HBGS and FDI in both pre-treatment and post-treatment could increase the value of the methodological study. Besides, "Facial Clinimetric Evaluation (FaCE)," another questionnaire used as a clinical assessment tool for facial paralysis of construct validity, was not used [33]. However, we should emphasize that we do not use this questionnaire since there is no Turkish version.

Implications and future directions

Turkish FDI is the first assessment tool adapted for patients with facial disability. Clinicians will be able to specifically evaluate the physical and social functions of patients with facial paralysis. HBGS provides clinical ratings only based on the clinician's observation. In addition to this assessment, measurement with subjective tools will be more clinically meaningful. Turkish FDI has a short, effortless, practical structure. In this way, the patient's condition can be quickly reported and archived. Thereby, the progress of the clinical condition can be monitored. PROMs are required to be used after being validated for a particular patient population. Turkish FDI will provide more precise and concise results than assessment tools that evaluate the overall quality of life. In addition, it will be valuable to validate the Turkish FDI for different types of facial paralysis patient populations in future studies.

In electronic medical record systems, the multi-disciplinary team can collaborate with standardized evaluation tools. Communication between healthcare professionals accelerates when evaluations made by different clinicians at different times are performed with these standardized tools. In addition, it is important that telerehabilitation and remote patient assessment can be made with these standardized tools. Symptoms of peripheral facial paralysis vary depending on time. For this reason, the clinician can see the progression related to the patient's condition by conducting a remote evaluation with the Turkish FDI. Documentation can be provided graphically with the scores of functional status related to facial paralysis obtained in the survey. Besides, by performing minimal detectable change (MDC) in future studies, it can be estimated whether the improvements in the patient's progression are clinically significant.

In future studies, performing responsiveness analysis of Turkish FDI through telerehabilitation will be valuable both to observe how the remote monitoring of facial paralyzed patients is managed with standardized tools and to control the changes that Turkish FDI responds to treatment. In summary, Turkish FDI is a useful tool for optimizing the rehabilitation process of the patient and increasing the communication between the patient and the clinician.

Conclusions

It was concluded that the Turkish version of the FDI is a valid and reliable questionnaire and can be used in all native Turkish speaking patients with peripheral facial paralysis. Our study is of great importance since there are no PROMs for the Turkish speaking patients that can be used in the assessment of facial functions and quality of life, specifically. This assessment tool can be used in clinical routine and research settings to evaluate facial paralysis. Subjective assessment of the physical and social functions of patients with PFP and management of the treatment program through these assessments will be significant for health professions in this area. In future studies, besides the validity and reliability of the questionnaire in individuals with other facial neuromuscular diagnoses, we think that it would be considered to perform a responsiveness analysis after physiotherapy and rehabilitation and other treatments for facial paralysis or paresis.

Ethical approval

Our study was conducted in accordance with the Helsinki declaration, taking the patient's consent within ethical principles. Permission has been obtained from concession holder, APTA (American Physical Therapy Association), for the Turkish translation of the FDI. The study protocol was approved by the local ethics committee (No: GO 17/153-14).

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Disclosure statement

No potential conflict of interest was reported by the author(s).

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Appendix 1

FASİYAL YETERSİZLİK İNDEKSİ (FYİ)

Lütfen yüz kaslarınızın fonksiyonu ile ilgili problemlerle alakalı aşağıdaki sorulara en uygun cevabı seçiniz. (Her bir soru için geçen aydaki fonksiyonunuzu göz önünde bulundurun.)

Fiziksel Fonksiyon

1. Yemek yerken yiyeceği ağzınızda tutmakta, yiyeceği ağız içinde hareket ettirmede ya da yanağınızda sıkıştırmakta ne kadar zorluk çektiniz?

Genellikle……yaptım.	Genellikle…….. yüzünden yemedim.
5- Zorluk çekmeden	1- Sağlığım
4- Azıcık zorlanarak	0- Başka sebepler
3- Biraz zorlanarak	
2- Çok zorlanarak	

2. Bardakla içerken ne kadar zorluk çektiniz?

Genellikle……yaptım.	Genellikle…….. yüzünden içmedim.
5- Zorluk çekmeden	1- Sağlığım
4- Azıcık zorlanarak	0- Başka sebepler
3- Biraz zorlanarak	
2- Çok zorlanarak	

3. Konuşurken bazı özel sesleri çıkarmada ne kadar zorluk çektiniz?

Genellikle……çıkardım.	Genellikle…….. yüzünden konuşmadım.
5- Zorluk çekmeden	1- Sağlığım
4- Azıcık zorlanarak	0- Başka sebepler
3- Biraz zorlanarak	
2- Çok zorlanarak, konuşmanın çoğunda yuvarlayarak	

4. Aşırı göz yaşarması veya göz kuruluğu ile ilgili ne kadar zorluk çektiniz?

Genellikle;	Genellikle……yüzünden yaşarma olmadı.
5- Hiç zorlanmadım	1- Sağlığım
4- Azıcık zorlandım	0- Başka sebepler
3- Biraz zorlandım	
2- Çok zorlandım	

5. Dişlerinizi fırçalamada veya ağzınızı çalkalamada ne kadar zorluk çektiniz?

Genellikle……yaptım.	Genellikle…… yüzünden dişlerimi fırçalamada veya ağzımı çalkalamada zorluk çekmedim.
5- Zorluk çekmeden	1- Sağlığım
4- Azıcık zorlanarak	0- Başka sebepler
3- Biraz zorlanarak	
2- Çok zorlanarak	

<u>İyi Olma / Sosyal Fonksiyon</u>

6. Zamanınızın ne kadarında kendinizi sakin ve huzurlu hissettiniz?

6- Her zaman	3- Bazen
5- Çoğu zaman	2- Nadiren
4- Epeyce bir zaman	1- Hiçbir zaman

7. Zamanınızın ne kadarında kendinizi etrafınızdaki insanlardan uzak tuttunuz?

1- Her zaman	4- Bazen
2- Çoğu zaman	5- Nadiren
3- Epeyce bir zaman	6- Hiçbir zaman

8. Ne kadar süre kendinizi etrafınızdaki insanlara karşı sinirli hissettiniz?

1- Her zaman	4- Bazen
2- Çoğu zaman	5- Nadiren
3- Epeyce bir zaman	6- Hiçbir zaman

9. Ne sıklıkla erken kalktınız ya da geceleri uykunuzdan birçok defa uyandınız?

1- Her gece	4- Bazı geceler
2- Çoğu gece	5- Birkaç gece
3- Birçok gece	6- Hiçbir gece

10. Yüzünüzün fonksiyonu sizi ne sıklıkla dışarıda yemeğe gitmekten, alışverişe çıkmaktan veya aile içi veya sosyal aktivitelere katılmaktan alıkoydu?

1- Her zaman	4- Bazen
2- Çoğu zaman	5- Nadiren
3- Epeyce bir zaman	6- Hiçbir zaman

Fiziksel Fonksiyon $$\frac{(\text{Toplam Puan (1-5. Sorular)} - N) * 100}{N * 5}$$

Sosyal Fonksiyon $$\frac{(\text{Toplam Puan (6-10. Sorular)} - N) * 100}{N * 4}$$

N: Cevaplanan soru sayısı