

Clinical Validation of Orthodontic Oral Health Literacy and Behavior Tools (OHL-Ortho & OHB): A Cross-Sectional Assessment Using CPITN, OHI-S and Objective Knowledge Measures

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Article

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Abstract

Fixed orthodontic appliances create plaque-retentive surfaces that increase the risk of gingival inflammation and deteriorating oral hygiene, making patients' oral health literacy and behavior central to maintaining periodontal health throughout treatment. The OHL-Ortho and OHB instruments are newly developed orthodontic-specific tools that have undergone psychometric validation but lack clinical validation, leaving uncertainty about their applicability in real-world settings. This study evaluated the reliability and clinical validity of both instruments in adult orthodontic patients by assessing their associations with objective knowledge measures and clinical indices. Fifty-two participants undergoing fixed orthodontic treatment completed the OHL-Ortho and OHB questionnaires, followed by a structured orthodontic knowledge quiz and a single-blind clinical examination using CPITN and OHI-S. Both scales demonstrated strong internal consistency and high test–retest reliability. Higher literacy scores were associated with greater factual orthodontic knowledge, while better reported oral health behaviors corresponded to lower periodontal treatment needs and improved oral hygiene status. Regression analyses showed that orthodontic literacy significantly predicted oral health behavior, and both measures independently predicted oral hygiene outcomes. These findings provide the first clinical validation of the OHL-Ortho and OHB tools and support their use in identifying patients at risk for inadequate self-care, guiding targeted education, and improving periodontal and hygiene outcomes during orthodontic treatment.

INTRODUCTION

Fixed orthodontic appliances such as braces remain the primary treatment modality for moderate to severe malocclusions, with an estimated 71.7% of orthodontic patients globally undergoing fixed appliance therapy.¹ While effective, these appliances introduce significant oral hygiene challenges.² Brackets, archwires, and elastomeric components contribute to plaque retentive surfaces that are difficult to clean.³ When coupled with the prolonged duration of treatment—typically ranging from 18 to 24 months—there is an increased risk of plaque accumulation, gingival inflammation, and subsequent periodontal disease, particularly in patients with inadequate oral hygiene.^{4,5}

Maintaining optimal oral health during orthodontic treatment requires consistent engagement in oral health behaviors (OHBs), such as brushing, interdental cleaning, dietary compliance, and professional care.⁶ However, these behaviors are influenced by an individual's oral health literacy (OHL), defined as the ability to obtain, comprehend, evaluate, and act upon oral health information.⁷ Higher OHL is associated with better self-care and clinical outcomes.^{8,9}

Despite its importance, most existing OHL assessment tools such as REALD-30 and ToFHLiD focus narrowly on word recognition and functional literacy, overlooking the critical and interactive domains essential for orthodontic self-management.^{10,11} Moreover, these general instruments do not assess the

unique informational demands of orthodontic care, such as understanding bracket-friendly diets, wire activation schedules, bonding material care, and elastomeric hygiene.¹²

To address this gap, Thirasupa et al.¹³ developed two orthodontic specific tools: the OHL-Ortho scale and the OHB scale. The OHL-Ortho questionnaire, grounded in the integrated health literacy model by Sorensen et al.¹⁴ and the patient-centered framework by Osborne et al.¹⁵, evaluates five domains: access, understanding, appraisal, application, and communication. The OHB scale assesses orthodontic related behaviors, including brushing frequency, dietary habits, and dental visits. Both tools exhibited excellent psychometric properties during development (OHL-Ortho: $\alpha = 0.97$; OHB: $\alpha = 0.89$), but their clinical validity remains untested. To date, no clinical validation of the OHL-Ortho or OHB instruments has been conducted in any population, making this study the first global clinical validation of these tools.

Orthodontic patients often struggle to translate general health advice into appliance-specific tasks.² Without a validated, targeted tool, clinicians cannot reliably identify patients with limited comprehension of self-care instructions potentially undermining outcomes.¹⁶ Although the OHL-Ortho and OHB instruments were originally developed and psychometrically validated in a Thai population, their performance in other cultural and geographic settings remains unknown.¹³ Importantly, these tools have not been evaluated in South Asian populations, where distinct dietary patterns, cultural health beliefs, and communication dynamics differ substantially from the context in which the instruments were developed. Such population-specific variations may influence how patients interpret, appraise, and apply orthodontic information, underscoring the need to examine whether these tools retain validity when used in new cultural environments.

This study addresses these gaps by undertaking a multi-method clinical validation of the OHL-Ortho and OHB instruments in adult orthodontic patients in Pakistan. By integrating subjective responses with objective outcomes, this study aims to generate robust, convergent evidence supporting the validity and utility of these tools in clinical orthodontic practice.

MATERIALS AND METHODS

Study Design and Setting:

This cross-sectional clinical validation study was carried out between February and June 2025 at the Orthodontic Clinics of XX University Hospital (XX), , Pakistan.

Ethics Approval and Consent to Participate:

This study was reviewed and granted exemption by the Institutional Ethical Review Committee of Aga Khan University Hospital, Karachi, Pakistan (Exemption No. 2025-12034-39228). All procedures were performed in accordance with the ethical standards of the institutional research committee and with the Declaration of Helsinki.¹⁷ Written informed consent was obtained from all participants prior to enrollment in the study.

Participants and Eligibility Criteria:

Adults aged 20-40 years undergoing fixed orthodontic treatment for at least three months were recruited. Additional inclusion criteria were the ability to read and write in English and willingness to provide written informed consent. Exclusion criteria included a history of periodontal therapy within the past four months, current use of medications known to affect periodontal tissues (e.g., immunosuppressants, anticonvulsants), systemic conditions likely to impact oral health (e.g., uncontrolled diabetes, immunodeficiency), cognitive impairment or psychiatric illness that would preclude valid questionnaire completion, a history of previous orthodontic treatment, and current smoking.

Sample Size Calculation:

Sample size was calculated using G*Power software (Version 3.1.9.7; Heinrich Heine University, Düsseldorf, Germany), targeting a strong Pearson correlation ($r = 0.40$) between OHL-Ortho scores and clinical indices (CPITN and OHI-S). With two-tailed $\alpha = 0.05$ and 80% power, the required sample size was 47. To accommodate potential incomplete or unusable data, the sample size was inflated to 52 participants.

Sampling and Recruitment:

A non-probability consecutive sampling strategy was employed. Eligible participants were approached during their routine orthodontic review visits. Written informed consent was obtained prior to data collection, in accordance with the Declaration of Helsinki.¹⁷

Data Collection:

Data collection was conducted in a supervised, structured clinical setting. After obtaining consent, participants were first asked to complete a demographic and clinical form including age, gender, education level, treatment phase (alignment, space closure, or finishing), and duration of appliance wear. They then completed three tools in a fixed order. The *Oral Health Behavior (OHB)* questionnaire (14 items) assessed toothbrushing, interdental cleaning, dietary practices, and dental visits; each item was scored 1 (never) to 5 (always), producing a total score of 14-70, with higher scores indicating better oral health behavior. The *Oral Health Literacy-Ortho (OHL-Ortho)* questionnaire (31 items across five domains: access, understanding, appraisal, application, and communication) used a 1-5 (strongly disagree to strongly agree) scale, yielding total scores of 31-155; higher scores denoted greater orthodontic health literacy. The 12-item multiple-choice *Oral Health Knowledge* quiz was developed and expert-validated by five experienced orthodontists (≥ 3 years of clinical experience) which assessed bracket care, hygiene tools, dietary compliance, periodontal awareness, and patient-provider communication; each correct response scored one point (total range 0-12).

To assess content validity, items were independently rated for relevance and clarity on a 4-point Likert scale by three senior orthodontic educators (≥ 5 years of academic and clinical experience). The Content

Validity Index (CVI) was calculated at both the item level and the scale level, indicating excellent content validity. The quiz was pilot tested with 12 orthodontic patients for clarity and feasibility; minor revisions were made based on their feedback accordingly.

The full OHL-Ortho questionnaire, OHB questionnaire, the 12-item orthodontic knowledge MCQ quiz, and the scoring proforma used in this study are provided in the Supplementary Information (Supplementary File 1).

Clinical Examination and Indices:

Following completion of the questionnaires, a single blind clinical examination was conducted by a calibrated examiner. The following indices were recorded:

Community Periodontal Index of Treatment Needs (CPITN): All six sextants were examined using a WHO ball-tipped probe. Scores (0 - 4) were recorded per sextant and average per participant.

Simplified Oral Hygiene Index (OHI-S): Debris and calculus were scored on six index teeth using Greene and Vermillion's method. A composite score (0-6) was computed for each participant.

Together, these indices capture short-term oral hygiene status (OHI-S) and longer-term periodontal condition (CPITN), enabling a comprehensive assessment for subsequent validity analyses. The assessment sequence was standardized to minimize priming and response bias (**Figure I**). A neutral, trained researcher was present to clarify instructions without leading participant responses. Data were entered into a structured electronic proforma and verified for accuracy and completeness.

Examiner Calibration:

The clinical indices were recorded by two independent orthodontic residents trained in CPITN and OHI-S methodology using a WHO ball-ended probe. Examiner calibration was conducted on a separate sample (N = 20) to assess inter-examiner reliability, and on a subsample re-examined after two weeks (N = 10) to assess intra-examiner reliability. Agreement for clinical indices was quantified using Cohen's kappa.

Data Analysis:

All data were entered into Microsoft Excel and analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY). Descriptive statistics-including means, standard deviations (SD), medians with interquartile ranges (IQR), and frequencies with percentages were used to summarize demographic, behavioral, literacy, and clinical variables. Treatment stage was collected for descriptive purposes only and was not included in the analytic models, as the study's aim was clinical validation rather than examining phase-specific influences. The Shapiro-Wilk test was used to assess the normality of continuous variables, including OHL-Ortho scores, OHB scores, quiz scores, CPITN, and OHI-S. Internal consistency of the OHL-Ortho and OHB instruments was evaluated using Cronbach's alpha. Item-level reliability was assessed through inter-item and item-total correlations. Test-retest reliability of the OHL-Ortho and OHB instruments was

assessed using intraclass correlation coefficients (ICCs) in a subsample of 30 participants who completed the questionnaires twice, separated by a two-week interval.

Objective validity of the OHL-Ortho instrument was examined by correlating OHL-Ortho scores with quiz scores using Spearman's correlation. Similarly, convergent validity of the OHB scale was assessed using Spearman's correlation between OHB scores and clinical indices (CPITN and OHI-S), as the data did not meet the normality assumption. To explore predictive and structural relationships, bivariate linear regression was conducted to assess the association between OHL-Ortho and OHB scores. Furthermore, multiple linear regression models were constructed with CPITN and OHI-S as dependent variables, and OHL-Ortho and OHB scores as independent predictors, adjusting for potential confounders such as age, gender, and duration of orthodontic treatment. All statistical tests were two-tailed, and a p -value < 0.05 was considered statistically significant. Assumptions for linear regression, including homoscedasticity, independence, and normality of residuals, were assessed and met."

RESULTS

Participant Characteristics and Normality Assessment

A total of 52 orthodontic patients were enrolled in the study, including 29 females (56%) and 23 males (44%). The sample predominantly comprised individuals with higher educational attainment, reflecting the typical patient population at a university-based orthodontic clinic. Specifically, 50% were graduates and 25% held postgraduate degrees, while 20% had completed secondary education and 5% had primary or no formal education.

The results of the Shapiro-Wilk test showed that the OHL-Ortho, OHB, and OHI-S scores were normally distributed ($p > 0.05$), while age, quiz scores, and CPITN were non-normally distributed ($p < 0.05$). Normally distributed variables, including OHL-Ortho, OHB, and OHI-S, displayed mean scores with relatively small standard deviations, whereas non-normally distributed variables, including age, quiz scores, and CPITN, demonstrated median values with narrow interquartile ranges, suggesting relatively low variability across participants (Table I).

Reliability Analysis

Both the OHL-Ortho and OHB instruments demonstrated strong psychometric properties. The OHL-Ortho tool showed good internal consistency (Cronbach's $\alpha = 0.82$) and high test-retest reliability (ICC = 0.82; 95% CI: 0.78-0.85; subsample $N = 30$). The OHB scale displayed excellent internal consistency ($\alpha = 0.91$) and test-retest reliability (ICC = 0.91; 95% CI: 0.88-0.93; subsample $N = 30$). Examiner calibration ($N = 20$) showed substantial inter-examiner agreement for the clinical indices (Cohen's $\kappa = 0.84$). Intra-examiner reliability, assessed two weeks later on a subsample of 10 patients, yielded $\kappa = 0.87$.

Validity Testing

A statistically significant and strong positive correlation was observed between OHL-Ortho scores and quiz scores ($p = 0.610$, $p < 0.001$), supporting the objective validity of the OHL-Ortho instrument (Table II). Participants with higher self-reported orthodontic literacy demonstrated greater factual knowledge, reinforcing the instrument's ability to reflect true orthodontic understanding (Figure II). Similarly, the OHB scale demonstrated convergent validity with clinical indices, showing strong, inverse correlations with both CPITN ($p = -0.627$, $p < 0.001$) and OHI-S scores ($p = -0.669$, $p < 0.001$) (Table II). Participants who reported better oral health behaviors tended to have lower periodontal treatment needs and improved oral hygiene status, validating the OHB tool's ability to reflect actual clinical outcomes (Figures III and IV).

Regression Analysis

The bivariate linear regression model revealed that OHL-Ortho significantly predicted OHB scores ($B = 0.391$, $R^2 = 0.84$, $p < 0.001$) with a one-point increase in OHL-Ortho corresponding to a 0.39-point increase in OHB (Table III).

In the multiple regression model assessing predictors of oral hygiene outcomes, both OHL-Ortho and OHB emerged as significant independent predictors of OHI-S scores ($R^2 = 0.67$, $p < 0.001$). Each one-point increase in OHL-Ortho was associated with a 0.016-unit reduction in OHI-S, while each one-point increase in OHB corresponded to a 0.097-unit reduction (Table III). These findings indicate that both literacy and behavior independently contribute to better oral hygiene outcomes.

DISCUSSION

This study presents the first clinical validation of the orthodontic specific instruments, Oral Health Literacy-Ortho and Oral Health Behavior scales, originally developed by Thirasupa et al.¹³, within a South Asian context. The original psychometric validation employed latent modeling approaches such as Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM).¹³ In contrast, our study adopted a pragmatic and multi-method strategy, anchored in real-world clinical outcomes, reinforcing the tools' utility and applicability in routine orthodontic care.

The OHL-Ortho instrument demonstrated good internal consistency and test-retest reliability. The OHB scale showed even stronger reliability ($\alpha = 0.91$), closely aligning with the original findings ($\alpha = 0.89$).¹³ Minor score variations may reflect individual differences in comprehension and experience, yet the instruments demonstrated strong reliability within this clinical population.

A key methodological strength of this study was the external validation strategy. OHL-Ortho scores were correlated with a structured, content-validated orthodontic knowledge quiz, and OHB scores were validated against objective clinical indices: CPITN and OHI-S. This triangulated framework enhances the clinical interpretability and real-world relevance of both instruments.

Significant associations between literacy (OHL-Ortho), behavior (OHB), and clinical status (quiz scores, OHI-S and CPITN) in this study align with Sorensen's¹⁴ integrated model of health literacy. This framework posits that higher levels of orthodontic literacy enhance individuals' ability to adopt effective self-care behaviors, which in turn promote better clinical outcomes. These findings also parallel the validation work of Thirasupa et al.¹³ supporting the relevance of these instruments in linking knowledge to practice within orthodontic populations.

Regression analysis further reinforces the relationship between literacy, behavior and clinical status that higher orthodontic literacy predicted better oral-health behavior, and both literacy and behavior independently predicted oral-hygiene outcomes. This supports the theoretical foundation that knowledge (capability) and behavior (motivation/action) must coexist to influence clinical outcomes, aligning with behavior change frameworks such as the COM-B model and the Health Belief Model.¹⁸ These models emphasize that improved understanding, perceived benefit, and self-efficacy are critical for sustaining oral health behaviors. This was reflected in our sample, where higher literacy and behavioral scores were consistently associated with better periodontal and hygiene status during orthodontic treatment.

Building on this, our findings are consistent with the broader body of research: Khan et al.¹⁹ reported that higher scores on the Health Literacy in Dentistry (HeLD-14) tool in India were inversely associated with CPITN scores ($p = -0.52, p < 0.001$), while Batista et al.²⁰ in Brazil found that oral health literacy (using the OHLI tool) correlated with better periodontal health. Similarly, studies in the United States have linked lower OHL-measured using the Comprehensive Measure of Oral Health Knowledge (CMOHK)-with poorer clinical outcomes and irregular preventive attendance.²¹ Together, these patterns across populations and tools strengthen the construct linking health literacy to clinical status.

However, traditional general oral health literacy tools such as REALD-30 or TOFHLiD may underperform in orthodontic settings due to their limited scope and lack of context-specific items.^{10,11} Our 12-item orthodontic knowledge quiz was designed to capture bracket care, elastomeric hygiene, and compliance behaviors, domains essential for orthodontic success but absent in conventional instruments. This underscores the importance of domain-specific assessments, particularly when applied in specialty care settings.

Clinically, the validated OHL-Ortho and OHB instruments offer a practical, time-efficient method for orthodontists to screen patients chairside for literacy or behavioral gaps. Their integration into digital platforms-such as patient portals, chairside apps, or initial consultation software will support personalized counseling, improve compliance, and help predict treatment adherence. Moreover, their use in academic or public health settings could assist in identifying at-risk groups, designing targeted interventions, and monitoring treatment progress.

Integration of oral health literacy and behavior tools like OHL-Ortho into electronic dental records (EDRs) is increasingly endorsed in international consensus frameworks as a strategy to enhance patient care with real-time alerts and personalized educational prompts. The FDI World Dental Federation's 2025 Consensus Statement, crafted by global experts, advocates embedding key oral health data into EHR

systems to support comprehensive, coordinated care, while also highlighting barriers including standardization, interoperability, data security, and stakeholder engagement.²² Building on this vision, OHL-Ortho and OHB could be integrated into clinical systems to flag low literacy scores and suboptimal oral health behaviors, triggering tailored educational prompts or clinician alerts to improve engagement and reduce disparities in orthodontic outcomes by promoting equitable, patient-centered engagement.

Finally, this study illustrates the feasibility of deploying validated OHL and OHB measures in culturally diverse and lower-middle-income environments. Their strong psychometric performance, along with objective correlation to clinical indicators, supports their broader applicability and positions them as promising tools for both research and practice in orthodontics and oral health promotion.

Recommendations:

The validated OHL-Ortho and OHB instruments should be considered for integration into initial orthodontic assessments to identify patients with limited literacy and suboptimal behaviors. Early detection may support personalized education and behavior change strategies, potentially improving adherence and treatment outcomes.

To enhance implementation, especially in resource-limited settings, these tools can be adapted for use in mobile applications or integrated into electronic dental records for point-of-care screening.

Future research should focus on longitudinal validation through prospective cohorts or randomized controlled trials to evaluate their impact on clinical parameters such as oral hygiene, plaque control, and treatment efficiency. Multicenter studies across varied populations are also recommended to confirm generalizability.

Limitations:

Several limitations should be acknowledged. First, this was a single-centered study conducted at a tertiary care academic institution with a modest sample size ($N = 52$), which may limit the external generalizability of the findings. While the sample was statistically adequate for the intended validation analyses, larger multi-center studies are warranted to ensure broader applicability across different demographic and clinical settings. Second, although both instruments were pilot-tested and demonstrated strong reliability, the potential for questionnaire bias cannot be fully excluded, especially in self-reported measures where social desirability or recall bias may influence responses. Lastly, given the cross-sectional design, causal relationships between orthodontic literacy, behaviors, and clinical outcomes could not be established. Future longitudinal studies are recommended to evaluate predictive validity over time.

CONCLUSION

The OHL-Ortho and OHB instruments demonstrated strong internal consistency, excellent test-retest reliability, and convergent validity in a Pakistani adult orthodontic population.

A clinically grounded, multi-method validation approach was employed, correlating self-reported data with both knowledge scores and clinical indices, reinforcing the instruments' practical utility.

These tools can support targeted patient education, behavior modification strategies, and evidence-based orthodontic care in diverse settings.

Integration of such validated instruments into routine orthodontic workflows and digital platforms may enhance personalized risk assessment and long-term oral health outcomes.

ABBREVIATIONS

ICC

Intraclass correlation coefficient

IQR

Interquartile range

CVI

Content validity index

I-CVI

Item-level content validity index

S-CVI/Ave

Scale-level content validity index (average method)

CPITN

Community Periodontal Index of Treatment Needs

OHI-S

Oral Hygiene Index–Simplified

OHL-Ortho

Oral Health Literacy–Orthodontics

OHB

Oral Health Behavior

SPSS

Statistical Package for the Social Sciences

SD

Standard deviation

CI

Confidence interval

DECLARATIONS

Ethics approval and consent to participate:

This study was reviewed and granted exemption by the Institutional Ethical Review Committee of Aga Khan University Hospital, Karachi, Pakistan (Exemption No. 2025-12034-39228). All procedures were performed in accordance with the ethical standards of the institutional research committee and with the Declaration of Helsinki.¹⁷ Written informed consent was obtained from all participants prior to enrollment in the study.

Consent for Publication:

Not applicable. No identifying images, clinical photographs, or personal participant information are included in this manuscript.

Availability of data and materials:

The datasets generated and/or analysed during the current study are not publicly available due to ethical and institutional restrictions related to patient confidentiality but are available from the corresponding author on reasonable request.

Competing interests:

The authors declare no competing interests.

Funding:

None declared.

Authors' Contributions

M.R.I: Study conception and design, data collection, data analysis, and drafting of the manuscript.

S.M.A.G: Data collection and manuscript revision.

M.M: Data collection and manuscript revision.

R.H.S: Supervision, critical feedback, and guidance during manuscript preparation.

M.F: Senior supervision, oversight of study design, interpretation of results, and final manuscript revisions.

All authors read and approved the final manuscript.

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TABLES

Table I. Descriptive Statistics of Study Variables

Variable	Distribution	Measure	Value
OHL-Ortho	Normal	Mean ± SD	123 ± 6.4
OHB	Normal	Mean ± SD	56.1 ± 3.8
OHI-S	Normal	Mean ± SD	2.9 ± 1.0
Age	Non-normal	Median (IQR)	26.5 (23.0-30.0)
Quiz Score	Non-normal	Median (IQR)	8.5 (8.0-9.0)
CPITN	Non-normal	Median (IQR)	2.0 (1.7-2.3)

N = 52, SD = Standard deviation, IQR = Interquartile range

OHL-Ortho = Oral health literacy - Orthodontics, OHB = Oral health behavior

OHI-S = Oral hygiene index-simplified, CPITN = Community periodontal index of treatment needs

Table II. Correlation between Literacy, Behavior Tools, and Oral Health Indices

Relationship	ρ (Spearman's rho)	p -value
Objective Validity OHL-Ortho vs. Quiz	0.610	$\leq 0.001^{**}$
Convergent Validity OHB vs. CPITN	- 0.627	$\leq 0.001^{**}$
Convergent Validity OHB vs. OHI-S Score	- 0.669	$\leq 0.001^{**}$

N = 52, **Spearman correlation analysis**

$p \leq 0.05^*$, $p \leq 0.001^{**}$

OHL-Ortho = Oral health literacy - Orthodontics, OHB = Oral health behavior

OHI-S = Oral hygiene index-simplified, CPITN = Community periodontal index of treatment needs

Table III. Regression Coefficients for Predictors of OHB And OHI-S

Model	Dependent Variable (DV)	Independent Variable (IV)	Coefficient (β)	p -value	95% CI
OHL $\rightarrow$ OHB (Linear) ($R^2 = 0.84$)	OHB	OHL-Ortho	0.391	$\leq 0.001^{**}$	0.357, 0.425
OHL + OHB $\rightarrow$ OHI-S (Multiple) ($R^2 = 0.67$)	OHI-S	OHL-Ortho	-0.016	$\leq 0.001^{**}$	-0.024, -0.008
		OHB	-0.097	$\leq 0.001^{**}$	-0.126, -0.068

N = 52, **Linear regression analysis**

$p \leq 0.05^*$, $p \leq 0.001^{**}$, CI = Confidence Interval, R^2 = The explanatory power of the model

OHL-Ortho = Oral health literacy - Orthodontics, OHB = Oral health behavior

OHI-S = Oral hygiene index-simplified

Figures

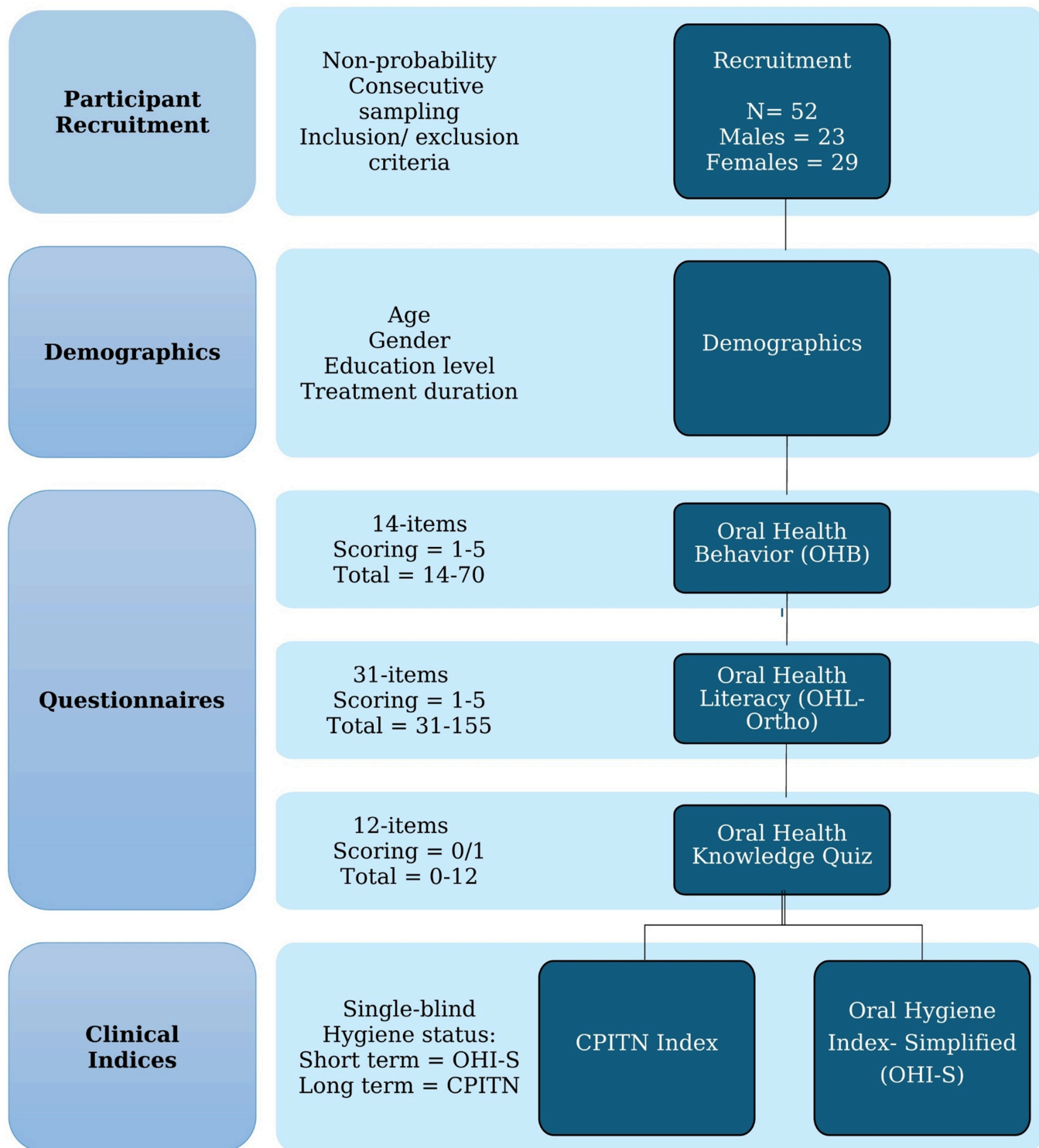


Figure 1

Data Collection Flow Chart

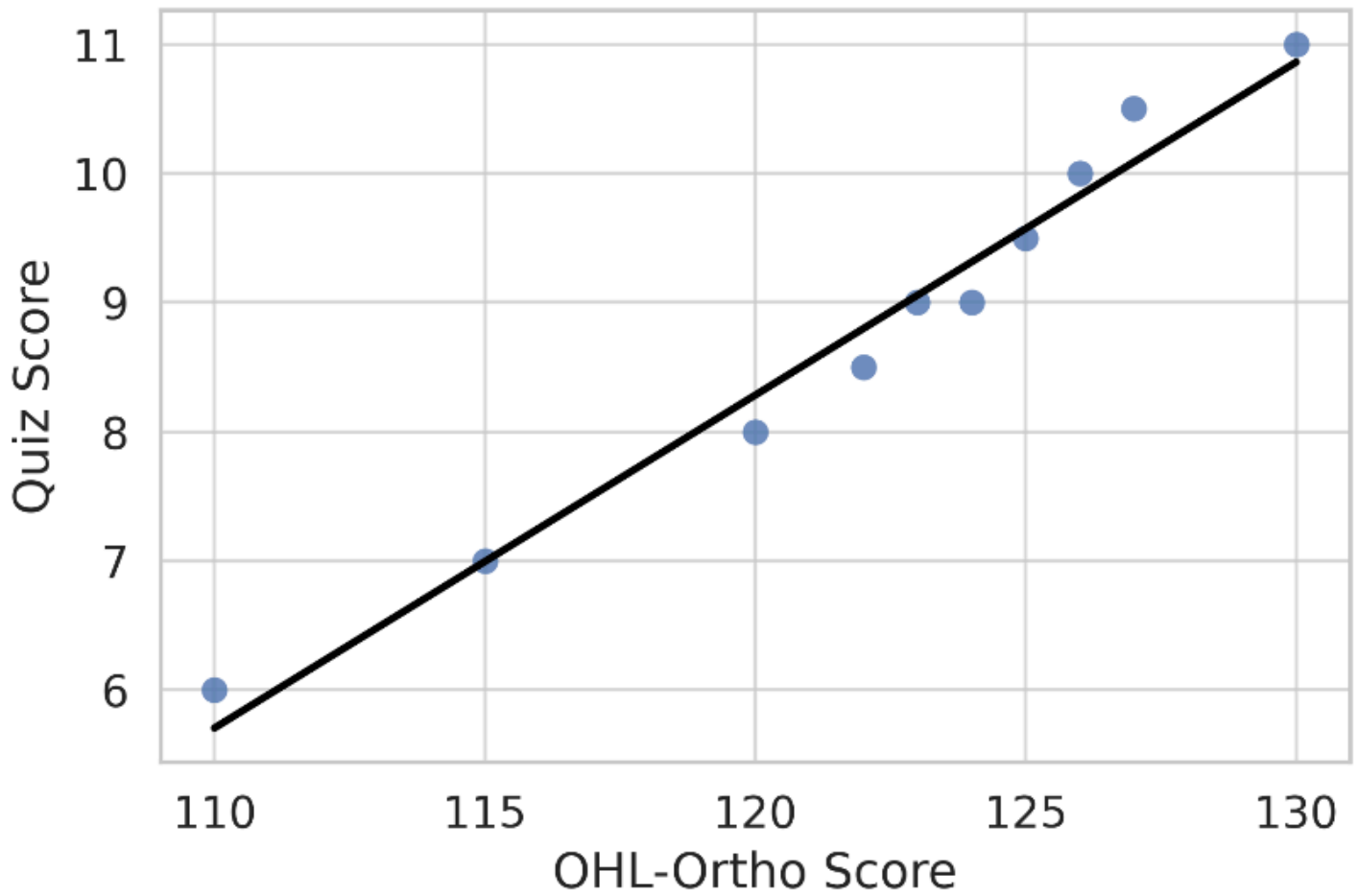


Figure 2

Objective Validity: OHL-Ortho vs. Quiz

N = 52, ***Spearman correlation analysis***

OHL-Ortho = Oral health literacy - Orthodontics

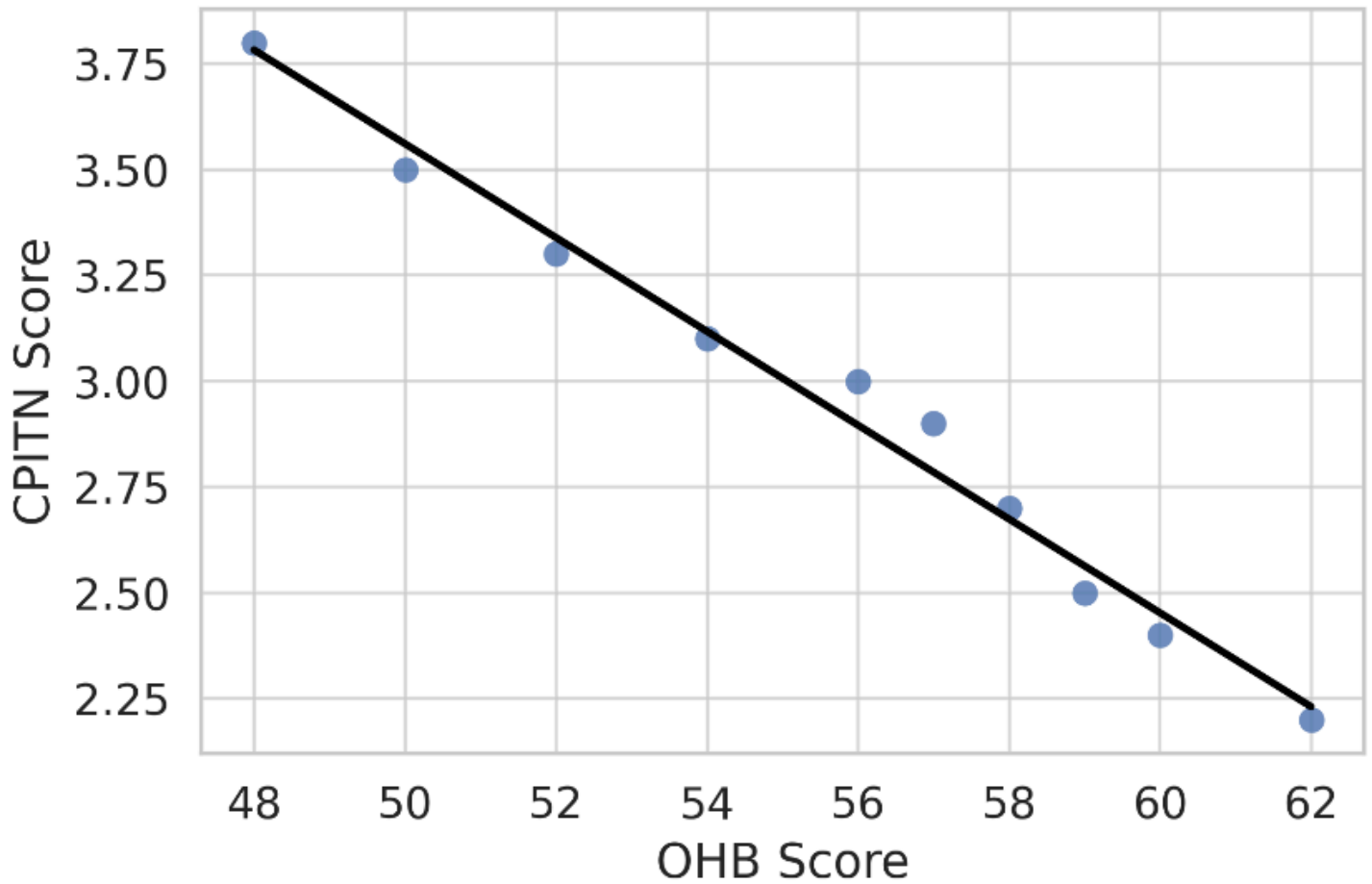


Figure 3

Convergent Validity: OHB vs. CPITN

N = 52, ***Spearman correlation analysis***

CPITN = Community periodontal index of treatment needs,

OHB = Oral health behavior

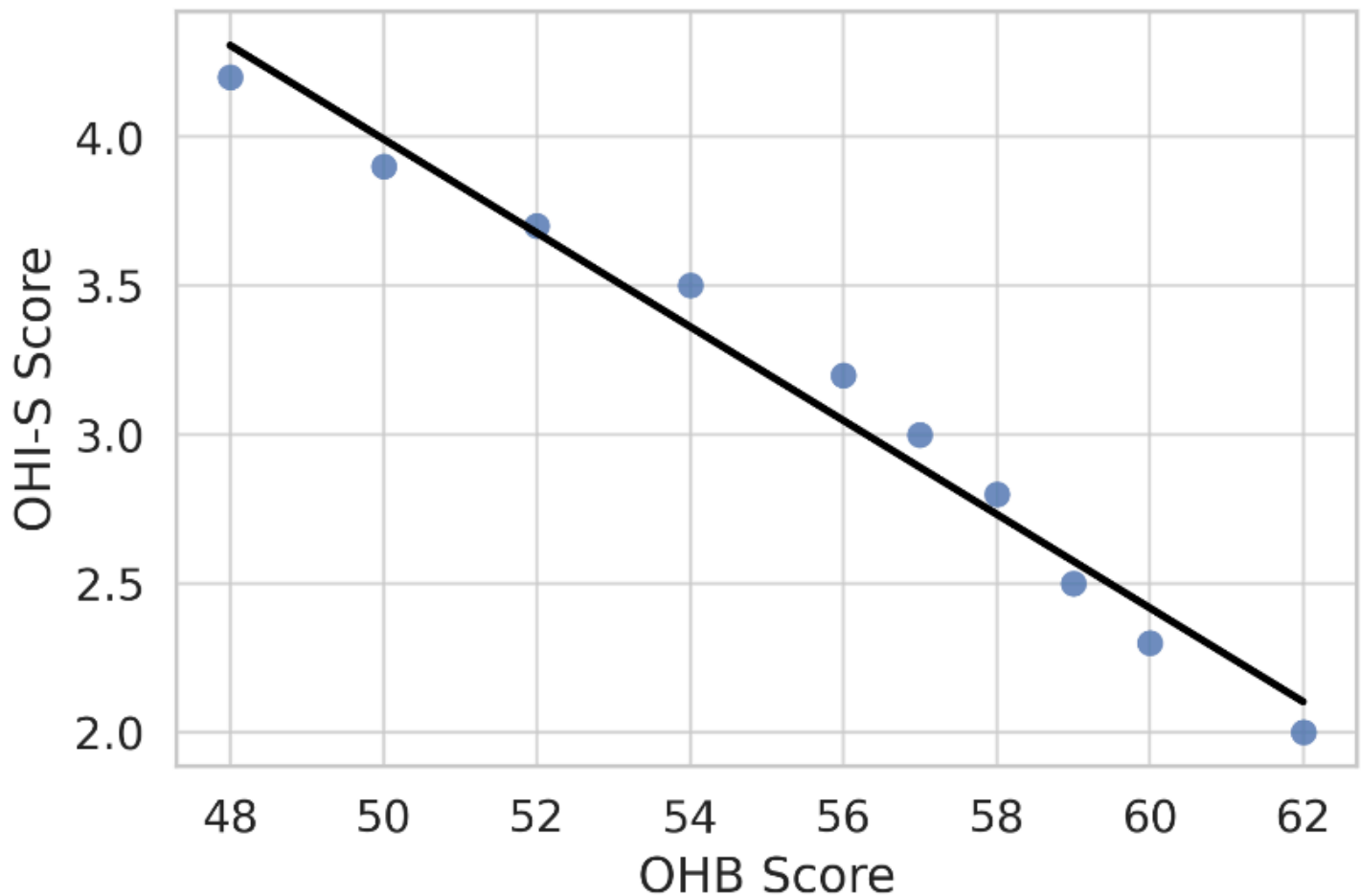


Figure 4

Convergent Validity: OHB vs. OHI-S

N = 52, *Spearman correlation analysis*

OHB = Oral health behavior, OHI-S = Oral hygiene index-simplified

Supplementary Files

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