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Validation, Reliability and Repeatability of the Ocular Surface Disease Index (OSDI) Questionnaire in a Sample of the Palestinian Population: The Pa-OSDI

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Abstract

PURPOSE: To translate and validate a Palestinian dialect version of OSDI.

METHODS: The translation procedure included five stages; forward translation, revision of translation, backward translation, refinement of translation and finally test of the pre-final version. The final sets of questionnaires were constructed using an online JotForm platform. The online platform was chosen to automatically calculate the questionnaire's final overall score. Overall, 260 participants were instructed to fill out the English and the Pa-OSDI version twice to conduct the reliability of the translated version and repeatability evaluation.

RESULTS: The mean age of the participants was 33.45 ± 11.74 years. Cronbach's alpha for all domains was greater than 0.80, except the “blurred vision” and “deteriorating vision” domains (0.77 and 0.74 respectively). The mean overall score difference between the OSDI and Pa-OSDI was 0.86 based on the Bland-Altman chart. For repeatability, no significant difference in the overall scores between the two repeats of the Pa-OSDI ($p=0.632$). The outcome for the Pa-OSDI overall score (sessions 1 and 2) was a clinically difference (bias) of 0.21. By using the Varimax rotation method, only three factors (ocular symptoms, vision-related function, and environmental triggers) had eigenvalues greater than one in the structure of the Pa-OSDI.

CONCLUSION: The Pa-OSDI is an appropriate reliable and repeatable tool for the determination of dry eye symptoms, ocular discomfort and quality of life in the Palestinian dialect speaking population. This version could remove the language barrier in answering OSDI domains more easily.

KEYWORDS: OSDI questionnaire; Palestinian dialect version; dry eye syndrome; ocular discomfort

INTRODUCTION

Previous literature has revealed that the ocular surface disease index (OSDI) questionnaire is the best valid tool that is commonly used to screen populations for the assessment of dry eye disease (DED) [1-2]. Similarly, studies demonstrated that the OSDI is the essential criteria for evaluation of severity, and change of the functional quality of life in dry eye cases [3-4]. Currently, the questionnaire is one of the most common instruments for diagnosis of dry eye syndrome with comorbidities such as glaucoma, allergic conjunctivitis, blepharitis and bronchial asthma [5-7]. The OSDI has a good test-retest reliability, psychometric properties, concurrent validity and uses the Rasch analysis since its initial development [3-4, 8]. Studies conducted by Vitale et al. [9] and Simpson et al. [10] demonstrated significant correlations between the OSDI and other domains. For instance, the McMonnies questionnaire, the national eye institute visual function questionnaire (NEIVFQ-25), the dry eye questionnaire (DEQ), subjective evaluation of symptoms of dryness (SESoD), and the ocular comfort index (OCI). Indeed, the domain has been accepted as a dry eye item and was applied to find the possible risk factors of dry eye symptoms across the globe [11]. The questionnaire was translated and validated in many languages including Portuguese [12], Spanish [13], Bahasa Malaysia [14], Persian [1], Chinese [15], Filipino [16], Japanese [17] and classical Arabic [18]. However, one of the drawbacks of formal language is that it limited the reliability of the domain, particularly in populations with low literacy rate [19-20]. In Palestine, Shanti and co-workers revealed that 71% of a West Bank sample population was symptomatic [21]. In that report, the frequency of dry eye was recorded based on the original OSDI overall score. Therefore, the purpose of our report was to validate the translation of the OSDI to Palestinian dialect and its cultural adaptation in Palestine. Using the Palestinian OSDI (Pa-OSDI), it would be beneficial to apply this valuable instrument for clinical and research purposes among subjects with dry eye disease in Palestine.

SUBJECTS AND METHODS

Ethical Approval The validation study was approved by the Palestinian Health Research Council Helsinki committee (PHRC/HC/883/21, dated April 05, 2021). The participants were contacted through an online messaging platform (WhatsApp), phone call and text message to ask for their details and then filled out the consent, original, and translated Pa-OSDI online.

Study Design A cross-sectional observational study was carried out using a stratified sampling technique in four provinces (South Gaza, Mid-Zone, Gaza, and North Gaza) in Gaza Strip (Figure 1). This study was conducted between June and November 2021. The maximum sample size is the number of domains \times 20 described in the

literature [22]. Therefore, the appropriate sample size is 260 participants for this study. Adult subjects (aged 18 years old and above) were included. Those who were proficient in Arabic and English languages Palestinian graduates and undergraduates who passed the Arabic and English papers in their secondary education certificate examination in Palestine (Tawjihi) were included while non-Palestinians were excluded.

Development of Pa-OSDI Version

The Palestinian version of OSDI was designed similarly to the original English version. It consists of 12 questions in three subscales “ocular symptoms (5 questions), “vision-related (3 questions) and “environmental triggers (3 questions). Each question has the same five Likert-type response options ranging from Never (0) to Always (4). Pa-OSDI version was developed following the previous guidelines [23-24]. The methodology of the study was involved several steps as follows (Figure 2):

1. Forward translation of the OSDI from English to Palestinian dialect was conducted independently by Palestinian medical translators and non-medical translators.
2. Revision of both Palestinian dialect translations was carried out by a committee of three bi-lingual Palestinian ophthalmologists and two professional Palestinian dialect translators to produce a second draft of Pa-OSDI.
3. Backward translation of the Pa-OSDI draft was conducted by two other Palestinian medical translators and two other non-medical translators, who were masked to the original version.
4. The backward translation of the Pa-OSDI draft was compared with the original version to determine any inconsistencies, which was revised by eight professionals in the ophthalmology field (Master's and Ph.D. degree holders).
5. Test of the pre-final version was done on ten Palestinian public respondents (6 males and 4 females) to check their understanding and interpretation of the survey. Based on the findings of the pre-test evaluation, minor modification of the “instructions, category responses and items” of the Pa-OSDI version was done as revealed in Table 1.

Reliability and Repeatability of the Pa-OSDI

For the reliability test, all participants were required to fill out both OSDI and the Pa-OSDI versions. The research team randomly allocated them to two groups (#1, #2). Participants in Group #1, a sample ($n=130$) began with the original version followed by Pa-OSDI while the participants in Group #2 ($n=130$) completed the Pa-OSDI followed

by the original version. The first session was carried out in the morning while the second session was held in the evening. The final sets of questionnaires were constructed using an online platform (<http://www.jotform.com>). The online platform was chosen to automatically calculate the OSDI final score and make it more accessible for dissemination. To investigate the repeatability, a sample ($n=260$) filled out the Pa-OSDI again within one to two-week intervals.

Data Analysis

Microsoft Excel and SPSS software v.22 were used to analyze the data. The baseline features for the sample population and single domain for the Pa-OSDI version were carried out by applying descriptive statistics. Values were given as numbers or percentages, means and/or standard deviations or median or skewness, and minimum or maximum. Non-parametric (Mann-Whitney test) was used to compare between the Pa-OSDI overall and sex, and Pa-OSDI overall and marital status. Kruskal-Wallis test was used to evaluate the associations between Pa-OSDI overall and each of the independent variables. The independent variables were education level, employment status, and place of residence. The Spearman correlation was recorded to evaluate the linear correlation between the Pa-OSDI overall and age. A reliability test of the Pa-OSDI was carried out by using Cronbach's alpha coefficient test, inter-item correlation, Bland-Altman plot, and the Ladder plot. In addition, a repeatability test was conducted by applying the coefficient of repeatability, coefficient of variation, differences, Bland-Altman plot, a scatter plot, scree plot, and the Varimax rotated factor. Differences between the original and Pa-OSDI domains and between Pa-OSDI (session-1 and session-2) were evaluated with a non-parametric test (Wilcoxon signed-rank test).

RESULTS

Descriptive Data and Subject's Characteristics

Overall, 260 participants filled out the questionnaires, including 145 males, 163 married, 100 subjects up to bachelor degree and 89 individuals living in Gaza city, Palestine. Regarding employment status, 121 (61.9%) were employed, while 139 (38.1%) were not working (students, housewives, unemployed, or retired). The mean age of the participants was 33.45 ± 11.74 years as listed in Table 2. Association between the subject's characteristics and Pa-OSDI overall score is depicted in Table 3. The Pa-OSDI overall score did not differ with sex or marital status ($p>0.05$). In addition, there was no influence of education level, employment status, or place of residence on the Pa-OSDI overall score. Lastly, no significant univariate relationship was reported between age and Pa-OSDI overall score ($r=-0.034$; $p=0.580$). The minimum, maximum, mean score, standard deviation, skewness and kurtosis of

single domains included in the Palestinian version of the OSDI is illustrated in Table 4. The lowest mean score was for the domain of “deteriorating vision”. Whereas the highest was for the domain of “discomfort or sensitivity due to light exposure”. All of the domains demonstrated positive skewness. For kurtosis, the variables were not normally distributed since they ranged from -0.02 to 2.58. Based on the skewness and kurtosis tests, the data was revealed a non-normality distribution.

The Reliability of the Pa-OSDI

The median (interquartile range) of single domain and sub-scale scores of the original and Pa-OSDI versions are depicted in Table 5. The results demonstrated that the Cronbach's alpha (α) was above 0.8 for all of the domains except the “blurred vision” and “deteriorating vision” domains (0.77 and 0.74 respectively). The internal consistency revealed a Cronbach's α value for ocular symptoms (domains 1 to 5) was 0.84, vision-related function (domains 6 to 9) was 0.88, and environmental factor stimuli of dry eye symptoms (domains 10 to 12) were 0.90 (Table 6). Domain number 5 and subscale 3 (domains 10 to 12) were significantly different between the original and Pa-OSDI based on the non-parametric Wilcoxon signed-rank tests. However, the medians of domain number 5 and subscale 3 have the same values in both versions of the questionnaires. The Bland-Altman chart reveals that the mean overall score difference between the OSDI and Pa-OSDI was 0.86. As listed in Figure 3, the coefficient of reliability (CoR) was +/- 21.81 with the upper confidence limit (UCL) was 22.67 and lower confidence limit (LCL) was -20.84 in a numerical score ranging from 0 to 100. The internal consistency indices were also expressed by a ladder plot, which displays the slight differences between the overall mean score of a single domain in comparison between the OSDI version and the Pa-OSDI version (Figure 4).

The Repeatability of the Pa-OSDI

All of the participants from four sites (145 males and 115 females) were instructed to fill out the 12 domains of Pa-OSDI twice. The second session was conducted after one to two weeks. Our results demonstrated no significant differences in the single domains, sub-scale and overall scores between the two repeats of the Pa-OSDI, except for Pa-3, Pa-4, Pa-5, and Pa-10 domains (Table 7 and Table 8). However, the Pa-3 “Pain or Irritation and Congestion in the Eyes”, Pa-4 “Blurred Vision”, Pa-5 “Deteriorating Vision”, and Pa-10 “Stormy Weather” had the same medians (interquartile range) for session 1 and session 2 of the questionnaire. The Pa-OSDI overall score (sessions 1 and 2) for each Palestinian participant are depicted in Figure 5. The outcome for the Pa-OSDI overall score (sessions

1 and 2) was a clinically different (bias) of 0.21. This conforms to a scatter plot that illustrated a positive correlation in the Pa-OSDI overall score between the two sessions.

Factor Analysis of the Pa-OSDI

As depicted in a scree plot, only three factors (subscales) had eigenvalues greater than one in the structure of the Pa-OSDI. Our three main subscales exist had values of subscale-1 (6.47), subscale-2 (1.27) and subscale-3 (1.01), which explained 72.92% of the total variance (Figure 7). By using the Varimax rotation technique, all domains were known and clustered into individual factors in the absence of cross-loading domains (Table 9). The domain that had the lowest value (0.544) was Pa-12, “air-conditioned places”, whereas the highest value (0.909) was Pa-1 and Pa-2, “discomfort or sensitivity due to light exposure” and “feeling of a foreign body or grittiness in the eyes” respectively.

DISCUSSION

This study demonstrates the development of OSDI in the Palestinian dialect version. Our research team designed the Pa-OSDI structure similar to the original English version in accordance with the previous guidelines [23-24]. Although Palestine has a superior adult literacy rate of 97% compared to the global 91% [25-26], the estimation of ocular symptoms, vision-related functions and environmental triggers might not be accurate using an Arab version of OSDI in standard language. Thus, the current study builds Pa-OSDI in a dialectal language using an online messaging platform. In this study, the Cronbach’s alpha coefficient of the Pa-OSDI overall score was 0.88, each subscale was between 0.84 and 0.90, and single domain ranged from 0.74 to 0.88. Previous study [27] found that the alpha greater than 0.7 is satisfactory. Therefore, the findings indicate that the level of reliability of the Pa-OSDI version is desirable. The internal consistency range in this descriptive study is in agreement with many studies including Farsi, Bahasa Malaysia and Japanese versions [1, 14, 17]. Our data noted a significant difference in Domain-5 and subscale-3 values between the original and Pa-OSDI versions. This may be due to the minor disagreement between the forward translation, backward translation and the original version as shown in Table 1. The outcomes may indeed vary from two coping domains because of different cultures, society, nationality and language [20, 23]. Besides, other papers had also found domain-5 “poor vision”, that was associated with visual symptoms, is very difficult to understand well [18, 28]. The Bland-Altman chart and ladder plot were also to illustrate good reliability between the two tools. Our version was comparable to Aziimah et al. [14] who validated a Bahasa Melayu version of OSDI in Malaysian participants. In our study, no difference in overall score between the

two sessions. However, a significant difference in the Pa-3, Pa-4, Pa-5, and Pa-10 domains were found for both repeats. The reason perhaps that the series of domains were related to the external factors such as job and weather contribution to the slight variation of dry eye symptoms result during a short interval [29]. Results of the Palestinian participants were also applied to investigate the repeatability level of the Pa-OSDI. Our limit of agreement (LoA) in Bland-Altman chart for repeatability ranged from 21.26 to 20.89 (Figure 5). Both of the scores were lower than 23 was indicated as moderate dry eye disease in the OSDI overall score [14]. Scatter plot is to show the participants mean. An improvement was observed at the period of the second Pa-OSDI. Hence, these figures found a good test-retest repeatability between sessions of Pa-OSDI. The outcomes of Pa-OSDI found that the three subscales (ocular symptoms, vision-related and environmental triggers) accounted for 72.92% of the total variance. Our results are slightly greater than a previous study on Arab participants with age range (18-75) years old. The classical Arabic study reported that the extracted three subscales explained 68% of the variance. These results revealed that the construct validity of OSDI may be different with the classical Arabic compared to the Palestinian Arabic dialect versions.

CONCLUSIONS

In conclusion, the cross-cultural adaptation of the OSDI questionnaire had demonstrated desirable reliability, validity, repeatability and factor analysis of the Palestinian dialect version. Consequently, the Pa-OSDI is an efficient tool to assess the ocular symptoms, vision-related function, and environmental triggers of dry eye disease. Our outcomes provided an online application of the Pa-OSDI questionnaire on Gazan community adult participants, particularly in primary eye care clinics. Finally, the questionnaire could remove the language barrier in managing their subjects.

On the other hand, the sensitivity of Pa-OSDI was not tested in this study since our study did not explore dry eye participants before answering those domains, as carried out by S. Koh et al (2020) in examining sensitivity. This is a drawback of the study. Domain-5 “poor vision” was a Palestinian dialect back-translated phrase such as “deteriorating vision” which was associated with the non-use of eyeglasses. This is another drawback of the current study that leads to confusion.

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Conflicts of Interest: The authors have no relevant financial or non-financial interests to disclose.

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Competing Interests

The authors have no relevant financial or non-financial interests to disclose.

Author Contributions

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Mohammed Aljarousha. The first draft of the manuscript was written by Mohammed Aljarousha and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Ethics Approval

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the the Palestinian Health Research Council Helsinki committee (PHRC/HC/883/21, dated April 05, 2021).

Consent to Participate

Informed consent was obtained from all individual participants included in the study.

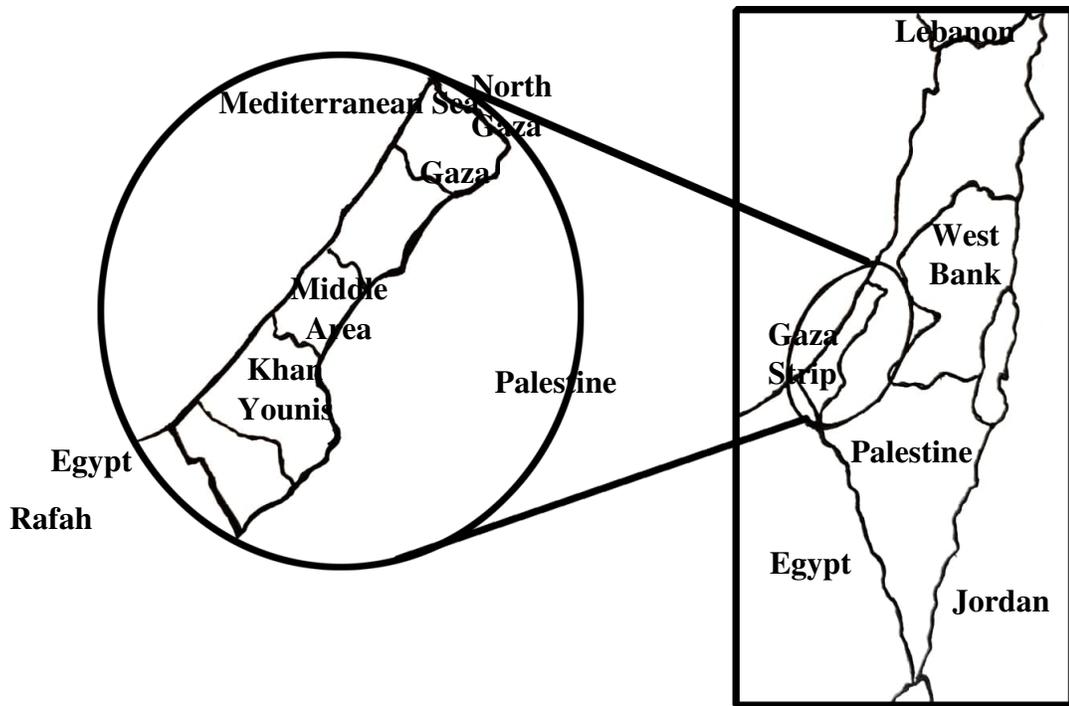


Figure 1 Map of Palestine and five provinces of Gaza Strip

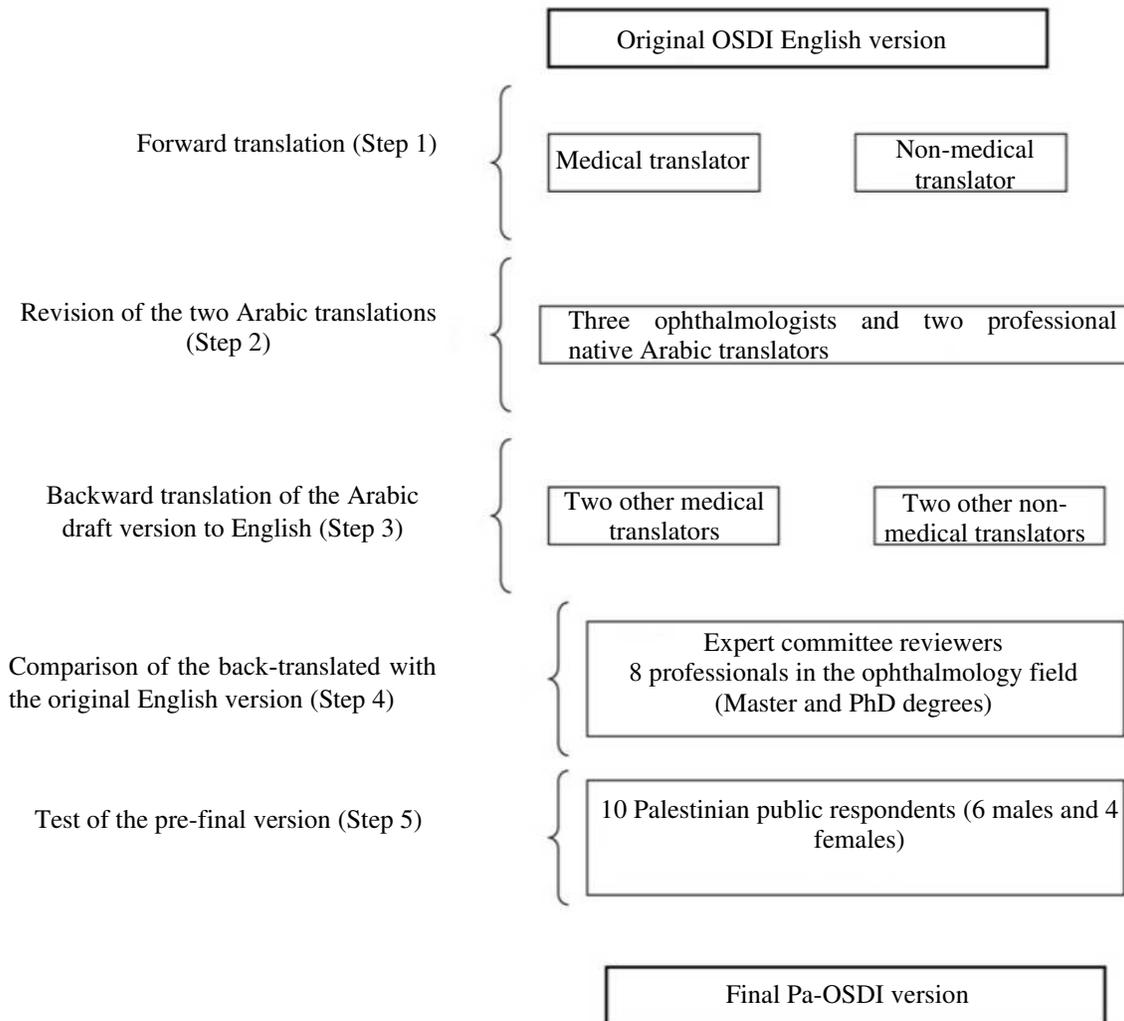


Figure 2: Validation and reliability of Pa-OSDI version

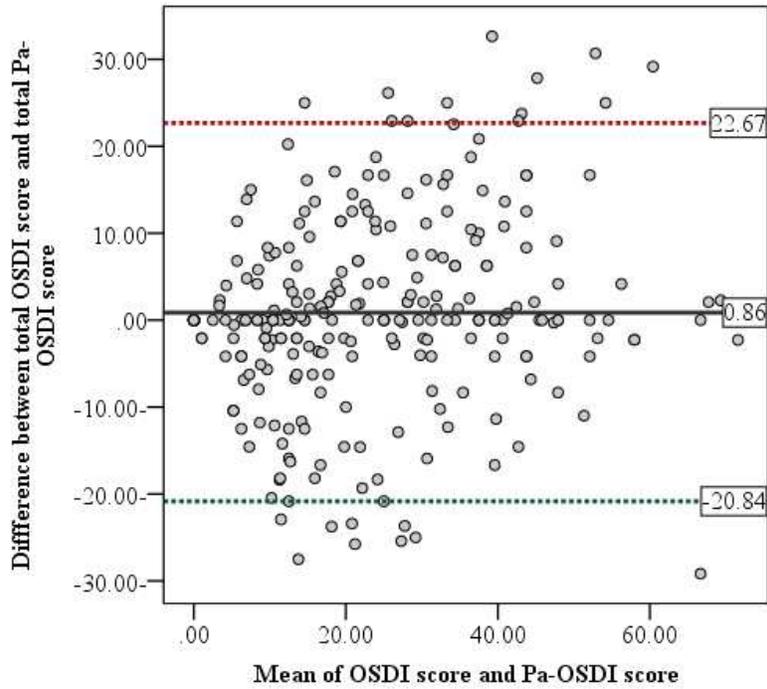


Figure 3 Bland-Altman Plot for clinical agreement between the OSDI and Pa-OSDI overall score showed a clinical difference (bias) of 0.86 unit

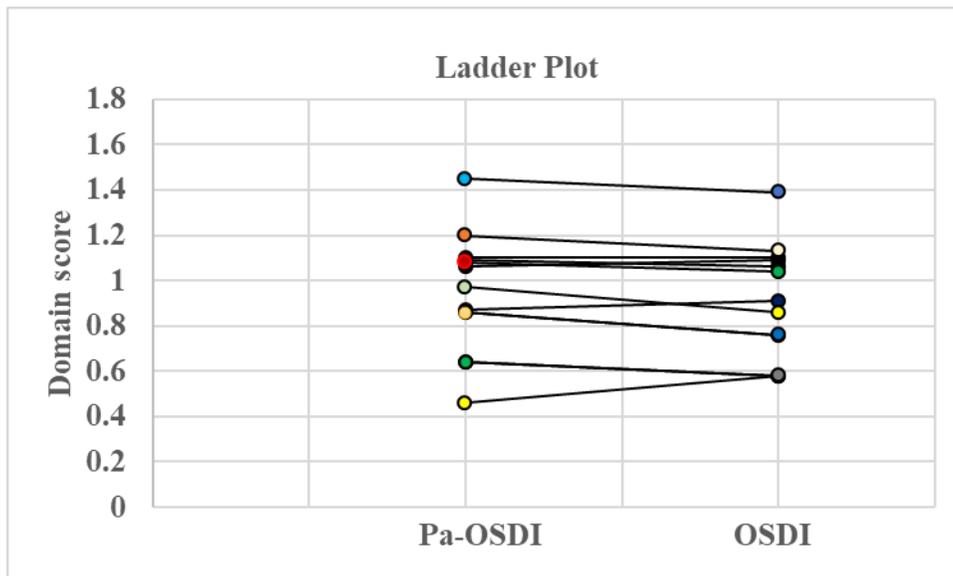


Figure 4 Ladder plot of internal reliability revealing the difference between the overall mean score of single domain in Pa-OSDI and OSDI

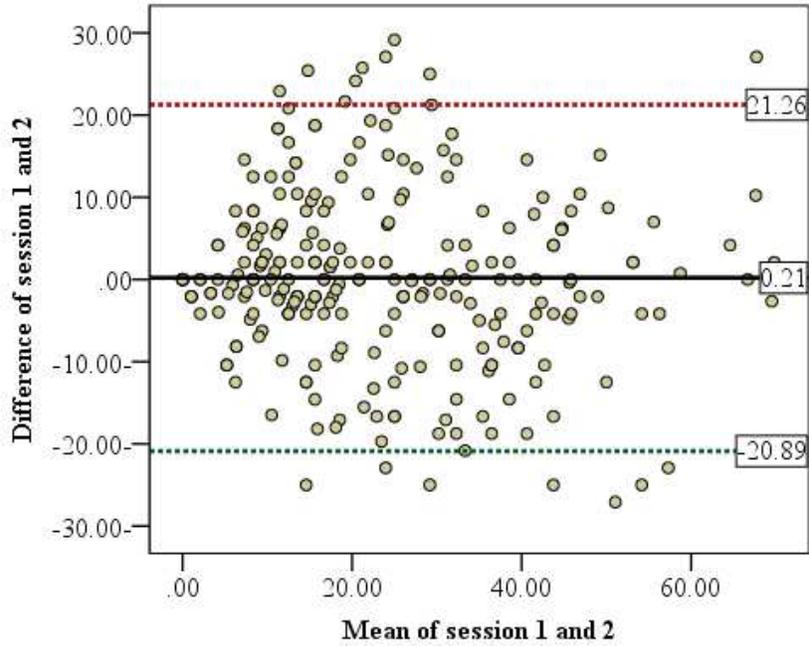


Figure 5 Bland-Altman Plot for clinical agreement between the Pa-OSDI overall score (session 1 and 2) revealed a clinical difference (bias) of 0.21 unit

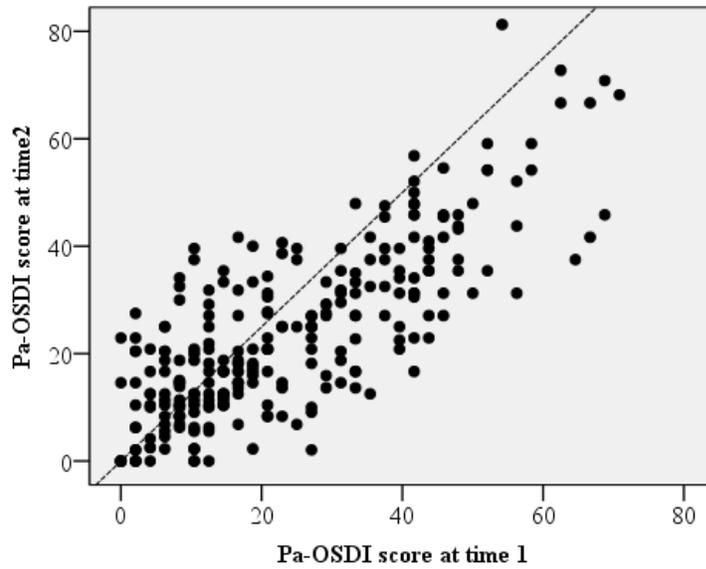


Figure 6 A scatter plot of test-retest repeatability of the Pa-OSDI overall obtained from 260 subjects

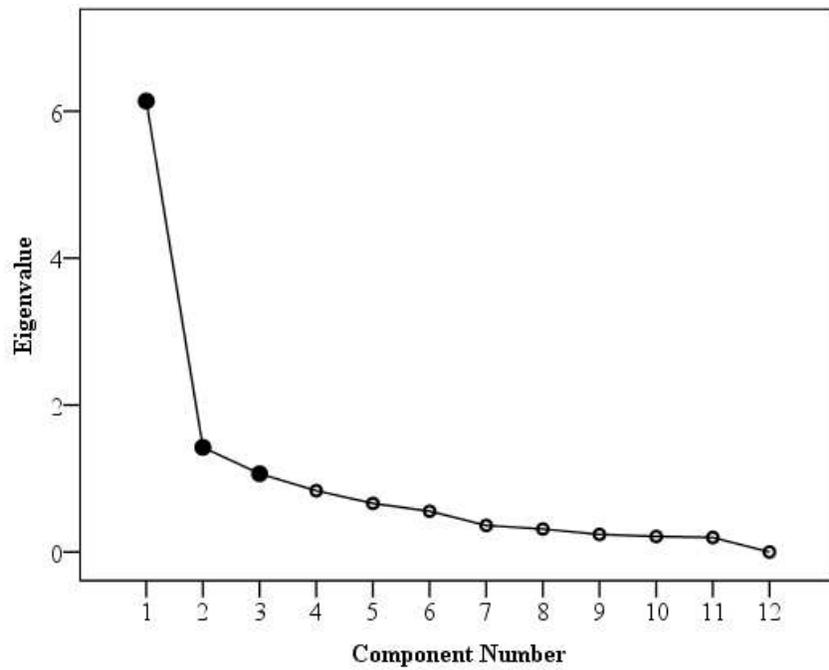


Figure 7 Scree plot of Pa-OSDI questionnaire in factor analysis. The bold circles represent the three factors (subscales) and all variables ≥ 1.00 were reported

Table 1: List of misunderstood instructions/category responses/items of the Pa-OSDI version into English

Instructions/category responses/items	Refinement translation problem (s)	Solution (s)
Instruction	Patient is uncommon word in a clinical research studies.	Revised to subject/candidate (create data collection).
Category responses	Lack of understanding of terms all of the time, most of the time, half of the time, and some of the time in the pre-final version.	These were clarifying into Palestinian dialect that meant always, often, sometimes, and rarely.
Instruction	Use a phrase of experienced patient to have a disorder is uncommon in Palestine.	Revised to suffer (A case to feel discomfort).
Item 2	Sand wording was unclarified in the Palesinian culture.	Grittiness phrasing is a main chief complaint in the Palesinian eyes.
Item 5	When backward translation of the Palesinian dialect draft version to English, the phrase poor vision became low vision, which would deliver amendment the direction and meaning of the domain.	The item poor vision was expressed into a phrase in Palestinian that meant deteriorating vision.
Abbreviations	ATM: Automated teller machines TV: Television	
Instruction	Uncomfortable phrase is less relevant in the cases feel pain.	Revised to discomfort (When they are in tired situations)

Table 2 Summary of baseline characteristics for the Palestinian sample population in the Gaza Strip region (n=260)

Sociodemographic variables	Number of subjects	Percentage (%)
Sex ^a		
Male	145	55.8
Female	115	44.2
Marital status ^a		
Single	97	37.3
Married	163	62.7
Divorced	0	0.0
Widow	0	0.0
Education level ^a		
Secondary school	33	12.7
Bachelor	127	48.8
Mater	44	16.9
Doctor of Philosophy	50	19.2
Others	6	2.3
Employment status ^a		
Students	47	18.1
Housewife	6	2.3
Employee	118	45.4
Self-employed	43	16.5
Not working	42	16.2
Retired	4	1.5
Place of residence ^a		
Gaza city	89	34.2
Middle area	37	14.2
North Gaza Strip	52	20.0
South Gaza Strip	82	31.5
Age (in years) ^b		
Median	31	
Mean	33.45	
Standard deviation	11.74	
Minimum	18	
Maximum	78	

Values were given as number or percentage ^(a), mean (standard deviation) or median and minimum or maximum ^(b)

Table 3 Association between the subject's characteristics and Pa-OSDI overall score

Pa-OSDI overall score		
	Median (IQR)	<i>p</i> -value
Sex^a		
Male	19.44(27.08)	0.400
Female	25.00(29.58)	
Marital status^a		
Single	23.00(25.00)	0.332
Married	19.44(28.41)	
Education level^b		
Secondary school	20.83(42.17)	0.583
Bachelor	19.44(25.69)	
Mater	27.18(31.87)	
Doctor of Philosophy	22.83(28.98)	
Others	24.75(35.09)	
Employment status^b		
Student	20.83(31.25)	0.751
Housewife	32.29(12.64)	
Employee	23.96(30.68)	
Self-employed	16.67(19.13)	
Not working	22.36(27.60)	
Retired	27.09(26.04)	
Place of residence^b		
Gaza city	22.73(26.78)	0.789
Middle area	27.08(27.14)	
North Gaza Strip	17.43(27.50)	
South Gaza Strip	20.64(29.42)	
Age^c		
	Correlation coefficient	
	-0.034	0.580

Comparison of medians (interquartile ranges) was carried out applying the non-parametric (Mann-Whitney and Kruskal-Wallis) tests ^(a, b), The Spearman correlation was recorded to evaluate the linear correlation between the age and Pa-OSDI overall score ^(c) (A value of *p* less than 0.05 was reported significant). Pa-OSDI: Palestinian ocular surface disease index; IQR: interquartile ranges

Table 4 Descriptive statistics of single domain for the Pa-OSDI version

Domains	Min	Max	M	SD	Skewness	Kurtosis
Pa01. Discomfort or sensitivity due to light exposure?	0.00	4.00	1.51	1.11	0.28	-0.572
Pa02. Feeling of a foreign body or grittiness in the eyes?	0.00	4.00	1.14	0.98	0.65	0.094
Pa03. Pain or irritation and congestion in the eyes?	0.00	4.00	1.14	0.96	0.49	-0.022
Pa04. Blurred vision?	0.00	3.00	0.86	0.83	0.52	-0.703
Pa05. Deteriorating vision?	0.00	3.00	0.43	0.72	1.73	2.581
Pa06. Reading?	0.00	4.00	0.77	1.01	1.32	1.171
Pa07. Night driving?	0.00	4.00	0.58	0.86	1.51	1.861
Pa08. Using digital devices like computer or automated teller machines (ATM)?	0.00	4.00	1.05	1.10	0.89	0.108
Pa09. Watching television (TV)?	0.00	4.00	0.82	0.89	0.95	0.453
Pa10. Stormy weather?	0.00	4.00	0.87	1.03	0.97	0.082
Pa11. Dry places (with low humidity)?	0.00	4.00	1.25	1.15	0.56	-0.701
Pa12. Air-conditioned places?	0.00	3.00	0.91	0.96	0.66	-0.697

Pa: Palestinian; Min: minimum; Max: maximum; M: mean; SD: standard deviation. Domains scores ranging from 0 (never) to 4 (always).

Table 5 Reliability test of single domain scores of the original and Palestinian ocular surface disease index questionnaires

Domains	Median (IQR)		Cronbach's Alpha	Inter-item correlation	<i>p</i> -value
	OSDI	Pa-OSDI			
D-1	1.00 (1.00)	1.00 (1.00)	0.87	0.77	0.187
D-2	1.00 (2.00)	1.00 (2.00)	0.85	0.74	0.930
D-3	1.00 (2.00)	1.00 (2.00)	0.82	0.70	0.399
D-4	1.00 (1.00)	1.00 (1.00)	0.77	0.62	0.412
D-5	0.00 (1.00)	0.00 (1.00)	0.74	0.59	0.008
D-6	1.00 (1.00)	0.00 (2.00)	0.83	0.72	0.990
D-7	0.00 (1.00)	0.00 (1.00)	0.88	0.79	0.456
D-8	1.00 (2.00)	1.00 (2.00)	0.88	0.79	0.141
D-9	1.00 (1.00)	1.00 (2.00)	0.84	0.73	0.151
D-10	1.00 (1.00)	1.00 (2.00)	0.88	0.79	0.196
D-11	1.00 (2.00)	1.00 (2.00)	0.87	0.78	0.152
D 12	1.00 (1.00)	1.00 (2.00)	0.85	0.74	0.095

D: domain; Pa: Palestinian; OSDI: ocular surface disease index; IQR: interquartile ranges; A value of *p* (Wilcoxon Signed Rank test) less than 0.05 was reported significant

Table 6 Internal consistency of three subscales of the original and Palestinian ocular surface disease index questionnaires

Subscale		Median (IQR)		Cronbach's Alpha	Inter-item correlation	p-value
		OSDI	Pa-OSDI			
Ocular symptoms (subscale1)		5.00 (5.00)	5.00 (5.00)	0.84	0.72	0.733
Change in functional quality of vision (subscale2)		3.00 (4.00)	2.00 (5.00)	0.88	0.79	0.817
Environmental stimuli of DE (subscale3)	factors	3.00 (3.00)	3.00 (4.00)	0.90	0.83	0.027

Pa: Palestinian; OSDI: ocular surface disease index; IQR: interquartile ranges; A value of *p* (Wilcoxon Signed Rank test) less than 0.05 was considered significant; DE: dry eye

Table 7 The Repeatability of the single domain in Pa-OSDI

Pa-OSDI Domains	Mdn score (IQR)		CoV	CoR	df	p-value
	Session 1	Session2				
D-1	1.0 (1.0)	1.0 (1.0)	0.03	0.46	0.004	0.71
D-2	1.0 (2.0)	1.0 (2.0)	0.007	0.24	-0.008	0.16
D-3	1.0 (2.0)	1.0 (2.0)	0.03	0.49	-0.03	0.005
D-4	1.0 (1.0)	1.0 (1.0)	0.03	0.52	-0.03	0.003
D-5	0.0 (1.0)	0.0 (1.0)	0.05	0.60	-0.05	0.001
D-6	1.0 (2.0)	1.0 (2.0)	0.05	0.65	-0.012	0.41
D-7	0.0 (1.0)	1.0 (1.0)	0.07	0.73	-0.004	0.76
D-8	1.0 (2.0)	1.0 (2.0)	0.04	0.54	-0.004	0.74
D-9	1.0 (2.0)	1.0 (2.0)	0.03	0.48	-0.012	0.26
D-10	1.0 (2.0)	1.0 (2.0)	0.05	0.64	-0.04	0.003
D-11	1.0 (2.0)	1.0 (2.0)	0.03	0.47	-0.012	0.26
D-12	1.0 (2.0)	1.0 (2.0)	0.04	0.54	0.004	0.74

D: domain; Pa: Palestinian; OSDI: ocular surface disease index; IQR: interquartile range; Mdn: median; CoV: coefficient of variation; CoR: coefficient of repeatability; df: difference; A value of *p* (Wilcoxon Signed Rank test) less than 0.05 was considered significant

Table 8 Comparison of three subscales and Pa-OSDI overall score between two sessions

Variable	Session 1 (n=260) (median(IQR))	Session 2 (n=260) (median(IQR))	<i>p</i>-value
Total subscale 1	5.00 (5.00)	5.00 (5.00)	0.915
Total subscale 2	2.00 (5.00)	2.00 (5.00)	0.885
Total subscale 3	3.00 (4.00)	2.00 (5.00)	0.267
Pa-OSDI overall score	20.83 (20.83)	19.79 (26.56)	0.632

IQR: interquartile ranges; A value of *p* (Wilcoxon Signed Rank test) less than 0.05 was considered significant; DE: dry eye; Pa: Palestinian; OSDI: ocular surface disease index

Table 9 Varimax rotated factor loading of 12 domains in Pa-OSDI version (n=260)

Domain	Description	Three subscales		
		Factor 1	Factor 2	Factor 3
		Ocular irritation Symptoms	Change in functional quality of vision	Environmental factors stimuli
Pa1	Discomfort or sensitivity due to light exposure?	0.909		
Pa2	Feeling of a foreign body or grittiness in the eyes?	0.909		
Pa3	Pain or irritation and congestion in the eyes?	0.753		
Pa4	Blurred vision?	0.574		
Pa5	Deteriorating vision?		0.823	
Pa6	Reading?		0.785	
Pa7	Night driving?		0.770	
Pa8	Using digital devices like computers or automated teller machines (ATM)?		0.676	
Pa9	Watching television (TV)?			0.773
Pa10	Stormy weather?			0.738
Pa11	Dry places (with low humidity)?			0.726
Pa12	Air-conditioned places?			0.544

The highest values were presented for single domains in the factors