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Translation and Validation of Convergence Insufficiency Symptoms Survey to Arabic Language

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Declaration

I declare that, except where explicit reference is madeto the contribution of others, this thesis issubstantially my own work and has not been submittedfor any otherdegree at the Arab American Universityor any other institution.

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Dedication

To those who have had the greatest influence on my academic journey after God,

To my dear parents, who instilled in me the love of knowledge and perseverance,

To my beloved wife, my faithful companion, always there to support me through every step,

To my two precious daughters, Yumna and Nour, the flowers of my life and the source of my happiness,

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To our brave Captives, who endure with resilience and inspire us with their unwavering strength,

To my distinguished teachers, whose wisdom and guidance illuminated my path,

To my friends and colleagues, who were the greatest source of support on this journey,

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as a token of my gratitude.

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Translation and Validation of Convergence Insufficiency Symptoms Survey toArabic Language

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Abstract

Background:Convergence insufficiency is the most common binocular vision disorder, characterized by decreased ability of the eyes to maintain alignment during near work. One of the most commonly used tools to evaluate the frequency and nature of symptoms associated with convergence insufficiency is the Convergence Insufficiency Symptoms Survey (CISS). Despite the availability of a translated Arabic version of CISS, its validation has been limited to university students, and the translation and validation were conducted without clinical testing to correlate CISS results with clinical diagnoses.

Objectives: The primary aim of this study was to translate the Convergence Insufficiency Symptom Survey into Arabic andvalidate its reliability for use in Arabic-speaking populations.

Methods: The study had two phases. First,the CISS was translated into Arabic following established guidelines.Second, the reliability of the translated survey was assessed by administering itto 151 participants using convenience sampling. Participants were selected from Al-Kemah Optical Center (Yatta), Ibrahim Optical Center (Salfit), and the optometry teaching clinic at the Arab American University (Ramallah) between August and December 2024. Validity was evaluated by comparing survey scores with clinical test results to ensure its accuracy for the Arabic-speaking population.

Results:The study found that 7.28% of participants were diagnosed with convergence insufficiency based onclinical tests. The CISS(Arabic Version) demonstrated moderate discriminatory ability (sensitivity = 63.64%, specificity = 66.43%), withthe cutoff set at 21 points for identifying convergence insufficiency. Internal consistency was assessed using Cronbach'salpha ($\alpha = 0.95$), indicating high reliability.Test-retest reliability showed a strong intraclass correlation coefficient (ICC=0.931,95% CI:0.90-0.95), confirming the survey's stability over time. These findings confirm the validity and reliability of the CISS (Arabic Version) for assessingconvergence insufficiency symptoms in Arabic-speaking populations.

CONCLUSION:The validated Arabic CISSis a reliable tool for assessing convergence insufficiency Symptoms in Arabic speakers in the Middle East and North Africa region and can support more effective clinical management.Further studies are needed to confirm its use across different age groups and binocular disorders.

Keywords: Convergence insufficiency symptoms survey, Arabic version, Validity,Reliability, Binocular Vision.

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List of Definitions of Abbreviations

Abbreviations	Title
CISS	Convergence insufficiency symptoms survey
CI	Convergence insufficiency
PROs	patient-reported outcomes
PD	Prism Diopter
AI	Accommodative Insufficiency
CE	Convergence Excess
OD	Ocular Dexter
OS	Ocular Sinister
MENA	Middle East and North Africa
PFV	Positive Fusional Vergence
NPC	Near Point of Convergence
AC/A	Accommodative Convergence to Accommodation Ratio
CITT	Convergence Insufficiency Treatment Trial
ICC	Intraclass Correlation Coefficient
OSDI	Ocular Surface Disease Index
VFQ-25	Visual Functioning Questionnaire-25
COSMIN	Consensus-based Standards for the Selection of Health Measurement Instruments
CE	Convergence Excess
NBV	Normal Binocular Vision

OMD	Oculomotor Dysfunction

Abbreviations	Title
AI	Accommodative Insufficiency
CISS(AV)	Convergence insufficiency symptoms survey Arabic version
LOGMAR	logarithm of the Minimum Angle of Resolution
IRB	Institutional Review Board
PPV	Positive Predictive Value
NPV	Negative Predictive Value
LOA	limits of agreement

Chapter One: Introduction

1.1 Background:

Eye care practitioners depend on patient-reported outcomes to thoroughly assess how a disorder considerably affects multiple aspects of quality of life, along with daily functioning, psychological well-being, and visual performance, to create highly personalized management plans. Quantifying symptoms with the use of Patient-reported outcomes (PROs) enables practitioners to fine-tune management plans. It additionally guarantees that treatments closely align with patient requirements, along with the intensity of symptoms(Yu et al., 2023).

PROs should be suitable for patients in terms of cognition, simplicity, and language.Moreover, it should be reliable to give practitioners valid results. To ensure accuracy and cultural relevance, researchers need to follow well-established guidelines to develop new PROs or translate existing ones for use in different languages and cultural contexts (Kaneyasu et al., 2024).

Several validated PROs known for their reliability and clinical relevance are widely used by practitioners and researchers in eye care. These include the Ocular Surface Disease Index (OSDI) for dry eye assessment (Aljarousha et al., 2023), the Visual Functioning Questionnaire-25 (VFQ-25), which evaluates how visual disorders impact daily activities, emotional well-being, and overall quality of life (Rentz et al., 2014), and the CISS, which quantifies symptoms associated with convergence insufficiency (M. Rouse, Borsting, Mitchell, Cotter, et al., 2009).The current chapter will provide comprehensive information about convergence insufficiency and the role of the CISS in its diagnosis and management.

1.1.1. Convergence Insufficiency: Definition,Diagnosis, andManagement

Convergence insufficiencyis characterized by a reduced ability of the eyes to converge during near work, leading to significant visual challenges. Patients withCIexperiencevarious symptoms, including headaches, blurred vision, asthenopia, transient double vision, a disturbing sensation of letters shifting on the page after 15 to 20 minutes of reading, frequent difficulties in maintaining place while reading, and diminished concentration during reading or doing near work(Gantz & Stiebel-Kalish, 2022a; Hashemi et al., 2017a; M. W. Rouse et al., 1999; Sharif et al., 2014).CI is the most common binocular vision disorder with a prevalence ranging from 2-17% in the general population(Gantz & Stiebel-Kalish, 2022b).

The impact of CI on individuals' quality of life cannot be ignored, as it affects academic progress and the completion of close-up work (Borsting et al., 2012a; M. Rouse, Borsting, Mitchell, Kulp, et al., 2009). These effects have increased in the 21st century, especially with the increased reliance on electronic devices such as computers and smartphones in learning, work, and entertainment, which increases the difficulties faced by people suffering from convergence insufficiency (Borsting et al., 2012b, 2016; Trieu & Lavrich, 2018).

The diagnostic criteria for CI vary among the studies. These variations in procedures and cut-off values result in inconsistent diagnoses for the same patient. To ensure accuracy, diagnostic criteria should be based on a combination of symptom assessment and clinical test results (Gantz & Stiebel-Kalish, 2022b), as demonstrated in the CI treatment trials see Table 1, (Scheiman et al., 2010).

Table 1.1: Diagnostic criteria of convergence insufficiency in convergence insufficiency treatment trials.

Criterion	Measurement/Threshold
Convergence Insufficiency Symptoms Survey Score (CISS)	1- CISS total score≥16 in children aged between 9 to 17 years. 2- CISS total score ≥21in adults aged between 18 to 30 years.
Cover test	Near Exophoria greater than distance Phoria by 4Δ
Near point of Convergence (NPC)	Anear point of convergence break of6 cm or greater .
Positive fusional vergence	Convergence reserves of less than twice the phoria value at near, or a break value of less than 15Δ
AC/A ratio	AC/A ratio less than 4:1

After confirming the diagnosis of CI, it is essential to conduct a cycloplegic refraction and to correct any refractive error present. Since refractive correction enhances sensory fusion between the two eyes, patients should be reevaluated after two months of receiving a refractive correction to assess their symptoms and clinical findings. If symptoms persist, vision therapy (VT) should be initiated(Borsting et al., 1999; Scheiman & Wick, 2008).

In some cases, vision therapy is not successful, and patients may need to wear spectacles with a base-in prism or undergo surgical intervention to relieve the symptoms associated with CI, especially if the CI is accompanied by constant double vision and exotropia at near(Scheiman & Wick, 2008). Surgical interventions include botulinum

toxin A injection(Hofsli et al., 2023), central mini-plication of medial rectus muscles(Merino et al., 2023), and slanted bilateral lateral rectus recession(Ren et al., 2020)are considered effective treatment approaches.

2.1.1.Overview of the Convergence Insufficiency Symptoms Survey

The CISS is one of the most effective tools for identifying symptoms of CI and measuring changes in symptoms after vision therapy(Borsting et al., 2004; M. Rouse et al., 2004). This survey was developed by the ConvergenceInsufficiency and Reading Study Group(Borsting et al., 1999).which conducted a rigorous and comprehensive review of previously reported CI symptoms in the literature, identifying 51 symptoms. Through a refinement process, the group reduced these to 13 survey items by removing overlapping or less relevant symptoms and combining similar ones in the same item, such as eye fatigue, visual fatigue, and eye strain.

CISS was further refined and improved by Borsting et al. through a three-stepprocess.First, they expanded the questionnaire to include symptoms experienced during near work, such as using digital devices, in addition to studying and reading. Second, they carefully split two questions along with came up with a 15-question version instead of 13 questions, justifying this editing by getting an even more precise question about specific symptoms, specifically question number one, where in the original version it asks about eyes feeling tired or uncomfortable during studying or reading, while in the new version it was split into two question, one about feeling tired as well as one about feeling uncomfortable, Finally they dramatically increased the answers choices from 4 to 5 to improve the accuracy of tracking symptoms improvement after CI management (Borsting et al., 2004).

The 15-questionsurvey assesses the type, form, and frequency of symptoms experienced by patients with CI. Each question has five Likert options never, rarely, sometimes, often, and always,with each option assigned a specific numerical value (Figure 2.1). The total CISS score is obtained by summing the 15-item scores. Total

scores range from 0, indicating the absence ofsymptoms, to 60,being the most severe level of symptomatic experience.

Patients can independently read and answer the questions or have a clinician read the questions to them. The completion time of the CISS survey is around 10 to 15 minutes(M. Rouse, Borsting, Mitchell, Cotter, et al., 2009; Scheiman & Wick, 2008).

Convergence Insufficiency Symptom Survey

Name _____ DATE __/__/__

Clinician instructions: Read the following subject instructions and then each item exactly as written. If subject responds with "yes" - please qualify with frequency choices. **Do not give examples.**

Subject instructions: Please answer the following questions about how your eyes feel when reading or doing close work.

		Never	(not very often) Infrequently	Sometimes	Fairly often	Always
1.	Do your eyes feel tired when reading or doing close work?					
2.	Do your eyes feel uncomfortable when reading or doing close work?					
3.	Do you have headaches when reading or doing close work?					
4.	Do you feel sleepy when reading or doing close work?					
5.	Do you lose concentration when reading or doing close work?					
6.	Do you have trouble remembering what you have read?					
7.	Do you have double vision when reading or doing close work?					
8.	Do you see the words move, jump, swim or appear to float on the page when reading or doing close work?					
9.	Do you feel like you read slowly?					
10.	Do your eyes ever hurt when reading or doing close work?					
11.	Do your eyes ever feel sore when reading or doing close work?					
12.	Do you feel a "pulling" feeling around your eyes when reading or doing close work?					
13.	Do you notice the words blurring or coming in and out of focus when reading or doing close work?					
14.	Do you lose your place while reading or doing close work?					
15.	Do you have to re-read the same line of words when reading?					
		__x 0	__x 1	__x 2	__x 3	__x 4

TOTAL SCORE _____

Figure 1.1: Convergence insufficiency symptoms survey (M. Rouse et al., 2004).

The CISS validity and reliability were assessed in both children and adults. For children aged 9 to 18 years, research found that with a cutoff of 16 points, the CISS exhibited 95.7% sensitivity and 87.5% specificity (Borsting et al., 2004). For adults in the 19 to 30 age range, the CISS demonstrated a higher degree of sensitivity (97.8%).

The CISS also demonstrated nearly equal specificity (87%) with a cutoff of 21 points (M. Rouse et al., 2004).

2.1. Study Significance:

The current research fills a critical gap in knowledge by conducting a systematic translation, cultural adaptation, and validation of the CISS for use in the Middle East and North Africa (MENA) region. The resulting survey will enhanceaccurate diagnosis and management of CI. Moreover, the availability of a culturally adapted and valid Arabic version of CISS will enable conducting high-quality research in binocular vision.

1.1. Research Problem:

Despite the availability of an Arabic version of the CISS, a gap in knowledge remains. The CISS has been previously translated into the Arabic language, but the study had limited demography, as participants were recruited from only one university. This narrow sampling hinders the application of the finding to the general population, where there is considerable variation in factors such as education levels, awareness, and response patterns, all of which may influence the results. Additionally, the study did not conduct clinical assessments to confirm CI diagnosis or to assess the sensitivity and specificity of translated CISS. Furthermore, no studies have addressed the CISS's applicability to other Arabic-speaking countries or evaluated its psychometric properties comprehensively.

4.1. Study Objectives:

The current study aims to translate the CISS into Arabic using a standardized and rigorous translation methodologyandto evaluate the psychometric properties of the Arabic version, including its reliability and validity, using a representative sample.

5.1. ResearchQuestion:

To what extent does the Arabic version of the CISS demonstrate validity and reliability in assessing the frequency and severity of CI symptoms amongtheArabic-speaking population?

6.1. Research Hypothesis:

The researcher hypothesized that the current study would produce a valid and reliable Arabic version of the convergence insufficiency symptom survey.

6.2. Study Delimitations and Limitations:

The study was conducted from August 2024 to December 2024 at three optometric centers in Yatta, Salfit, and Ramallah, West Bank, Palestine. The researchers employed a convenience sampling technique to select 160 participants.

Participants were eligible ifthey were between 18 and 30 years old, had a monocular best corrected visual acuity of ≥ 0.10 log MAR at 6 meters, stereoacuity of 100 seconds of arc or better, the ability to read and understand informed consent, and were native Arabic speakers.

Participants were excluded if they had amblyopia (defined as a two-line difference or more between eyes), manifest tropia, nystagmus, or any ocular motility disorders. Further exclusion criteria included a history of ocular trauma or surgery, anisometropia greater than 2.50 diopters, vertical heterophoria exceeding one prism diopter, the

presence of ocular disease during the study period, or systemic disease known to affect binocular vision, such as myasthenia gravis, multiple sclerosis, Parkinson's disease, and Graves ophthalmopathy. Individuals using ocular medications were excluded, except for those using lubricating eye drops.

1.6.2 Study limitation:

The current study had several limitations. First,thevalidation Protocol focused only on CI without accounting for other binoculardisorders such as accommodative insufficiency and convergence excess. Second, Participant selection was limited to adults aged between 18-30 years, excluding children aged 9-17 years, and this may affect the generalizability of the study results.

7.1. Terminology:

Convergence insufficiency is characterized by a reduced ability of the eyes to converge during near work, leading to significant visual challenges. Patients with CI experience various symptoms, including headaches, blurred vision, asthenopia, and transient double vision(Scheiman & Wick, 2008).

Vision therapy is a structured series of exercises performed repeatedly to relieve symptoms associated with CI by normalizing near points of convergence, normalizing negative and positive fusional vergence, and developing regular coordination between vergence and accommodative demand (Scheiman & Wick, 2008).

Psychometric properties:the characteristics that express the effectiveness of the questionnaire or test in assessing a particular construct, these includereliability and validity(Pesudovs et al., 2007).

Validity:the ability of the questionnaire or test to identify the infected individuals(Acquadro et al., 2008).

Reliability:the expected degree of stability in the results when the measurement is repeated more than once(Acquadro et al., 2008)

Chapter Two: Literature Review

Surveys are increasingly relied upon to determine the degree of severity of symptoms and assess the extent of the effect of the disease on the quality of life of patients. Therefore, it is necessary to rely on guidelines agreed upon by researchers to evaluate questionnaires when they are developed or when they are translated from one language to another to guarantee their effectiveness and reliability. One widely recognized standard is the Consensus-based Standards for the Selection of Health Measurement Instruments (COSMIN) framework, which provides a well-organized way to assess the survey's psychometric properties. The COSMIN study design checklist assists researchers in reviewing critical attributes such as content validity, construct validity, reliability, and responsiveness. By promoting clear research objectives, transparent methodologies, and adequate sample sizes, the COSMIN framework ensures that PRO surveys are reliable and valid.(Mokkink et al., n.d.).

This chapter aims to critically review all studies that have been conducted to translate and validate CISS, to manipulate the methodology of the current research. It will also summarize all studies that have been conducted to explore the potential utility of CISS in diagnosing other binocular anomalies, such as accommodative excess and convergence excess, as well as its use in neurological research.

The following keywords we used to search the literature in PubMed and Google Scholar: "convergence insufficiency", "CISS validation", "CISS translation ", "cultural validation", "CISS in accommodative anomalies"," concussion", "convergence excess", and "CISS total scores". The inclusion criteria consisted of all studies that were conducted to translate and validate CISS, and all studies conducted to discover the potential employment of CISS in other binocular anomalies other than CI. Based on this inclusion criteria, ten studies were included, six of which were translation studies, and the other four focused on the clinical application of the survey.

1.2 Translation and Validation Studies:

This section summarizes each study in chronological order, focusing on its methodological strengths and limitations based on the COSMIN framework.

One notable study by Tavares et al. aimed to translate the CISS to Portuguese and evaluate its psychometric characteristics, including internal consistency and reliability(Tavares et al., 2014). The results showed that the psychometric characteristics of the Portuguese version of CISS are adequate, with Cronbach's alpha= 0.893 indicating high internal consistency, and interclass correlation coefficient=0.924 indicating good test-retest reliability and interrater reliability. Thus, the CISS was derivedassuitable for a Portuguese-speaking population. However, a few methodical issues have been laid bare that need improvement.

One of the limitations of the study was the lack of explanation about how the sample size was calculated and how the subjects were selected. The authors did not outline any inclusion and exclusion criteria, which raises the question of whether the sample is representative of the clientele, especially the patients with the diagnosis of CI. A more robust and clearer approach in subsequent studies would be able to enable the findings to be more consistent and generalizable.In addition, based on our interpretation of their analysis, they estimated temporal stability by incorporating Spearman's coefficient into their statistical analysis. This coefficient is a form of non-parametric correlation based on ranking, which is quite right to use for monotonic relationships. However, as the data was normally distributed (Mann-Whitney p-value = 0.656), Spearman's coefficient may not be the best parameter for measuring temporal stability since Pearson's correlation may be more effective (Tavares et al., 2014).

Another study by Pérez et al. aimed to translate and validate the CISS for the Spanish-speaking population(González-Pérez et al., 2020a). For the translation and cultural adaptation, the investigator followed a rigorous five-step procedure, which included direct translation, back translation, expert committee review, and pre-testing

with cognitive interviews to check for adequacy and relevance. Psychometric assessments such as Rasch analysis proved to uphold the unidimensional structure, reliability, and validity of the Spanish version. Regarding the intraclass correlation coefficient (ICC), satisfactory levels of repeatability were noted.

The Spanish version of CISS has been demonstrated to be valid and reliable for near-vision discomfort detection in the Spanish-speaking population, with cut-off values of ≥21 for adults and ≥16 for children 9-18 years. However, the study has some shortcomings. Some of these were the lack of a clinical diagnosis of convergence insufficiency, but relied on self-reported data, which introduces potential bias and may lead to an overestimation of symptoms. In addition, it did not relate the CISS scores with some objective clinical measures, such as positive vergence ranges, near point of convergence, or even cover test results, which would have proved valuable to substantiate the strength of the validity claims(González-Pérez et al., 2020b).

Building on the effort to adapt the CISS to different languages and contexts, another notable study conducted by Boccardo et al. focused on translating and validating the CISS in Italy.The research employed a standardized multi-step translation process to ensure accuracy. This process included forward translation, followed by backward translation and a review by experts in vision science. To assess the validity and reliability of the Italic version of CISS, it was administered to the participants aged between 18-30 years, and then a full eye exam, including binocular assessment, was conducted. The results showed a strong internal consistency with Cronbach'salpha = 0.89 and excellent test-retest reliability with an Interclass correlation coefficient = 0.92. It also supported the predictive validity of the translated CISS, with an area under the ROC curve of 0.67, confirming its ability to differentiate between CI and non-CI cases. Moreover, Rasch's analysis showed that the survey could reliably differentiate symptom severity(Boccardo et al., 2022a).

Nabovati and colleagues investigated theconstruct validity and reliability of the Persian version of the CISS among 30 Iranian patients with CI. This type of study also contributes to the body of knowledge by indicating the improvement in cultural and linguistic experiences of the use of CISS and translation as a process of two stages, translation and back translation, which is painstakingly done to achieve equivalence of concepts. The use of qualified bilingual translators and philologists also increased the validity of the translated questionnaire in clinical settings in Iran.Nevertheless, the study’s focus on only 30 participants limits any further extrapolation of the data for the

Iranian population in general. As the study notes, the figure calculated appears to be quite small, even though the sample size estimation was done properly, and underpinned with Cronbach's alpha statistic. Therefore, a need exists for the inclusion of a larger sample size to enhance the statistical power and a more thorough analysis of the CISS psychometric characteristics across different incorporated units to improve one's outcome. Indeed, its relevance and even accuracy could be further supported with multi-site studies that would examine the Persian CISS across a wide spectrum of clinical and non-clinical populations (Nabovati et al., 2020a) .

Astudyconducted by Phongsuraetal. focusedon translating and validating the CISS for the Thai population. The contentvalidity was assessed using the Index of Item Objective Congruence (IOC), with most of the items scored above the threshold of 0.5. High scores for internal consistency (Cronbach's alpha = 0.895) and test-retest reliability (Intraclass Correlation Coefficient = 0.964) indicate that the Thai version of the CISS is suitablefor use both inresearch and clinical settings. However, future studies incorporating clinical assessments, such as sensitivity and specificity testing, are necessary to further validate the Thai version of the CISS(Phongsura1 et al., 2024).

The Arabic version of the CISS was recently translated and culturally adapted for use in Saudi Arabia (Aljohani & Alnawmasi, 2024). The study employed a comprehensive approach of translation and adaptation, which included the five-step approach of forward and backwardtranslation. The Arabic version of CISS was tested on a sample of 104 Arabic-speaking university students aged 18 to 40, all of whom had normal visual acuity. Psychometric evaluation demonstrated strong reliability and validity, with high internal consistency (Cronbach's alpha = 0.88), and excellent test-retest reliability (Intraclass Correlation Coefficient = 0.93). additionally Bland-Altman analysis showed minimal mean difference between test and retest scores indicating score stability over time. However, limitations were noted in the study, including the lack of sample diversity since all participants were from a single university and the absence of objective clinical measures such as NPC, PFV, and cover test.(Aljohani & Alnawmasi, 2024).

Additional studies in the MENAregionare certainly necessary to evaluate the overall validity andthereliability of the translated CISS across multiple age groups. Also, its convergent validity should be confirmed through comparisons with clinical assessments for CI.

Table 1.2 presents a methodological critique of the translation and validation studies reviewed in this literature, using the COSMIN Study Design Checklist to assess their methodological rigor and measurement properties. It also compares their reliability, internal validity, and external validity to get a clear conclusion about their overall quality.

Table 1.2: Critique of CISS translation and validation studies using the Consensus-based Standards for the Selection of Health Measurement Instruments (COSMIN) Framework

Author(s)and year	Content Validity	Reliability	Cross-Cultural Validity	Age means ± SD	Sample Size	Overall Quality	Comments
Tavares et al. (2014)	Addressed; psychometric properties analyzed but lacked details on expert involvement.	High (ICC not reported; Cronbach's αm>0.8)	Minimal cultural adaptation described.	21.79 ± 2.42	70	Moderate	Strong initial finding but limited details on sample representativeness and inclusion/exclusion criteria.
Pérez et al. (2017)	High; included cognitive interviews with 48 participants to ensure clarity and comprehensibility.	High (Rasch analysis used; ICC reported as excellent)	Thorough Cultural adaptation.	15.86 ± 1.61	449	High	Strong Rasch analysis and reliability testing; minor concerns about responsiveness and lack of predictive validity testing.
Boccardo et al. (2019)	Addressed with expert reviews and translation-back translation process.	High (ICC=0.92, Bland -Altman analysis showed wide limits of agreements)	Comprehensive adaptation steps Taken.	21.9 ± 2.1	103	Moderate	Comprehensive process but reliability could be improved with narrower limits of agreement.

Table1.2: (Continued)

Author(s)and year	Content Validity	Reliability	Cross-Cultural Validity	Age means ± SD	Sample Size	Overall Quality	Comments
Nabovati et al. (2020)	High (Item Content Validity Index > 80%for all items, Scale Content Validity Index= 98.8%)	Excellent (ICC=0.95; Cronbach's α=0.77)	Robust cross-cultural adaptation.	25.70 ± 5.26	30	High	Psychometric testing, including discriminant validity, However, no comparison with healthy controls.
Phongsura et al. (2021)	Addressed through translation and cognitive debriefing with a representative sample.	High (ICC=0.89; Cronbach's α= 0.85)	Robust cross-cultural adaptation steps.	22.75 ± 1.32	200	High	Comprehensive psychometric validation, but lacked predictive validity testing and responsiveness assessment.
Aljohani et al. (2023)	Addressed through expert review and pre-testing with participants.	Excellent (ICC=0.93; Cronbach's α=0.88)	Thorough Cultural adaptation for Arabic-speaking populations.	27.2 ± 6.2	104	High	Showed excellent reliability and validity. However, the study did not include clinical tests to diagnose CI.

2.2 Expanding the Utility of the CISS: Application Beyond Convergence Insufficiency:

Borsting et al. (2003)reported that some children without CI had CISS scores greater than 16, This was attributed to the presence of other binocular disorders, leading to a recommendation for further research to evaluate the applicability of the CISS in other binocular disorders.

Pang et al. conducted a study to compare the CISS total scores between convergence excess(CE) and normal binocular vision (NBV) participants, where the CE group scored significantly higher points in CISS compared totheNBVgroup.However, the receiver operating characteristic curve revealed a low value with area under the curve (AUC) equal to 0.62, indicating alimited ability of CISS to differentiate CE from NBV(Pang et al., 2023).

Another study was conducted by the same author to examine the applicability of CISS in two disorders, oculomotor dysfunction (OMD) and accommodative insufficiency (AI). While the CISS showed good discriminatory power in OMD cases with a cutoff value of more than 15 points, it showed poor discriminatory power in AI cases, despite the similarity in most symptoms between the two disorders (Pang et al., 2021).

The CISS has also been used in the field of neuroscience, where Trbovich et al. conducted a study to quantify symptoms acquired after concussions. The results demonstrated the validity of CISS in assessing and better understanding visual difficulties after a concussion, such as acquired receded NPC.The CISS showed good sensitivity(70%) and specificity(53%) with a cutoff value greater than 23 points (Trbovich et al., 2019).

To further investigate PROs in adolescent concussion patients, Raghuram et al. conducted a retrospective study and found that the most commonly reported symptoms included headaches, tired eyes, difficulty concentrating, and discomfort in the eyes. Additionally, they compared the total scores between a self-administered CISS and a clinician-administered CISS, and they found much higher CISS scores in the self-reported survey. They attributed that to clinician-induced bias, which may led to lower the reported symptoms severity (Raghuram et al., 2022).

The result also demonstrates the potential usefulness of the CISS in tracking symptoms with disease progression, as patients in the sub-acute phase had higher CISS scores compared to those in the chronic phase (Raghuram et al., 2022).

3.2 summary

CISS has strong psychometric properties and has been successfully adapted to various cultures and languages, including Portuguese, Spanish, Italian, Persian, Thai, and Arabic. Additionally, practitioners can rely on it to develop personalized management plans for CI patients and other binocular disorders, including CE and AI. furthermore, it can be used as PROs for tracking symptoms in patients with concussions.

Despite the availability of an Arabic version of the CISS, a gap in knowledge remains. Aljohani et al. focused on a limited demographic, as their study participants were taken from one university only,This narrow sampling hinders the application of the findings to the general population, where there is considerable variation in factors such as education levels, awareness, and response patterns, all of which may influence the results. Additionally, the study did not conduct clinical assessments to confirm CI diagnosis or to assess the sensitivity and specificity of translated CISS. Furthermore, no studies have addressed the CISS's applicability to other Arabic-speaking countries or evaluated its psychometric properties comprehensively using robust frameworks like COSMIN guidelines.

These gaps underscore the need for a more rigorous translation and validation process for CISS. The current thesis aims to address this critical gap by conducting a systematic translation, cultural adaptation, and validation of the CISS for use in the MENA region, thereby enhancing its reliability and diagnostic utility in clinical and research settings. Figure 1.2 shows the Conceptual frame work of the current study.

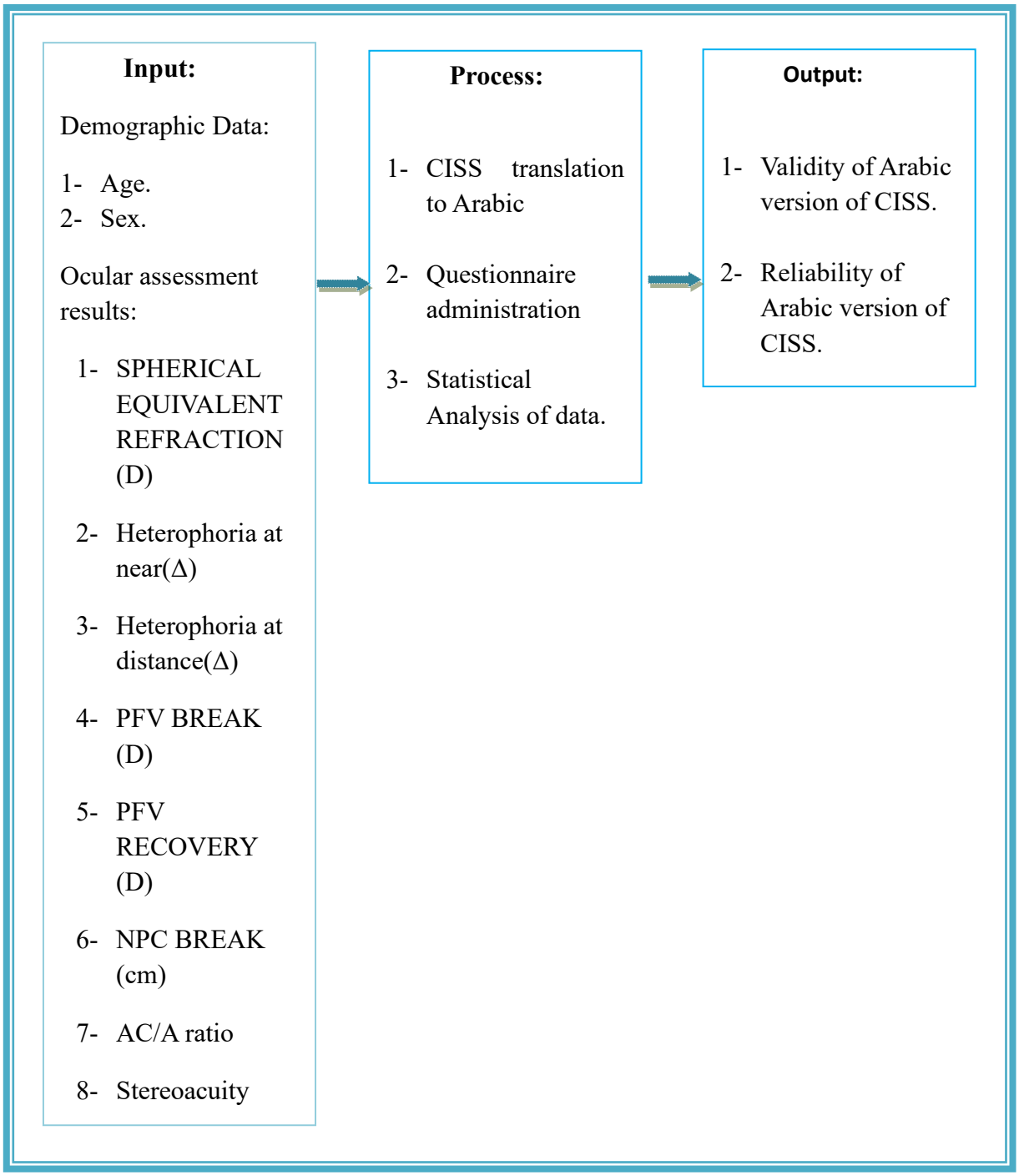

Figure 1.2: Conceptual framework for translation and validation of CISS to the Arabic language.Abbreviation: D= Diopter, PFV=Positive fusional vergence, NPC=Near point of convergence, AC/C ratio = Accommodative convergence to convergence ratio.

Chapter Three: Materials & Methods

1.3. Study Design

A cross-sectional study was conducted from August 2024 to December 2024 at three optometric centers in Yatta, Salfit, and Ramallah, West Bank, Palestine, for the systematic translation,culturalvalidation, and adaptation of the CISS.

2.3. Sample Size, Sampling Technique, and Settings

The required sample size was calculated by multiplying the number of items in the questionnaire by 10, as recommended in the literature(Acquadro et al., 2008; Mokkink et al., 2019; Nabovati et al., 2020b). This calculation yielded 150 participants as a total sample size. To accommodate a 5% non-response rate, an estimated 160 participants were recruited to join the study. The researchers employed a convenience sampling technique to select participants who attended Al-Kemah Optical Center, in Yatta, Ibrahim Optical Center, in Salfit, and the University Optometry Clinic at the Arab AmericanUniversity (AAUP), in Ramallah.

The study team recruited participants based on their availability and willingness to have an additional assessment conductedduring their routine clinic visits. Those who met the inclusion criteria were approached by the researcher and invited to voluntarily take part in the study after receiving a full explanation of the study'spurpose and procedures.

There are potential sources of bias in the current study.First, selection bias may arise from using a convenience sampling technique. To minimize this risk, three geographically distinct locations in the West Bank were selected to recruit participants,whichhelps enhance the diversity of the sample.Anotherpotential source of bias is recall bias; to minimize this risk, a clear instruction paragraph was provided at the beginning of the CISS(AV) survey.

3.3Inclusion And Exclusion Criteria

The following inclusion and exclusion criteria were adapted from previous studies to ensure appropriate participant enrollment (Boccardo et al., 2022b; González-Pérez et al., 2020a).

Participants were eligible if they were between 18 and 30 years old, had a monocular best corrected visual acuity of ≥ 0.10 log MAR at 6 meters, local stereoacuity of 100 seconds of arc or better, the ability to read and understand informed consent, and were native Arabic speakers.

Participants were excluded if they had amblyopia (defined as a two-line difference or more between eyes), manifest tropia, nystagmus, or any ocular motility disorders. Further exclusion criteria included a history of ocular trauma or surgery, anisometropia greater than 2.50 diopters, vertical heterophoria exceeding one prism diopter, the presence of ocular disease during the study period, or systemic disease known to affect binocular vision, such as myasthenia gravis, multiple sclerosis, Parkinson's disease, and Graves ophthalmopathy. Individuals using ocular medications were excluded, except for those using lubricating eye drops.

4.3.AConvergence Insufficiency Symptoms Survey (CISS) Translation

The translation process entails four stepsas described in the literature(Acquadro et al., 2008; Boccardo et al., 2022b; Bullinger et al., 1998), and shown in Figure 1.3. In the first step, forward translation:The CISS was translated from English to Arabic by two native Arabic speakers: an optometrist familiar with the CISS and a professional academic translator. Each translator produced an initial draft for the conceptual translation of the CISS. The researcher, along with an expert committee from the Optometry Department at the Arab American University, collaborated to reach a consensus on the preliminary translated version.

The second step involved backward translation.Two bilingual individuals, an optometrist with excellent English proficiency along with a professional academic translator, translated the Arabic version (AV) of CISS back into English. Collaboration

between the researcher and the expert committee from the Optometry Department at the Arab American University was pivotal in reaching a consensus on the preliminary back-translated CISS (AV).

The third Stepinvolvedconceptualverification to ensure equivalence between the original English version of the CISS and the back-translated version.Thisstage aimed to confirm that the translated items preserved their original meaning and construct.

The final step involved the finalization of the Arabic Version: The translated CISS wasreviewed by researchers specializing in binocular anomalies in the Middle East. A consensus on the final Arabic version was reachedby the study team.

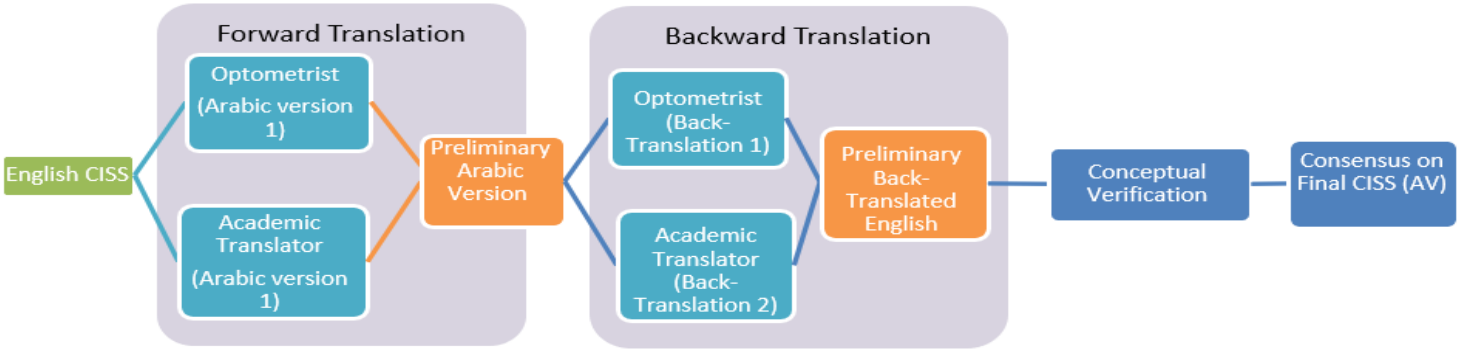

Figure 1.3: Steps to translate a CISS from English to Arabic

5.3. Data Collection

1.5.3. Questionnaire administration

The CISS (AV) was administered to all participants twice through Google Forms. The first administration occurred after the clinical assessment, and the second one took place 14 ±3 days after the first completion of the CISS (AV)(M. Rouse et al., 2004). The participants responded to the 15 items, with five response options for each item, scored as follows: never {0}, infrequently {1}, sometimes {2}, often {3}, and always {4}. The final score of the CISS (AV) was calculated by algebraic summation of all item responses, ranging from 0 to 60.

The second response of the CISS (AV) was used to calculate test-retest reliability. To avoid the learning effect and any significant changes in the condition, the existing

literature recommended a 14-day separation between the two responses(Boccardo et al., 2022b; M. Rouse et al., 2004).

2.5.3. Visual and Ocular Assessment

The researcher andwell-trained volunteer optometrists conducted visual and ocular assessments. Regular calibration sessions and discussions were held between the researcher and the volunteer optometrists to avoid inter-user variability in assessment techniques and interpretations.

All participants underwent a comprehensive visual and ocular assessment to confirm eligibility based on the inclusion criteria. A detailed ocular and medical history wasrecorded for each participant. Subjective refraction was conducted at a distance of 6 meters using a Tumbling E chart.

The binocular vision evaluation began with the NPC test, assessed using Gulden's Near Point Rule (Gulden Ophthalmic Company, Pennsylvania, United States). Step vergence was evaluated at near using a prism bar and a Gulden fixation stick held at 40 cm(Scheiman & Wick, 2008).Stereopsis was assessed with the Randot® Stereo test (Stereo Optical Company, Chicago, USA) ("Randot," n.d.). The prism cover test was conducted to objectively measure heterophoria at distance and near.

The accommodation convergence to accommodation (AC/A) ratio was calculated using the modified gradient method by subtracting the baseline phoria from the phoria measured with a +2.00 diopter lens, then dividing the result by 2.00(Gantz & Stiebel-Kalish, 2022c). Finally, a slit-lamp biomicroscope was used to screen for any ocular abnormalities that could affect binocular vision or visual function. These assessments ensured all participants were free from ocular diseaseor systemic conditions that may impact visual performance.

Allprocedures were conducted according to a well-defined clinical guideline, which is described in detail in Appendix 6 (Scheiman & Wick, 2008).

6.3. Study Variables

Demographical data and ocular assessment findings, including heterophoria at near and distance, positive fusional vergence findings, NPC, stereopsis, manifest refraction, and AC/A ratio, were classified as independent variables. The CISS(AV) total scores were classified as dependent variables. A score of 21 or higher was used as the cut-off point to classify participants as having CI, see Table1.3.

Table 1.3: Dependent and independent variables of the study

Independent Variables	Dependent Variables
OD SPHERICAL EQUIVALENT REFRACTION (D)	CISS(AV) total scores
OS SPHERICAL EQUIVALENT REFRACTION (D	
Heterophoria at near(Δ)	
Heterophoria at distance(Δ)	
PFV BREAK (D)	
PFV RECOVERY (D)	
NPC BREAK (cm)	
AC/A ratio	
Stereoacuity	

7.3. Data management

CI was defined as having the following four criterion:near exophoria greater than distance phoria by 4Δ, a receded NPC break of greater than 6 cm, convergence reserves of less than twice the phoria value at near, or a break value of less than 15Δ, andAC/A ratio less than 4:1. Table 2.3presentsthedefinition criteria that weas utilized to determine the final diagnosis of CI(Gantz & Stiebel-Kalish, 2022c; The Convergence Insufficiency Treatment Trial (CITT) Study Group, 2008).

Table 2.3: The definition criteria utilized in the final diagnosis of CI.

Test	Measurement/Threshold
Cover test	Near Exophoria greater than distance Phoria by 4Δ
Near point of Convergence (NPC)	A near point of convergence break of 6 cm or greater.
Positive fusional vergence	Convergence reserves of less than twice the phoria value at near, or a break value of less than 15Δ
AC/A ratio	AC/A ratio less than 4:1

8.3Statistical Analysis

The programming language R (Version 4.2.3) was used for statistical analysis to assess the validity and reliability of the CISS(AV). The data was entered twice and checked for matching to ensure accuracy.Normality was assessedusingtheShapiro-Wilk normality test to identify the appropriate statistical analysis test.

1.8.3 Testing validity of CISS (AV)

The validity of the CISS (AV) was assessed using convergent validity and criterion validity.

Convergent validity was assessed by checking the correlation between the result of the CISS (AV) and the result of the following tests: NPC, Step vergence test, alternative cover test, and AC/A ratio(Boccardo et al., 2022b).

Criterion validity was assessed using the receiver operating characteristic (ROC) curve (Boccardo et al., 2022b; Fawcett, 2006), The ROC curve was drawn by plotting the true positive rate (sensitivity) of the CISS (AV) on the y-axis and the false negative rate (1-specificity) on the x-axis. The researcher determined the ability of the CISS (AV) to discriminate between those who truly complain of CI and those who did not (Boccardo et al., 2022b).

2.8.3 Testing the reliability of CISS (AV)

The researcher used the intraclass correlation coefficient (ICC) and Cronbach's coefficient alpha to assess the reliability of CISS (AV).

Intraclass Correlation Coefficient (ICC) was used to assess the test-retest Reliability of the CISS (AV) scores (22). The ICC value can range from 0 to 1, with a value closer to 1 indicating higher agreement and reliability between measurements (Koo & Li, 2016).

The internal consistency was assessed by calculating Cronbach's coefficient alpha to determine if the CISS (AV) items were suitable for assessing the CI symptoms. Cronbach's alphavaluesgreater than 0.70indicate that the items in the CISS (AV) consistently measure the same construct (Boccardo et al., 2022b; Nabovati et al., 2020b).

9.3. Ethical considerations and approval:

The current study followed the tenets of the Declaration of Helsinki. Permission for translation and validation of the CISS was obtained from Dr. Eric Borsting, one of its authors. Ethical approval to conduct this study was obtained from the Institutional Review Board (IRB) committee at Arab American University, with the code number (R-2024/A/122/N). An Arabic informed consent explaining the study objectives and significance was obtained from all the participants enrolled in the study.

Chapter Four. Results

1.4. Participant Characteristics

A total of 160 participants (age range 18-30 years, mean age 21.5 ± 3.3 years, 49% female) underwent visual and ocular assessments at three optometric centers in the cities of Yatta, Salfit, and Ramallah, West Bank, Palestine. Nine participants (N=9, 5.63%) were excluded for the following reasons: Three did notrespond to the questionnaire a second time,two did not meet the age criteria(18-30 years), one had anisometropia of more than 2.5 Diopter, one had a history of refractive surgery (LASIK), one had vertical heterophoria exceeding 1 prism diopter and one had microesotropia. The final sample size included in the study was 151 participants (N=151) (Figure 1.4).

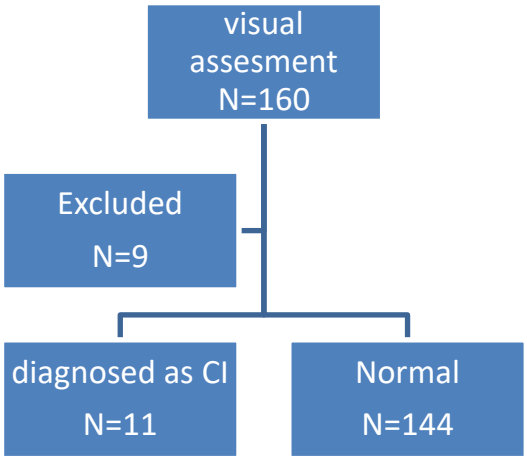

Figure 1.4: Flowchart showing the distribution of participants during the visual assessment phase (N=160).Nine participants were excluded based on the study's exclusion criteria. Eleven participants were diagnosed withconvergence insufficiency, while 144 were classified as normal.

2.4. Clinical Assessment Results:

Table 1 summarizes the main results of the visual and ocular assessment of the participantsincluded.The data revealed a wide range of results across the various measures for refractive error, eye alignment, and vergence function. Based on the diagnostic criteria utilized in this study,11 subjects (7.28%) were clinically diagnosed as having convergence insufficiency.

Table 1.4: The main refractive and binocular vision assessment results of the included participants(n=151)

Variable	MEAN± SD	Maximum	Minimum	Shapiro-Wilk
OD Spherical Equivalent Refraction (D)	-0.61±1.4	2	-6	$p < 0.001$
OS Spherical Equivalent Refraction (D)	-0.55±1.3	1.75	-6	$p < 0.001$
Heterophoria at near (Δ)*	-2.96±4.1	4	-25	$p < 0.001$
Heterophoria at a distance(Δ)*	-1.18±2.6	8	-16	$p < 0.001$
PFV BREAK (Δ)	17.28±7.1	40	1	$p < 0.001$
PFV RECOVERY (Δ)	13.51±6.3	35	0	$p= 0.0008$
NPC BREAK (cm)	2.6±3.6	22	0	$p < 0.001$
AC/A ratio	3.11±1.31	8	1	$p < 0.001$
Stereoacuity (seconds of arc)	59.86±28.2	100	20	$p < 0.001$
*A negative value indicates exophoria, while a positive value indicates esophoria.				

3.4. CISS(AV) Scores:

The total scores of the CISS(AV) in the first response did not follow a normal distribution with a P-value less than 0.05 in the Shapiro-Wilk normality test.This deviation from normality was further confirmed by the Q-Q Plot (see Figure 2.4), To ensure the validity of the statistical analysis the researcher used non-parametric statistical tests since these tests do not assume normality in the data.

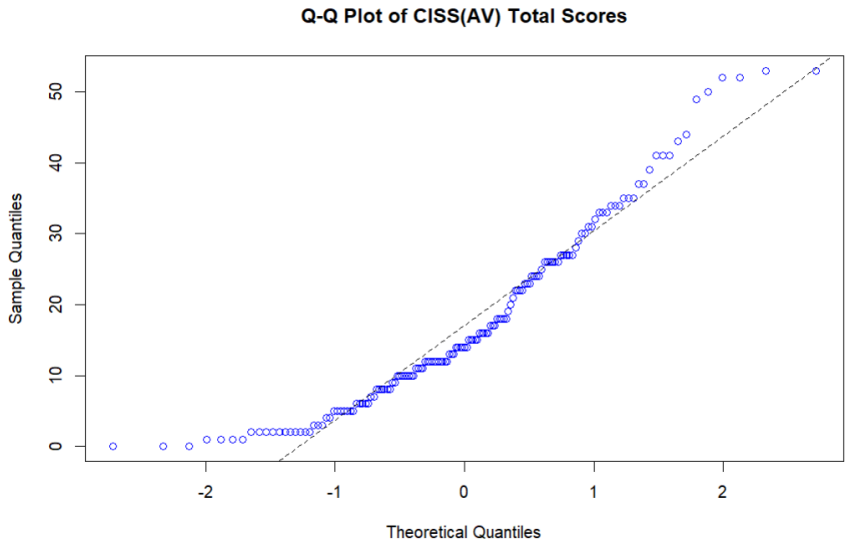

Figure 2.4 shows the Q-Q plot of the total score from the first CISS(AV) response.

Most of the points in the middle of the plot align well with the reference dashed line, indicating that the central portion of the data roughly follows a normal distribution.However, at both ends of the plot, the points deviate significantly from the dashed line, which indicates positive skewness in the data.

The CISS(AV) total scores were compared among three participant groups: those with CI, non-CI, and the overall group using a box plot diagram (Figure 3.4). The median score for the CI group (n=11) was significantly above the cutoff of 21points,

with a wider interquartile range and higher upper whisker value, indicating more severe symptoms. In contrast, the non-CI group had a median score below 21 points, with most scores clustered within the normal range, although a few outliers exceeded the cutoff.

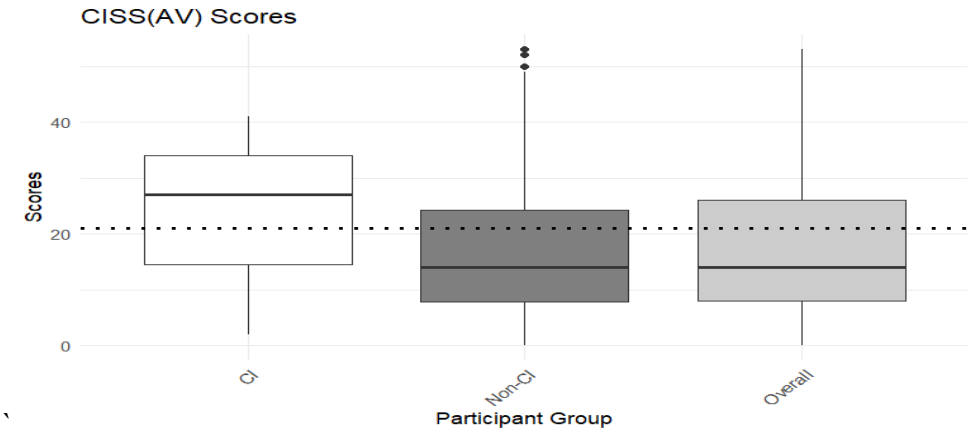

Figure 3.4: The box plot diagram shows the distribution of the CISS(AV) scores across participant groups, highlighting the cutoff score of 21 points by a dotted line, which differentiates between normal and abnormal symptom levels.

Figure 4.4presents a density plot of the CISS(AV) total scores across participants who were diagnosed with CI and non-CI. The black curve represents participants diagnosed with CI, while the gray curve corresponds to non-CI participants.The CI plot showsleft skewness with most participants scoring above the cutoff value of 21, with a peak around 34 points.In contrast, the non-CI plot showsright skewness with most non-CI participants scoring below the cutoff point, with a peak around 12 points. The visualization highlights the clear distinction in symptom severity between the two groups and reinforces the utility of the cutoff score for clinical assessment.

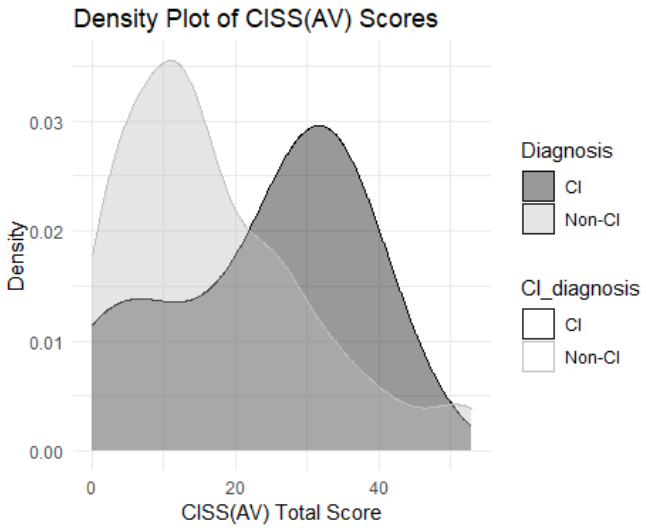

Figure 4.4: Distribution of the CISS(AV) total scores for all participants. The black curve represents participants diagnosed with CI, and the gray curve representsnon-CI participants.

4.4 Validity of CISS(AV)

1.4.4 Convergent Validity

The Spearman correlation was computed to examine the strength and direction of the relationship between the CISS(AV) total scores and the results of the binocular assessment tests. The result shows a weak positive association (P-value >0.05)between the CISS(AV) scores and NPC break recovery and a weak negative association (P-value > 0.05) between CISS(AV) total scores and PFV break, and AC/A ratio,asshown inTable3.4.

Table 3.4: Results of Spearman Correlation Between CISS(AV) and Clinical Test Results.

Clinical test	Spearman's Rho	P-value
Heterophoria at near (Δ)	-0.151	0.064
Heterophoria at a distance(Δ)	-0.141	0.083
PFV BREAK (Δ)	-0.132	0.105
NPC Break (CM)	0.109	0.181
NPC Recovery(CM)	0.106	0.191
AC/A ratio	-0.014	0.86

2.4.4 Criterion Validity

The CISS(AV) 's diagnostic performance in detecting CI was evaluated using the ROC curve (see Figure 5.4). The area under the curve (AUC) was 0.658, indicating a poor to fair ability to distinguish between participants with and without CI.

At a cut-off score of 21, the CISS(AV) proved a sensitivity of 63.64%,aspecificity of66.43%, a positive predictive value (PPV) of 12.96%, and a negative predictive value (NPV) of 95.88%. Thesefindings indicate that the CISS(AV) has moderate sensitivity and specificity, with a high NPV,suggesting it is particularly useful for ruling out CI in most cases(Akobeng, 2007).

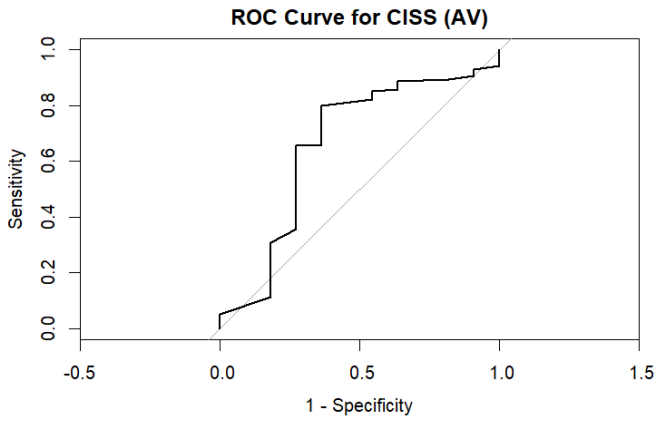

Figure 5.4: The curve represents the relationship between sensitivity (true positive rate) and 1-specificity (false positive rate) across various thresholds of the CISS(AV) score. The curve illustrates the trade-off between sensitivity and specificity.

5.4 Reliability of CISS(AV)

1.5.4 Internal Consistency

The internal consistency of the CISS (AV) scale was assessed using Cronbach's alpha. The overall Cronbach's alpha for the 15 items was found to be 0.95, indicating excellent internal consistency.

Further analysis of reliability, if an item was dropped, showed that the Cronbach's alpha would remain high for most items (ranging from 0.94 to 0.95), with the smallest reduction in alpha observed when Items such as Item 2, Item 4, and Item 6 were excluded, maintaining values close to the overall alpha.

Item statistics also showed high inter-item correlations, with average correlations (average r) ranging from 0.53 to 0.57 for most items. The item with the highest inter-item correlation was Item 10 (0.85), while Item 6 exhibited the lowest correlation (0.58).

2.5.4 Test-Retest Reliability

The Bland-Altman plot was used to evaluate the agreement between the test and retest scores of the CISS(AV) (Figure 6). The median difference between the two measurements was -1, indicating a slight negative bias. On average, the retest scores were marginally higher than the initial test scores. The limits of agreement (LOA) were calculated as 8.75 and -10.75, with the majority of the differences falling within these limits of agreement, demonstrating acceptable agreement between the measurements. The distribution of data points around the median difference line appeared consistent, with no evident trend or population bias, suggesting uniform agreement across the range of CISS (AV) total scores. However, a small number of data points lay outside the LOA(n=18), highlighting potential variability in individual responses.

The test-retest reliability of the CISS(AV) scores was evaluated using the Interclass Correlation Coefficient (ICC). Employing a two-way consistency model, the ICC value was 0.931, indicating excellent reliability. The 95% confidence interval for

the ICC ranged from 0.90 to 0.950, further supporting the high consistency between the test and retest scores.

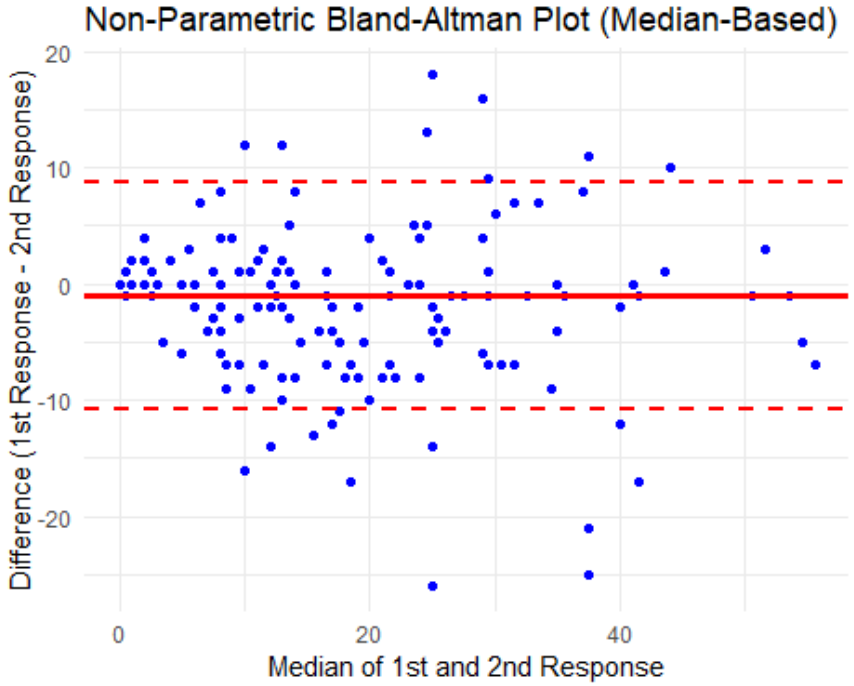

Figure 6.4: The Bland-Altman plot illustrates the agreement between the CISS(AV) test and retest total scores.The solid line represents the median difference (-1),while the upper and lower limits of the agreement (8.75and -10.75, respectively) are shown by the dashed lines.

ChapterFive:Discussion

In the current study, the CISS questionnaire was translated using an effective and well-known method in the translation and validation studies. After obtaining two different versions of the forward translation, the final copy was developed by the researcher in collaboration witha three-memberexpert committee from the Optometry Department at the Arab American University.

To ensure the translated version was effective for patients and researchers across the MENA region, it was reviewed by experts in binocular vision and vision therapy. Their feedback was incorporated to refine the translation.For example, the term "Examiner" was used instead of "Optometrist" in the instruction for the examiner, This adjustment was made to account for the variation in job titles and scope of practice for optometrists across different countries in the MENA region(Gammoh et al., 2024), ensuring that the instructions are universally applicableand clear. This approach underscores the importance of cultural and professional sensitivity in the translation process, which is essential for the successful adaptation of diagnostic surveys in diverse settings.

To further verify the accuracy of the translation, the Arabic version was compared with the Spanish version of the CISS, where a Spanish-speaking member of the expert committee from the Optometry Department at the Arab American Universitywas consulted to make this comparison. The result was positive, and no modifications were made to Arabic CISS. Subsequently, two independent translators conducted a backward translation into English. Their two versions were presented to the Scientific Committee at the College of Optometry, and the final copy of the back translation was approved and compared with the original CISS version. Accordingly, this version was approved to be distributed to the study participants to verify its validity and reliability.

A sufficient study sample in terms of number and geographical distribution is essential for adopting the study results and generalizing them to the target study community. According to recommended research standards, the sample size should exceed 100 participants to obtain valid statistical results(Mokkink et al., n.d.). In this

context, the current sample of 151 participants is considered appropriate in terms of number, as it reflects a good representation of the target community.

The sample distribution is geographically diverse, with data collected from three clinics in different locations, enhancing the comprehensiveness of the results. Furthermore, the balance between males and females in the sample (49% female) ensures fair representation of genders. The mean age of the participants, 21.5 ± 3.3 years, indicates that the sample is located within the middle of the target age range, which supports the accuracy of the results and their relevance to the age group relevant to the study (18-30 years).

Based on the diagnostic criteria used in this study, CI was diagnosed when all of the following were present: NPC greater than 6 cm, near exophoria greater than exophoria at distance by 4Δ, convergence reserves less than twice the near exophoria value, or break point less than 15Δ, andlow AC/A ratio(less than 4:1).Using this criteria, eleven individuals were diagnosed with CI, resulting in a prevalence of 7.28% in the study sample. This is consistent with the overall pooled global prevalence of 7.98% reported in a literature review about CI (Mohamed & Alrasheed, n.d.). However, due to the sample size, the prevalence rate in this study cannot be generalized. Further studies with larger samples are needed to determine the prevalence of CI among the Palestinian population and across the MENA region.

A limited number of studies have investigated CI prevalence in the MENA region. In Iran, Hashemi et al. reported a prevalence of 5.5%, with an average participant age of 30 years(Hashemi et al., 2017b). Another study by Sharif et al. found a prevalence of 10%, with a mean participant age of approximately 21.in Sudan, Hassan et al. reported a prevalence of 7.8%(Hassan et al., 2018). These variations in prevalence may be attributed to differences in diagnostic and testing criteria. Therefore, there is a need for further research across the MENA region, employing standardized diagnostic methods to obtain more reliable and comparable prevalence rates.

CISS(AV) showed good discriminative validity. The median CISS(AV) scores for CI participants (Median = 27) were significantly higher than those for non-CI participants (Median = 14), and they also exceeded the cut-off value of 21. This finding is consistent with Rouse et al., who validated the original version of CISS(M. Rouse et al., 2004), this consistency suggests that CISS(AV) retains the core psychometric properties of the original survey, even after translation and cross-culturaladaptation.

The results obtained in the Italian CISS validation study were different from the current study where the median of CISS scores in CI participants was less than 21 (Median= 17) and not significantly higher than the median of CISS scores in non-CI participants (Boccardo et al., 2022b).This discrepancy may reflect differences in sample characteristics or cultural interpretation of symptom severity. For instance, the Italian study included a smaller sample size (n=103), which could have reduced the statistical power to detect significant differences (Mokkink et al., n.d.).

Convergent Validity assessment showed a weak correlation between the CISS(AV) scores and the clinical test used in diagnosing CI such as NPC Break (ρ=0.109, p value=0.181), and PFV (ρ=-0.132, p value=0.105). While these correlations were not statistically significant (p.value> 0.05), they provide valuable insights into the relationship between subjective symptomreporting and signs, The positive correlation between CISS(AV) scores and NPC break suggests that as the NPC break increases,patients tend to report more symptoms. Conversely, the negative correlation with PFV indicates that as PFV improves, patients report fewer symptoms.

Although the lack of statistical significance limits the ability to draw definitive conclusions, these findings suggest that the CISS(AV) can still be a useful tool in clinical practice. Specifically, it can complement clinical assessments by providing a subjective measure of symptom improvement following vision therapy. Vision therapy aims to reduce the NPC break and enhance PFV;thus, the CISS(AV) can help track changes in patient-perceived symptoms alongside these clinical improvements.

Similar findings were obtained in the Italian validation study by Boccardo et al., which showed weak correlations between the Italian version of the CISS and most clinical tests except for NPC break and recovery, which demonstrated stronger positive correlations(Boccardo et al., 2022b), in contrast, a strong correlation between CISS scores and clinical test results was reported in a study conducted by Taky et al. where NPC break (r_s = 0.622, p-value = 0.0001), and NPC recovery (r_s = 0.620, p value= 0.0001), had the highest positive correlation(Darko-Takyi et al., 2022). These differences may be attributed to variations in study populations, sample sizes, or cultural adaptations of the CISS, highlighting the need for further research to better understand these relationships.

The ROC curve analysis demonstrated limited diagnostic accuracy for the CISS(AV), with an AUC of 0.658. Based on standard classification guidelines, an AUC below 0.7 is considered to reflect poor to moderate discrimination, whereas values above 0.7 indicate fair accuracy, and those above 0.8 suggest good diagnostic performance(Koo & Li, 2016). In this study, the CISS(AV) showed moderate sensitivity (63.64%) and specificity (66.43%), with a high NPV (95.88%).

These results align with previous studies, such as the Italian CISS validation study, which reported a sensitivity of 42% and specificity of 66.43%. However, it is different in PPV (27%) and NPV(85%) with the NPV of CISS(AV) being higher than the Italian version(Boccardo et al., 2022b).In contrast, the original CISS showed higher sensitivity (87%) and specificity (97.8%) in a study conducted by Rouse et al., The higher sensitivity and specificity reported by Rouse et.al may be attributed to their comprehensive binocular assessments, which excluded accommodative and other binocular anomalies, in contrast, the current study did not account for these factors, which could explain the lower diagnostic accuracy observed (M. Rouse et al., 2004).
Among all CISS translation and validation studies, only the current study and the Italian study have calculated sensitivity and specificity values. Other studies lacked clinical assessments to compare the CISS scores with clinical signs of CI.This calculation is crucial for integrating CISS with clinical tests, because one of the primary goals of translating the CISS is to integrate it with other clinical tests, enabling a better understanding of patient complaints and simultaneous monitoring of the impact of CI management on both signs and symptoms.Byincorporatingthese metrics, the current study provides a more comprehensive tool for clinicians to assess and manage CI, bridging the gap between subjective symptom reporting and clinical findings.

The internal consistency of the CISS(AV) showed excellent reliability, with an overall Cronbach's alpha for all items found to be 0.95, This result confirms that CISS (AV) is a highly reliable tool for assessing convergence insufficiency symptoms.

The current study reports a slightly higher Cronbach's alpha than the Arabic CISS by Al-johani et al. which was 0.88(Aljohani & Alnawmasi, 2024). These findings are in line with previous researchontranslatedCISS versions,whichhave shown onlyslight variations in internal consistency across different languages. All translated CISS versions exhibit excellent internal consistency. Reported Cronbach's alpha values range from 0.77 in the Persian version to 0.95 in the original validation study (Nabovati et al.,

2020b; M. Rouse et al., 2004).This consistency ensures reliability across diverse linguistic and cultural settings.

Strongevidence of the excellent reliability of CISS(AV) comes from the ICC test, which yielded a value of 0.931 (95% CI: 0.905-0.950). The narrow confidence interval reflects the high precision of this estimate, underscoring the consistency and stability of the CISS(AV) as a tool for assessing CI symptoms.These findings align closely with other validation studies, such as Arabicvalidation study (ICC = 0.93) (Aljohani & Alnawmasi, 2024), the Portuguese validation study (ICC = 0.924) (Tavares et al., 2014), the Italian validation study (ICC = 0.92)(Boccardo et al., 2022b), and theThai validation study (0.964) (Phongsura1 et al., 2024). This confirms that CI management can result in improvements in symptoms rather than the changes occurring by chance.

To visualize the test-retest reliability, the researcher used a non-parametric bland Altman plot.The plot revealed a slight negative bias with the median difference between the first and second response being -1. The limits of agreement (LOA) were found to be 8.75 and -10.75, with the majority of the differences (88.1%) falling within these limits. This demonstrates an acceptable level of agreement between the two responses, indicating that the CISS(AV) is a reliable tool for repeated measurement. Furthermore, the distribution of the differences around the median difference line was consistent with no clear upwardor downward trend, suggesting the absence of proportional or systematicbiasacross the range of CISS(AV) scores.

A small number of data points (n=18) fell outside the LOA, highlighting some variability in individual responses. This variability could be attributed to several factors, such as differences in the participants' state at the time of testing or other individual characteristics that may affect their convergence ability. These findings are consistent with other studies that have seen some degree of variability in test-retest reliability, especially in subjective measures like the CISS. Despite this, the overall high level of agreement suggests that the CISS(AV) is a robust and repeatable measure for assessing convergence insufficiency.

While this study offers valuable insights into the translation and validation of the CISS (AV) and shows its reliability and applicability in clinical practice, several limitationsmay affect the generalizability and interpretation of the findings. The diagnostic criteria used in the current study did not account for other binocular and accommodative anomalies, which could overlap with CI symptoms and impact the

sensitivity and specificity of the CISS(AV). Additionally, the validity of the CISS(AV) was assessed only in individuals aged 18-30 years, excluding younger age groups (9-17 years) who may also experience symptoms related to close work, reading, or smartphone use due to CI.

In conclusion, the current study demonstrated that the CISS(AV), which was translated and validated according to precise methodological steps based on reliable guidelines, has a high level of validity and reliability. It further confirms that the CISS(AV) is suitable for assessing symptoms in Arabic speakers in the MENA regions and monitoring therapeutic outcomes in clinical practice.

While the survey shows strong promise, further studies are recommended to validate its applicability in younger and older age groups and in diagnosing other binocular and accommodative anomalies. Such efforts will ensure the broader applicability of CISS(AV) across different populations and enhance its integration into clinical practice. Although additional research is required, the current study represents a significant contribution to the binocular vision field by providing a reliable Arabic-language CISS that can support both research and clinical management of CI in the MENA region.

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Appendices

Appendix 1: IRP Approval Letter

Arab American University

Institutional Review Board - Ramallah

الجامعـــة العربيـــة الأمريكيـــة

مجلس اخلاقيات البحث العلمي – رام الله

IRB Approval Letter

Study Title: "Translation and Validation of Convergence Insufficiency Symptoms Survey to Arabic Language".

Submitted by: Jafar Ibrahim Ayesh Qaresh

Date received: 24th July 2024

Date reviewed: 29th July 2024

Date approved: 29th July 2024

Your Study titled **"Translation and Validation of Convergence Insufficiency Symptoms Survey to Arabic Language"** with the code number **"R-2024/A/122/N"** was reviewed by the Arab American University Institutional Review Board - Ramallah and it was approved on the 29th of July 2024.

Sajed Ghawadra, PhD
IRB-R Chairman
Arab American University of Palestine

الجامعة العربية الأمريكية . فلسطين
مجلس اخلاقيات البحث العلمي . رام الله
IRB-R
ARAB AMERICAN UNIVERSITY-PALESTINE
INSTITUTIONAL REVIEW BOARD - RAMALLAH

General Conditions:

1. Valid for 6 months from the date of approval.
2. It is important to inform the IRB-R with any modification of the approved study protocol.
3. The Bord appreciates a copy of the research when accomplished.

رام الله – فلسطين

Tel: 02-294-1999 **E-Email:** IRB-R@aaup.edu **Website:** www.aaup.edu

Appendix 2: Forward Translation of the CISS by an Optometrist

استبيان يبحث قصور التقارب بين العينين

الاسم:.....التاريخ:.....

<u>تعليمات الطبيب أو الفاحص المختص</u>: يرجى قراءة التعليمات والأسئلة التالية الخاصة بالمشارك كما هي مكتوبة تماماً ومنغير إعطاء أمثلة توضيحية فإذا أجاب المشارك ب (نعم) يرجى الانتقال لاختيار التقييمالمناسب لحدة العَرَض كما هو موضحفي الجدول أدناه

تعليمات المشارك:من فضلك أجب عن الأسئلة التالية والمتعلقة بكيفية شعور العين أثناء القراءة أو عند القيام بنشاطات أو أعمالعلى مسافة القراءة.

		أبداً	نادراً	أحياناً	في كثير من الأحيان	دائماً
.1	هل تشعر بتعب في العينين عند القراءة أو عند القيام بنشاط على مسافة القراءة؟	0	1	2	3	4
.2	هل تشعر بعدم راحة في العينين عند القراءة أو عند القيام بنشاط على مسافة القراءة؟	0	1	2	3	4
.3	هل تعاني من الصداع عند القراءة أو عند القيام بنشاط على مسافة القراءة؟	0	1	2	3	4
.4	هل تشعر بالنعاس عند القراءة أو عند القيام بنشاط على مسافة القراءة؟	0	1	2	3	4
.5	هل تفقد التركيز عند القراءة أو عند القيام بنشاط على مسافة القراءة؟	0	1	2	3	4
.6	هل تواجه مشكلة في تذكر ما قرأته؟	0	1	2	3	4
.7	هل تواجه ازدواجية في الرؤية عند القراءة أو عند القيام بنشاط على مسافة القراءة؟	0	1	2	3	4
.8	هل ترى الكلمات تتحرك، تقفز، تعوم، أو تظهر وكأنها تطفو على الصفحة عند القراءة او القيام بنشاط على مسافة القراءة؟	0	1	2	3	4
.9	هل تشعر وكأنك تقرأ ببطء؟	0	1	2	3	4
.10	هل سبق لك وان شعرت بألم في عينيك عند القراءة أو عند القيام بنشاط على مسافة القراءة؟	0	1	2	3	4
.11	هل سبق لك وان شعرت بتهيج في عينيك عند القراءة أو عند القيام بنشاط على مسافة القراءة؟	0	1	2	3	4
.12	هل تشعر ب شد حول العينين عند القراءة أو عند القيام بنشاط على مسافة القراءة؟	0	1	2	3	4
.13	هل تلاحظ عدم وضوح الكلمات أو وضوحها تارة وعدم وضوحها تارة أخرى عند القراءة أو القيام بنشاط على مسافة القراءة؟	0	1	2	3	4
.14	هل تواجه صعوبة في الانتقال من سطر لآخر وتفقد مكان القراءة؟	0	1	2	3	4
.15	هل تشعر بأنه يجب عليك إعادة قراءة نفس السطر من الكلمات مرة أخرى؟	0	1	2	3	4
حتى تحصل على النتيجة، اجمع عدد الاجابات في كل عمود مضروبة في قيمة ذلك العمود		x0	x1	x2	x3	x4
المجموع						

Appendix 3:Forward Translation of the CISS by a Translator

الاسم: التاريخ:

تعليمات الاخصائي الاكلينيكي: اقرأ تعليمات الموضوع التالية لكل بند بالضبط. إذا كانت الإجابة "بنعم"، يرجى التقيد باختيارات التكرار. لا تعطي أمثلة.

تعليمات الموضوع: يرجى إجابة حول كيفية الشعور في عينيك عند القراءة أو أداء عمل عن قرب

		أبدا	نادرا	أحيانا	غالبا	دائما
1	هل تشعر عيناك بالتعب عندما تقرأ أو تؤدي عملا عن قرب؟					
2	هل تشعر عيناك بالضيق عندما تقرأ أو تؤدي عملا عن قرب					
3	هل تشعر بالصداع عندما تقرأ أو تؤدي عملا عن قرب؟					
4	هل تشعر بالنعاس عندما تقرأ أو تؤدي عملا عن قرب؟					
5	هل تفقد القدرة على التركيز عندما تقرأ أو تؤدي عملا عن قرب؟					
6	هل تعاني منعدم تذكر ما قرأت؟					
7	هل تحس بازدواج الرؤية عندما تقرا أو تؤدي عملا عن قرب؟					
8	هل ترى الكلمات تتحرك، أو تقفز، أو تسبح وتطفو على الصفحة عندما تقرأ أو تؤدي عملا عن قرب؟					
9	هل لديك ميل للقراءة ببطء؟					
10	هل تتأذى عيناك عندما تقرأ أو تؤدي عملا عن قرب؟					
11	هل تلتهب عيناك عندما تقرأ أو تؤدي عملا عن قرب؟					
12	هل تشعر بالشد حول عينيك عندما تقرأ أو تؤدي عملا عن قرب؟					
13	هل تلاحظ عدم وضوح الكلمات أو عدم استقرار التركيز عليها عندما تقرأ أو تؤدي عملا عن قرب؟					
14	هل تفقد مكانك عندما تقرأ أو تؤدي عملا عن قرب؟					
15	هل يجب عليك إعادة قراءة نفس كلمات السطر عندما تقرأ؟					
		X0	X1	X2	X3	X4

مجموع النقاط----------

Appendix 4: BackwardTranslationof the CISS ByanOptometrist

Convergence Insufficiency Symptoms Survey

Participant Name: _____ Date: _____

Examiner's instructions: Please read the following instructions and questions for the participant precisely as they are written, without giving illustrative examples. If the participant chooses (yes), please move on to choosing the appropriate assessment of the severity of the symptom as shown in the table below. If the participant responds "No" choose the column with number 0.

Participant Instructions: Please answer the following questions regarding how your eyes feel while reading or performing action at close range (at a reading distance).

Question	Never	Rarely	Sometimes	Often	Always
1. Do your eyes get tired when you read or perform close-up work?					
2. Do you feel discomfort in your eyes when reading or doing close work?					
3. Do you get a headache when you read or do close work?					
4. Do you feel sleepy when you read or do close work?					
5. Do you lose concentration when you read or do close work?					
6. Do you experience any problems with remembering what you read?					
7. Do you experience double vision when reading or doing close work?					
8. When reading or doing close work, do you see the words moving, jumping, or floating over the page?					
9. Do you feel that your reading is slow?					
10. Do you feel pain in your eyes when reading or doing close work?					
11. Do you experience eye soreness when reading or doing close work?					
12. Do you feel tension around your eyes when reading or doing close work?					
13. When reading or doing close work, do the words seem unclear or do they seem to fade and reappear?					
14. Do you lose place of focus or concentration when you read or perform close-up work?					
15. During reading, do you need to repeat the same line more than once?					
To calculate the score, add the number of answers for every column and multiply each number with the value of that column. Then calculate the sum of the values.	0 ×	1×.....	2×.....	3×.....	4×.....

Appendix 5: Backward Translation of the CISSBy A Translator

A Questionnaire Measuring Symptoms of Convergence Insufficiency

NameDate:

Examiner's instructions: Please read the following instructions and questions for the participant precisely as they are written, **without giving illustrative examples.** If the participant chooses(yes), please move on to choosing the appropriate assessment of the severity of the symptom as shown in the table below.

Participant Instructions: Please answer the following questions regarding how your eyes feel while reading or performing action at close range (at a reading distance).

	Never	Rarely	Sometimes	Often	Always
1- Do your eyes get tired when you read or perform close-up work?					
2- Do you feel discomfort in your eyes when you read or perform close-up work?					
3-Do you get a headache when you read or perform close work?					
4-Do you feel sleepy when you read or do close work?					
5- Do you lose concentration when you read or perform close-up work?					
6- Are you having trouble in remembering what you read?					
7-Do you experience double vision when you read or perform close-up work?					
8- When you read or perform close-up work, do you see the words as if they are moving, jumping, or floating on the surface of the page?					
9-Do you feel that your reading is slow?					
10- Do you feel pain in your eyes when you read or perform close-up work?					
11-Do you suffer from eye allergy when you read or perform close-up work?					
12-Do you feel tightening around your eyes when you read or perform close-up work?					
13-When you read or perform close-up work, do you notice that the words are not clear or seem to disappear at times and appear again?					
14- Do you lose place of focus or concentration when you read or perform close-up work?					
15- While reading, do you have to repeat the same line more than once?					
To get the result, add the number of answers in each column and multiply it by the value of that column.	**0×…..**	**1 ×…..**	**2 ×…..**	**3 ×…..**	**4×…..**

Appendix 6: Examination Form

PATIENT INFORMATION	
Name:	Participant CODE: Place of testing: 1- Al-Kemah Optical Center. 2- Ibrahim Optical Center. 3- optometry clinic at AAUP.
DOB: / / SEX:1-M / 2- F Phone: Address:	
Age: Exam Date:	

Case History	
Reason for visit:	
HPI:	PAST ,FAMILY AND / OR SOCIAL HISTORY :
Which eye has the problem? OD OS OU Does the problem cause vision loss or blur? Loss - Blur Is occurrence sudden or gradual? sudden-- gradual How severe is the problem?Mild -Moderate - Severe Is it worse at any specific distance? Distance – Near –Both How long does the problem last? Intermittent – Constant How long has the problem been occurring? Short-term – Long term	POH :…….. ROS:( )Const ( ) CV ( ) ENT ( ) Pulm ( ) GI( ) End ( ) GU ( ) Derm( ) Heme/onc ( ) Neuro ( )Musculoskeletal FOH:…… FMH:…… Med: …… Allergies: …… Cig (Y / N) Occupation: …… SH…… Are they oriented to time &place?
Other question:	

Entrance Testing:		Old Spectacle:	
DVA OD sc cc**:** **PH:**	**DVA OS** sccc**:** **PH:**	OD	RX: yrs.
NVA OD sc cc:	**NVA OS**sc cc**:**	OS	
Pupil: **ERRL:** Y/N **APD:** Y/N	**EOM**	**Confrontation:**	**AUTO REFRACTOMETER SHEET :**
Refractive status:			
Wet Retinoscopy: **OD :**……**OS :**……			
Manifest Refraction: **OD :**…… **VA:OS :**……**VA:**			
Final Prescription: OD : …… OS : …… IPD: ……			

Appendix 6: Examination Form

Binocular assessment					
NPC		Cover Test		Step vergence test	Stereo:
Break	Recovery			BASE OUT:	
		CTD:	CTN:	(/ /)	1-norm. 2- abn.
					AC/A ratio: (using +2.00)
		1-norm. 2-abn.	1-norm. 2-abn.	1-norm. 2-abn.	1-norm. 2- abn.
avg. 1- norm. 2- abn. Normal value: ≤ 6cm.		Normal value: the difference between near exophoria and distance phoria less than 4Δ		Normal value: convergence reserves of more than twice the phoria value at near, or a break value of more than 15Δ.	$AC/A = \frac{\text{Phoria with additional minus lenses} - \text{baseline phoria}}{\text{Absolute power of additional minus lenses}}$

Slit Lamp Exam			Posterior Segment Evaluation		
OD		OS	OD		OS
	L/L			CDR	
	Conj			NRR	
	cornea			Macula	
	AC			Posterior Pole	
	Iris			Vessels	
	angles			Vitreous	
	Lens			Periphery	
Other tests:					

ASSESMENT	PLAN

Optometrist:……..

Appendix 7: Binocular Vision Examination Guidelines

TEST	Procedure
Near point of convergence test.	The examiner asked the participants to keep looking at optotypes in the 20/30 line on the accommodation card while moving it toward the participant's eyes at approximately 1-2 cm/sec until the participant reported seeing double or the examiner noticed a break in fusion (breakpoint). After that, the examiner moved the accommodation card backward until the participants regained single vision (recovery point). Break and recovery points were measured from the participant's eye to the accommodation card. This test was repeated three times, and the average of the results was taken(Scheiman & Wick, 2008).
Stepvergence test (PFV)	The examiner instructed the participant to hold the Gulden fixation stick approximately 40 cm from their eyes and focus on the 20/30 isolated letters displayed on it. Subsequently, the examiner gradually increased the base-out prism's power in front of the participant's right eye at about 2 prism diopters per second. The process continued until the participant reported blurry vision (blur), at which point the examiner further increased the prism power until the participant experienced double vision (break). The prism power was then gradually decreased until the participant regained single vision (recovery). Three values were recorded during this test: blur, break, and recovery(Scheiman & Wick, 2008).
Stereopsis Test	The examiner held the test plates at 40 cm from the participants in a well-illuminated room and instructed the participants to wear polarized glasses with full refractive correction and to look at the plates containing the circles and determine which one of the three circles seemed to float forward,The final result of this test ranged from 400 to 20 second of arc (Scheiman & Wick, 2008).
Prism cover test	This test was conducted using an eye cover, a prism bar, aGulden fixation stick held by the participant at 40 cm from their eyes, and a Snellen chart placed at 6 meters. For the distance cover test, the examiner asked the participants to look at two lines greater than their (BCVA) on the Snellen chart and then alternately covered their eyes, neutralizing the phoria with a prism bar. For the near cover test, the examiner asked the participants to focus on the 20/30 line on the Gulden stick and then alternatively covered their eyes, neutralizing phoria using a prism bar(Scheiman & Wick, 2008).

Appendix 8: Final Arabic version of CISS

استبيان لقياس أعراض قصور التقارب

الاسم: ..... لتاريخ:.....

تعليمات الفاحص:الرجاء قراءة التعليمات والأسئلة التالية للمشارك كما هي مكتوبة تماماً **ومن غير إعطاء أمثلة**توضيحية فإذا أجاب المشارك ب (نعم) يرجى الانتقال لاختيار التقييم المناسب لحدة العَرَض كما هو موضح في الجدول أدناه.

تعليمات المشارك:من فضلك أجب عن الأسئلة التالية المتعلقة بالأعراض التي تشعر بها في عينيك أثناء القراءة أو أداء عمل على المسافةالقريبة (على مسافة القراءة).

	أبدا (0)	نادرا(1)	أحيانا(2)	غالبا (3)	دائما (4)
1–هل تشعر بتعب في عينيكعندما تقرأ أو تؤدي عملا عن قرب؟					
2–هل تشعر بعدم راحة في العينين عندما تقرأ أو تؤدي عملا عن قرب؟					
3–هل تعاني من الصداععندما تقرأ أو تؤدي عملا عن قرب؟					
4–هل تشعر بالنعاس عندما تقرأ أو تؤدي عملا عن قرب؟					
5–هل تفقد التركيز عندما تقرأ أو تؤدي عملا عن قرب؟					
6–هل تواجه مشكلة في تذكر ما قرأته؟					
7–هل تواجه ازدواجية في الرؤية عندما تقرا أو تؤدي عملا عن قرب؟					
8– عندما تقرأ أو تؤدي عملا عن قرب، هل ترى الكلمات وكأنها تتحرك، تقفز، او تطفو على سطح الصفحة؟					
9–هل تشعر بأن قراءتك بطيئة؟					
10–هل تشعر بألم في عينيكعندما تقرأ أو تؤدي عملا عن قرب؟					
11–هل تشعر بالتحسس في عينيك عندما تقرأ أو تؤدي عملا عن قرب؟					
12–هل تشعر بشد حول عينيكعندما تقرأ أو تؤدي عملا عن قرب؟					
13–عندما تقرأ او تؤدي عملا عن قرب، هل تلاحظ ان الكلمات غير واضحة أو تبدو وكأنها تتلاشى تارة وتعود تارة أخرى؟					
14–هل تفقد مكان تركيز نظرك عندما تقرأ أو تؤدي عملا عن قرب؟					
15– أثناءالقراءة، هل تضطر لتكرار نفس السطر أكثر من مرة؟					
للحصول على النتيجة قم بجمع عدد الإجابات في كل عمود واضربها بقيمة ذلك العمود.	.....× 0	.....1×	.....2×	.....3×	.....4×

النتيجة النهائية: .....

ترجمة وتفعيل استبيان أعراض قصور التقارب إلى اللغة العربية

اسم الطالب: جعفر إبراهيم عايش قرعيش.

أسماء لجنة الإشراف:د.إبراهيمطه، د. يزن قموة، د.خليل حريبات.

ملخص

المقدمة ومشكلة الدراسة: يعتبر قصور التقارب من أكثر مشاكل الرؤية الثنائية شيوعا، ومن أهم أعراضه انخفاض قدرة العينين على التركيز على نفس النقطة لفترات طويلة أثناء النظر على المسافات القريبة. يستخدم استبيان أعراض قصور التقارب على نطاق واسع لتقييم الأعراض المصاحبة لهذه الحالة. وبالرغم من توفر نسخة مترجمة للغة العربية من استبيان قصور التقارب، إلاإنالباحثين اقتصروا للتحقق من صحته على طلاب جامعة واحدة فقط، وتم إجراء الترجمة والتحقق من صحتها دون إجراء اختبارات سريريه لربط نتائج استبيان أعراض قصور التقارب البصري بالتشخيصات السريرية.

أهداف الدراسة: تهدف هذه الدراسة إلى ترجمة استبيان أعراض قصور التقارب الى اللغة العربية والتحقق من فعاليته وموثوقيته للاستخدام بين الناطقين باللغة العربية.

إجراءات الدراسة: تمت الدراسة على مرحلتين؛ في المرحلة الأولى، تمت ترجمة الاستبيان من الانجليزية إلى العربية وفقاً لإرشادات معتمدة. أما المرحلة الثانية، فقد شملت تقييم موثوقية النسخة المترجمة من خلال تطبيقها على 151 مشاركًا، تم اختيارهم من مراجعي كل من مركز القمة للبصريات في يطا، ومركز إبراهيم للبصريات في سلفيت، وعيادة تدريس البصريات في الجامعة العربية الأمريكية في رام الله، في الفترة ما بين أغسطس 2024 إلى ديسمبر 2024. وقد تم تقييم الاستبيان المترجم من خلال مقارنة نتائجه بنتائج الفحوصات السريرية، مما يعزز دقة الاستبيان وقابليته للتطبيق بين الناطقين باللغة العربية.

ملخص النتائج: أظهرت نتائج الدراسة أن 7.28% من المشاركين تم تشخيصهم بقصور التقارب، كما أظهرت النسخة العربية من استبيان قصور التقارب قدرة تمييزية متوسطة في تشخيص الحالة، حيث تم تحديد العلامة 19 كنقطة مثلى للتمييز بين الأشخاص السليمين والأشخاص المصابين بقصور التقارب. كما أكدت تحليلات الاتساق الداخلي وموثوقية الاختبار وتكرار الاختبار على الموثوقية العالة للاستبيان، مما يدعم استخدامه كأداة موثوقة وفعالة في تقييم أعراض قصور التقارب بين الناطقين باللغة العربية.

الخلاصة واهم التوصيات: أثبتت الدراسة ان النسخة العربية من استبيان قصور التقارب تتمتع بمستوى عال من الصلاحية والموثوقية، مما يجعلها أداة مناسبة لتقييم أعراض قصور التقارب بين الناطقين بالعربية في منطقة الشرق الأوسط وشمال أفريقيا. ومع ذلك، توصي الدراسة بإجراء المزيد من الأبحاث للتحقق من قابليته للتطبيق على الفئات العمرية المختلفة والمشكلات البصرية الأخرى، لضمان تطبيقه بشكل أوسع في الممارسات السريرية.

الكلمات المفتاحية:قصور التقارب، ترجمة، استبيان قصور التقارب، موثوقية استبيان.