PSYCHOMETRIC VALIDATION OF THE ULTRASHORT SLOVENIAN (OHIP-SVN5) AND CROATIAN (OHIP-CRO5) ORAL HEALTH IMPACT PROFILE QUESTIONNAIRES

PSIHOMETRIČNA VALIDACIJA ULTRAKRATKE SLOVENSKE (OHIP-SVN5) IN HRVAŠKE RAZLIČICE (OHIP-CRO5) VPRAŠALNIKA ORAL HEALTH IMPACT PROFILE

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ABSTRACT

Keywords

Oral health

Quality of life

Questionnaire

Validity

Reliability

Slovenia

Croatia

Aim
The study tested the validity, reliability and responsiveness of the ultrashort Slovenian and Croatian versions of the 5-item Oral Health Impact Profile (OHIP-5).

Methods
A total of 663 participants from the general population (400 from Slovenia and 223 from Croatia), 68 students (38 from Slovenia and 30 from Croatia), and 60 dental patients with treatment needs (30 from Slovenia and 30 from Croatia) were included in this investigation. Internal consistency was assessed using Cronbach's alpha, and test-retest reliability was evaluated with intraclass correlation coefficients (ICC). Exploratory factor analysis (EFA) was performed to test whether the data fit the unidimensional model, and two types of validity were assessed: concurrent validity and known-group validity.

Results
The internal consistency of the Slovenian and Croatian ultrashort OHIP versions was confirmed by Cronbach's alpha coefficients greater than 0.7 and the test-retest reliability, with sufficient ICC values. The factor analysis for both OHIP-5 versions showed a one-dimensional model and good factor loadings. Concurrent validity was confirmed through significant associations between self-reported oral health and the OHIP-5 summary scores. The OHIP-SVN5 and OHIP-CRO5 distinctly and significantly distinguished between different groups with differences in oral health impairment. Responsiveness to change of the OHIP-5 questionnaires showed that in Slovenian patients, three items decreased after treatment, while in Croatia, the scores of all OHIP-5 items and the summary score were significantly reduced after the treatment.

Conclusions
Slovenian and Croatian ultrashort OHIP-5 questionnaires are adequate one-dimensional instruments consistent with the four-dimensional model of oral health.

IZVLEČEK

Ključne besede

ustno zdravje

kakovost življenja

vprašalniki

veljavnost

zanesljivost

Slovenija

Hrvaška

Namen
Študija je preverjala veljavnost, zanesljivost in odzivnost ultrakratke slovenske in hrvaške različice vprašalnikov Oral Health Impact Profile (OHIP-5).

Metode
V raziskavo je bilo vključenih 663 oseb iz splošne populacije (400 iz Slovenije, 223 iz Hrvaške), 68 študentov (38 slovenskih, 30 hrvaških) in 60 zobozdravstvenih pacientov s potrebo po zdravljenju (30 slovenskih, 30 hrvaških). Notranja skladnost je bila ocenjena s Cronbachovim alfo, ponovljivost meritev pa z intraklasnimi korelacijskimi koeficienti (ICC). Z eksploratorno faktorsko analizo (EFA) smo preverili, ali podatki ustrezajo enodimenzionalnemu modelu. Ocenjeni sta bili tudi dve vrsti veljavnosti: sočasna in diskriminativna.

Rezultati
Notranja skladnost obeh različic OHIP-5 je bila potrjena s Cronbachovimi alfa koeficienti > 0,7, test-retest zanesljivost pa z zadostnimi ICC vrednostmi. Faktorska analiza je potrdila enodimenzionalno strukturo. Sočasna veljavnost je bila potrjena s pomembnimi povezavami med samooceno ustnega zdravja in seštevki OHIP-5. Obe različici (OHIP-SVN5 in OHIP-CRO5) sta jasno in značilno ločili med skupinami z različnim stanjem ustnega zdravja. Občutljivost na spremembe je pokazala, da so se pri slovenskih pacientih po zdravljenju znižale vrednosti treh postavk, medtem ko so se pri hrvaških pacientih statistično značilno znižale vrednosti vseh postavk in skupna ocena.

Zaključki
Slovenska in hrvaška ultrakratka vprašalnika OHIP-5 sta ustrezni enodimenzionalni orodji, primerljivi z drugimi validiranimi različicami in skladni s štiridimenzionalnim modelom ustnega zdravja.

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1 INTRODUCTION

Dental patient-reported outcome measures are important psychometric instruments that enable patients to self-assess the impacts of oral diseases and evaluate dental treatment modalities. Among several psychometrically validated questionnaires assessing self-perceived oral health, the Oral Health Impact Profile (OHIP) is the most frequently used and methodologically investigated instrument. Oral Health-Related Quality of Life (OHRQoL) is typically assessed nowadays using one version of the OHIP questionnaire, which consists of 49, 14, or 5 items (1-3). Additionally, disease-specific OHIP instruments have also been developed, such as OHIP-EDENT for edentulous patients (4), OHIP-TMD (5) for patients whose problems originate from the temporomandibular joints (6), or OHIP-ESTHET for assessment of orofacial aesthetics (7). The questionnaires, consisting of multiple items, place a significant burden on the person completing them because a lot of time is required, and some items may be unintentionally omitted. However, the 5-item OHIP version represents a questionnaire with the lowest burden for the patient, as five responses can be chosen on a 5-point ordinal rating scale, still capturing at least one question from each of the four dimensions of OHRQoL, specifically, Oral Function, Orofacial Pain, Orofacial Appearance, and Psychosocial Impact (8-11). Recently, it was proposed to use the ultra-short version, i.e., the OHIP-5, to replace the more extended versions, because it has been proven that summary scores of the 5-, 14-, and 49-item versions are highly correlated (12, 13). Using the shortest version should have the greatest potential to facilitate the future clinical use of the OHIP instrument (14).

In Slovenia, the OHIP-49 and OHIP-14 have already been validated (15, 16). In Croatia, the OHIP-49, OHIP-14 and OHIP-EDENT have been validated through psychometric testing (16-18). However, the shorter, that is, the 14-item OHIP version, has been used more often in research and clinical settings than the original, longer 49-item version (18-32). To reduce respondents' and examiners' burden and time consumption, and to ensure that all questions are answered, many countries have already developed and validated ultra-short OHIP-5 versions (3, 33-40). In Chile, the ultra-short OHIP 7-item version was also validated (41).

This study aimed to validate the Slovenian and Croatian versions of the OHIP-5 questionnaire in a target population. We hypothesised that the Slovenian and Croatian versions of the OHIP-5 would demonstrate adequate internal consistency, construct validity, test-retest reliability and responsiveness.

2 METHODS

2.1 Forward-backward translations of the OHIP-5 questionnaire

The Slovenian and Croatian versions were translated from the English 5-item version (3) using established standards (42). In each country, a professional translator and a dentist fluent in English, with international experience in English-speaking countries, performed the initial translation into Slovenian or Croatian. After review by two English-fluent dentists, the final versions were back-translated into English by another professional translator in collaboration with another dentist fluent in English, separately in each country. Both back-translations were then independently evaluated and compared with the original English version by two native English speakers.

2.2 Patients and data collection

The institutional ethics committees in Slovenia and Croatia approved the study under reference numbers 0120-219/2017-3 and 05-PA-26-6/2015, respectively. The participants were selected from different populations. Their mean age, gender, age range and research purposes for psychometric validation of the OHIP-5 questionnaire in Slovenia and Croatia are presented in Table 1.

A total of 663 participants from the general population (400 in Slovenia and 223 in Croatia) were involved in the research, as well as 68 students (38 in Slovenia and 30 in Croatia), and 60 dental patients with treatment needs (30 in each country). Each participant received a thorough written explanation of the study's purposes and procedures and was assured of anonymity. In Slovenia, participants were recruited consecutively from among employees in educational or research institutions, while in Croatia, participants were recruited consecutively from among patients and their accompanying persons in the waiting room of their family practice doctors (Table 1). The responses to the OHIP-5 questions were made on a 5-point Likert scale (0=never; 1=hardly ever; 2=occasionally; 3=fairly often; and 4=very often) and referred to the period of the last 7 days (43). In addition to the OHIP-5 questions, the participants recruited from the Slovenian general population also answered questions about their age, gender, denture wear (either fixed or removable), and self-assessed their oral health and oral appearance on a 4-point scale (0=excellent; 1=good; 2=fair; 3=poor). In Croatia, the participants from the general population also answered questions about their age, gender and whether they wore a removable denture (yes or no), and assessed their self-perceived oral health, which was reported on a 5-point Likert scale as 0=excellent; 1=very good; 2=good; 3=fair; 4=poor. All participants completed the written forms, and no questionnaire had missing data in either country. Dental students in both countries also participated and completed the OHIP-5 questionnaire

Table 1. Age, gender and research purpose of the respondents answering five questions of the Oral Health Impact Profile (OHIP-5).

Sample	n (% female)	Mean age (standard deviation)	Age range (years)	Research purpose
General population SVN†	400 (72.8)	53.8 (9.7)	28-70	Internal consistency, EFA, Concurrent validity, Known group validity
General population CRO*	223 (65.5)	59.96 (14.6)	28-82	Internal consistency, EFA, Concurrent validity, Known group validity
Students SVN§	38 (68.4)	22.6 (1.7)	20-26	Test-retest reliability
Students CRO‡	30 (70.0)	22.0 (1.4)	19-25	Test-retest reliability
Patients with treatment needs SVN#	30 (54.0)	50.8 (14.2)	18-70	Responsiveness (sensitivity to change)
Patients with treatment needs CRO‡	30 (65.0)	65.5 (10.4)	37-81	Responsiveness (sensitivity to change)

Legend:
EFA - exploratory factor analysis
† Educational and research institutions in Ljubljana, Slovenia
* People in the general practice doctor's waiting room who came for a referral, examination, or due to sick leave for themselves or somebody else
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twice within 2-week intervals without any changes that could influence their OHRQoL. For recruited patients who required treatment, a trained dentist in each country conducted an oral examination before the first administration of the OHIP-5 questionnaire.

2.3 Statistical analysis

2.3.1 Reliability

Two types of reliability were assessed: internal consistency and test-retest reliability. The internal consistency was evaluated by calculating the Cronbach's α reliability coefficient, the Cronbach's α reliability coefficient if the item was deleted, and the average inter-item correlation for the OHIP scores (44). The Cronbach's α values ≥0.70 were considered satisfactory (45), while values >0.20 were considered acceptable for the inter-item correlation (46). For the test-retest reliability of the OHIP-5 Questionnaire, a convenience sample of 38 dental students was selected in Slovenia, and a sample of 30 was chosen in Croatia. Subjects were not allowed to undergo oral/dental treatments for two weeks; if any oral problems occurred, they would be excluded. The intraclass correlation coefficients (ICC) were calculated based on the one-way repeated-measures analysis of variance (ANOVA) from the repeated administration of the same questionnaires within a two-week period (47). The ICC>0.80 indicated excellent agreement, 0.61-0.80 good agreement, 0.41-0.60 moderate agreement and <0.40 poor agreement.

2.3.2 Exploratory Factor Analysis

Exploratory factor analysis (EFA) was performed to test the dimensionality of the OHIP-SVN5 and OHIP-CRO5, aiming to determine whether the data fit a unidimensional model. Before the analysis, the Kaiser-Meyer-Olkin (KMO) statistic of sampling adequacy and Bartlett's test of sphericity were made. The Kaiser-Meyer-Olkin values should be above 0.6, and Bartlett's test of sphericity should have a significance of <0.0001 to perform the EFA. A minimum eigenvalue of 1 was assigned as the factor extraction criterion, and item loadings ≥0.4 were considered sufficient. A scree-plot was also designed, and the total variance was calculated.

2.3.3 Validity

Two types of validity were assessed: concurrent validity and known-group validity.

2.3.3.1 Concurrent validity

The association between self-reported oral health and the OHIP-5 summary scores was assessed by calculating the Spearman rank correlation. In the Slovenian sample from the general population, concurrent validity was evaluated using the Spearman rank correlation between the OHIP-SVN5 summary scores and self-perceived oral health, as well as between the OHIP-SVN5 summary scores and self-perceived orofacial aesthetics. In Slovenian participants, self-perceived oral health and self-perceived orofacial aesthetics were rated on a 4-point scale, ranging from zero to three (0=excellent; 1=good; 2=fair; 3=poor). Self-perceived

oral health in Croatia was assessed on a 5-point Likert scale (0=excellent; 1=very good; 2=good; 3=fair; 4=poor).

2.3.3.2 Known group validity

Tests were conducted to determine whether the OHIP-5 scores discriminate between two groups known to differ. This was assessed by testing the differences of each item and the OHIP-5 summary scores between the groups expected to have differences in OHRQoL impairment. In the Slovenian general population, validity was tested between participants with a denture (fixed or removable) and participants with natural teeth. In contrast, the validity of the Croatian general population sample was tested by comparing participants with removable dentures to those without them. The non-parametric Mann-Whitney U test was used for that purpose. Based on our previous research (15-32), we assumed that individuals with dentures would have worse oral health than those with natural teeth.

2.3.4 Responsiveness

Responsiveness of the OHIP-SVN5 and the OHIP-CRO5 was tested in 30 Slovenian and 30 Croatian patients with treatment needs (Table 1). Slovenian patients required tooth extraction following unsuccessful endodontic treatment in the posterior jaw regions, while Croatian patients needed new complete dentures. All patients completed the OHIP-5 questionnaires twice: first, immediately before treatment, and second, one month after treatment. We assumed that OHRQoL would improve after treatment, compared to the status before treatment. The significance of the differences in the OHIP-5 scores between the baseline and the follow-up administrations was tested using the Wilcoxon Rank Sign non-parametric test and by calculating the standardised effect size (48) using the formula: (Baseline OHIP score - follow-up OHIP score)/(Standard deviation of baseline OHIP score). According to Cohen, effect sizes are classified as small (0.2), medium (0.5), or large (0.8) (49).

3 RESULTS

3.1 Reliability

3.1.1 Internal consistency

The Cronbach's α coefficients were 0.766 for the OHIP-SVN5 and 0.706 for the OHIP-CRO5 questionnaire. Table 2 presents the mean values, standard deviations, and Cronbach's alpha coefficients for the Slovenian and Croatian OHIP-5 versions after one item was deleted. Table 3 shows inter-item correlation matrices of the Slovenian and Croatian OHIP-5 Questionnaires. All inter-item correlations were greater than 0.20 in the Slovenian and Croatian OHIP-5 questionnaires and were considered acceptable (46).

3.1.2 Exploratory factor analysis

The Kaiser-Meyer-Olkin (KMO) statistic for sampling adequacy was 0.783 for the OHIP-SVN5 and 0.768 for the OHIP-CRO5. The Bartlett's test for sphericity was 537.76, with p<0.0001 in the Slovenian OHIP-5 version, while the Bartlett's test for sphericity was 232.68, with p<0.0001 in the Croatian OHIP-5 version. The results of the EFA for the Slovenian and Croatian versions of the OHIP-5 questionnaire revealed a one-dimensional model, as all items loaded onto a single latent factor. The OHIP-SVN5 explained 52% of the variance, while the OHIP-CRO5 explained 50%. The scree plot also shows a one-factorial model for both language versions. The results of factor loadings are presented in Table 4. The Scree plots are presented in Figure 1.

3.1.3 Test-retest reliability

The test-retest reliability results of the Slovenian and Croatian students are presented in Table 5. The ICCs indicated very good to excellent reliability. There were no significant differences between the questionnaires completed within two weeks, either for each item or for the OHIP summary scores (p>0.05). In the Slovenian version, the ICC was not computed for the item: 'Less flavour in food', as the difference was zero.

Table 2. Means, standard deviations and Cronbach's alpha when the item was deleted from the OHIP-SVN5 and OHIP-CRO5 questionnaires.

OHIP-5 item	OHIP-SVN5			OHIP-CRO5		
	Mean	Standard deviation	Cronbach's alpha if the item is deleted	Mean	Standard deviation	Cronbach's alpha if the item is deleted
Difficulty chewing	0.97	1.10	0.69	0.87	1.04	0.60
Painful aching	0.67	0.85	0.74	0.41	0.76	0.67
Uncomfortable with appearance	0.70	1.08	0.71	0.82	1.03	0.70
Less flavour in food	0.24	0.64	0.73	0.25	0.53	0.64
Difficulty doing usual jobs	0.18	0.56	0.74	0.17	0.49	0.68

Table 3. Inter-item correlation matrix of the OHIP-SVN5 and the OHIP-CRO5.

OHIP-SVN5 Inter-item Correlation Matrix	Difficulty chewing	Painful aching	Uncomfortable with appearance	Less flavour in food	Difficulty doing usual jobs
Difficulty chewing	1.000				
Painful aching	0.464	1.000			
Uncomfortable with appearance	0.536	0.361	1.000		
Less flavour in food	0.447	0.280	0.428	1.000	
Difficulty doing usual jobs	0.409	0.356	0.388	0.556	1.000
OHIP-CRO5 Inter-item Correlation Matrix					
Difficulty chewing	1.000				
Painful aching	0.424	1.000			
Uncomfortable about appearance	0.412	0.231	1.000		
Less flavour in food	0.469	0.339	0.351	1.000	
Difficulty doing usual jobs	0.369	0.315	0.240	0.516	1.000

Table 4. Factor loadings of one dimension of the OHIP-5 questionnaire.

Item	OHIP-SVN5	OHIP-CRO5
	One component	
Difficulty chewing	0.787	0.774
Painful aching	0.651	0.642
Uncomfortable about appearance	0.744	0.611
Less flavour in food	0.744	0.780
Difficulty doing usual jobs	0.740	0.699

Extraction Method: Principal Component Analysis. One component extracted.
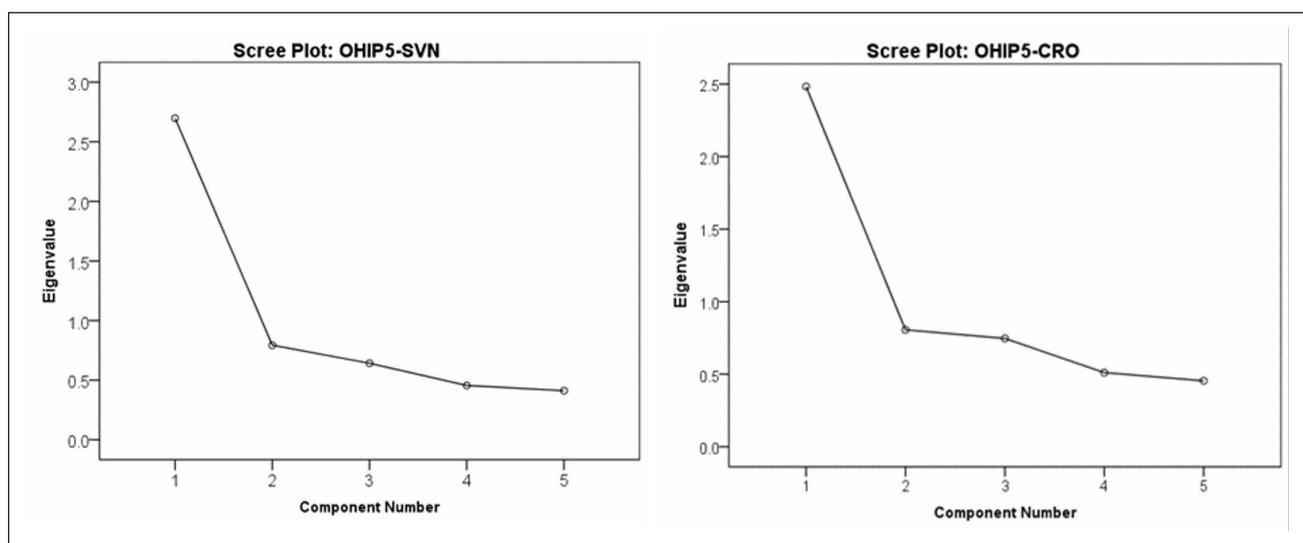

Figure 1. Scree-plots of the OHIP-SVN5 and OHIP-CRO5.

Table 5. Test-retest reliability measured by intraclass correlation coefficients (ICC) of the Slovenian and Croatian versions of the 5-item Oral Health Impact Profile (OHIP-SVN5 and OHIP-CRO5).

OHIP-SVN5: Students (n=38)	ICC	Mean difference (standard deviation)	95% confidence interval	p
Difficulty chewing	0.74	-0.03 (0.43)	-0.169 – 0.12	0.711 N.S.
Painful aching	0.65	0.105 (0.61)	-0.093 – 0.30	0.291 N.S.
Uncomfortable about appearance	0.82	0.105 (0.45)	-0.043 – 0.25	0.160 N.S.
Less flavour in food	N.C.	0 (0)	N.C.	N.C.
Difficulty doing usual jobs	0.70	-0.026 (0.60)	-.080 - 0.03	0.324 N.S.
Summary score	**0.82**	**0.157 (0.89)**	**-0.133 – 0.45**	**0.279 N.S.**
OHIP-CRO5 Students (n=30)	**ICC**	**Mean difference (standard deviation)**	**95% confidence interval**	**p**
Difficulty chewing	0.84	0.033 (0.32)	-0.086 – 0.153	0.537 N.S.
Painful aching	0.70	0.033 (0.18)	-0.035 – 0.10	0.326 N.S.
Uncomfortable about appearance	0.76	0.067 (0.37)	-0.070 – 0.20	0.326 N.S.
Less flavour in food	0.70	0.033 (0.18)	-0.035 – 0.10	0.326 N.S.
Difficulty doing usual jobs	0.70	0.033 (0.18)	-0.035 – 0.10	0.326 N.S.
Summary score	**0.70**	**0.20 (0.664)**	**-0-048 - 0.45**	**0.110 N.S.**

Legend:
ICC=Intraclass correlation coefficient
p=p-value
N.S.=p>0.05
N.C.=not computed because the standard error of the difference was 0

3.2 Concurrent validity

The results of the concurrent validity of the Slovenian and Croatian versions of the OHIP-5 questionnaires are presented in Table 6. The associations between self-reported oral health and the OHIP-5 summary scores, as assessed using the Spearman rank correlation, were positive and significant in both versions of the OHIP-5. Additionally, a significant association was found between self-reported orofacial aesthetics and the OHIP-5 summary scores in the Slovenian version.

3.3 Known-groups validity

The known-groups validity (i.e., divergent validity) was assessed by testing the significance of the differences in the OHIP-SVN5 and OHIP-CRO5 summary scores between groups, which were expected to have differences in OHRQoL impairment, and are presented in Table 7. The non-parametric Mann-Whitney U test was applied. It revealed significantly more impaired OHRQoL, as indicated by higher scores on each of the OHIP-5 items and higher summary scores for both OHIP-5 versions, in individuals wearing dentures.

3.4 Responsiveness (sensitivity to change)

Means and standard deviations of the pre- and post-treatment scores, mean differences, Z values, significance of the differences, effect sizes for each item, and OHIP-5 summary scores in Slovenian and Croatian patients are presented in Table 8.

Table 6. Concurrent validity of the Slovenian and Croatian OHIP-5 Questionnaires.

General population SVN (n=400)			
Self-reported oral health	**n**	**OHIP-5 summary score**	**Spearman's rho**
excellent	51	0.69 (1.16)	0.601**
good	224	1.86 (2.06)	
fair	94	4.33 (3.38)	
poor	31	7.77 (3.81)	
Self-reported oral aesthetics	**n**	**OHIP-5 summary score**	**Spearman's rho**
excellent	52	1.12 (1.71)	0.510**
good	213	1.83 (2.12)	
fair	106	3.99 (3.17)	
poor	29	7.90 (4.29)	
General population CRO (n=223)			
Self-reported oral health	**n**	**OHIP-5 summary score**	**Spearman's rho**
excellent	85	0.31 (0.64)	0.892**
very good	48	1.93 (1.11)	
good	53	4.36 (1.06)	
fair	23	6.61 (2.27)	
poor	4	10.25 (0.96)	

Legend: ** p<0.01

Table 7. Known-groups validity, assessed by the Mann-Whitney U test.

OHIP-SVN5	Denture (Fixed and Removable)	N	Mean	Standard Deviation	Z	P
Difficulty chewing	no	304	0.74	0.93	-7.020	<0.001**
	yes	96	1.70	1.24		
Painful aching	no	304	0.57	0.79	-4.174	<0.001**
	yes	96	0.98	0.94		
Uncomfortable about appearance	no	304	0.53	0.93	-4.910	<0.001**
	yes	96	1.23	1.34		
Less flavour in food	no	304	0.14	0.49	-5.262	<0.001**
	yes	96	0.54	0.92		
Difficulty doing usual jobs	no	304	0.12	0.46	-3.214	<0.001**
	yes	96	0.34	0.80		
OHIP-SVN5 summary score	no	304	2.10	2.56	-7.080	<0.001**
	yes	96	4.80	3.86		
OHIP-CRO5	**Removable denture**	**N**	**Mean**	**Standard Deviation**	**Z**	**P**
Difficulty chewing	no	128	0.30	0.57	-10.031	<0.001**
	yes	95	1.65	1.03		
Painful aching	no	128	0.20	0.55	-4.754	<0.001**
	yes	95	0.68	0.90		
Uncomfortable about appearance	no	128	0.54	0.79	-4.534	<0.001**
	yes	95	1.20	1.18		
Less flavour in food	no	128	0.07	0.31	-6.153	<0.001**
	yes	95	0.48	0.67		
Difficulty doing usual jobs	no	128	0.05	0.29	-4.476	<0.001**
	yes	95	0.32	0.64		
OHIP-CRO5 summary score	no	128	1.17	1.67	-9.103	<0.001**
	yes	95	4.34	2.84		

Legend: ** p<0.01

Table 8. Sensitivity to change (responsiveness) of the OHIP-SVN5 (N=30) and OHIP-CRO5 (N=30), pre- versus post-treatment.

	Pre-treatment x±SD	Post-treatment x±SD	Mean difference x±SD	Z	P	Effect size
OHIP-SVN5						
Difficulty chewing	2.33±0.96	1.87±0.82	0.47±0.68	-2.64	0.008**	0.48
Painful aching	2.70±1.02	1.90±0.71	0.80±0.99	-3.67	0.001**	0.78
Uncomfortable about appearance	1.90±0.84	1.96±0.98	0.06±0.69	-0.58	0.564 N.S.	0.07
Less flavour in food	1.43±0.73	1.23±0.50	0.20±0.55	-1.90	0.056 N.S.	0.28
Difficulty doing usual jobs	1.47±0.63	1.20±0.41	0.27±0.58	-2.31	0.021*	0.43
Summary score	**9.83±2.29**	**8.03±1.73**	**1.80±1.40**	**-4.53**	**<0.001****	**0.79**
OHIP-CRO5						
Difficulty chewing	2.67±1.23	1.57±1.33	1.10±1.44	-3.35	0.001**	0.89
Painful aching	0.53±1.04	0.17±0.38	0.37±0.89	-2.31	0.021*	0.35
Uncomfortable about appearance	2.60±1.40	0.87±1.17	1.73±1.55	-4.10	<0.001**	1.24
Less flavour in food	0.80±1.19	0.40±0.89	0.40±0.81	-2.44	0.015*	0.34
Difficulty doing usual jobs	0.77±1.10	0.20±0.61	0.57±0.94	-2.85	0.004**	0.52
Summary score	**7.37±4.06**	**3.20±3.28**	**4.17±0.74**	**-4.25**	**<0.001****	**1.03**

Legend: * p<0.05; ** p<0.01; N.S. p>0.05

4 DISCUSSION

This study assessed the psychometric properties of the two ultrashort OHIP versions, specifically the OHIP-5 instrument for the Slovenian and Croatian language-speaking populations. The results revealed satisfactory psychometric characteristics for both instruments (OHIP-SVN5 and OHIP-CRO5), which may be used in clinical and research settings to assess OHRQoL and to distinguish between individuals with different levels of perceived oral health. Although other versions of the OHIP instrument already existed in Slovenia and Croatia (15-18), the 5-item OHIP had to be psychometrically validated for both language versions, since it has the least burden for the respondents among the various OHRQoL questionnaires. Internal consistency of the Slovenian and Croatian OHIP-5 instruments was confirmed by the Cronbach's α coefficients >0.7, and the test-retest reliability had excellent ICC values. No significant difference was observed in the two-week period between the completion of the same questionnaire (p<0.05).

The factor analysis of the Slovenian and Croatian versions of the OHIP-5 questionnaire showed a one-dimensional model and good factor loadings. In clinical and public health studies, a unidimensional structure simplifies the use of the ultrashort OHIP version, as it allows simple scoring and interpretation. For this reason, the ultrashort 5-item OHIP version has gained increasing popularity worldwide over the past five years. Scree plots also indicated a one-factor solution, as all items loaded onto a single latent factor. The one-dimensional model of the OHIP-5 questionnaire was also determined in other language versions where factor analysis was performed (34, 35, 37).

Concurrent validity was confirmed by significant associations between self-reported oral health, self-reported orofacial aesthetics and the OHIP-SVN5 summary scores, as well as between self-reported oral health and OHIP-5 summary scores in the Croatian population. Both the OHIP-SVN5 and OHIP-CRO5 distinctly and significantly distinguished between different groups with differences in oral health impairment, i.e., between denture wearers and individuals with teeth. It is well-known that individuals wearing dentures have more problems during masticatory function, perceive more pain in function, have more psycho-social problems due to denture instability than individuals with natural teeth (23, 26, 50-54), and even cognitive decline has been attributed to lower chewing forces (55, 56).

Responsiveness to change of the OHIP-5 questionnaires was investigated to find out whether the instrument is sensitive to measuring changes elicited by a treatment. In Slovenian patients whose therapy involved a posterior tooth extraction after unsuccessful endodontic treatment, only the items 'Difficulty chewing', 'Painful aching', and 'Difficulty doing usual jobs' decreased, as well as the OHIP-5 summary score, indicating less impaired oral health after the treatment. The effect size of the treatment of 0.78 was medium (almost large). However, orofacial appearance did not change significantly after tooth extractions, as all were done in the posterior regions. Additionally, the item 'Less flavour in food' did not change significantly, which was an expected result following such treatment. In Croatia, the scores of all OHIP-5 items and the summary score were significantly reduced after treatment, indicating improvement in OHRQoL one month

after the delivery of new complete dentures, with a large treatment effect size. The improvement observed reflects an intra-individual change, that is, a patient's OHRQoL improves after receiving new dentures. This does not contradict our previous assumption that, on an inter-individual level, people with complete dentures generally report poorer OHRQoL compared to those with natural teeth. All listed results indicated that the OHIP-5 questionnaire, although one-dimensional, is consistent with the four-dimensional model of oral health, similar to other ultrashort OHIP versions (34, 35, 37, 57).

This study also has some limitations that should be acknowledged. The test-retest reliability was assessed in student subsamples, which may limit the generalisability of our reliability findings to the broader adult population. In addition, although our patient samples provided valuable insights into the responsiveness of the two validated OHIP-5 language versions in patients with oral health problems, they may not fully represent the general population in terms of sociodemographic and health-related characteristics. Future studies could address these aspects by including more diverse study samples and by establishing normative values for the OHIP-SVN5 and OHIP-CRO5.

5 CONCLUSION

The results of this study revealed good psychometric properties for both the Slovenian and Croatian ultrashort OHIP versions (i.e., the OHIP-SVN5 and OHIP-CRO5), with minimal burden on the respondents. This contributes to the international alignment of OHRQoL measurement by supporting the use of a standardised, cross-culturally adapted OHIP-5 instrument in Slovenian and Croatian populations. The one-dimensional structures of both language versions are similar to other ultrashort OHIP versions, consisting of five items.

CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

ETHICAL APPROVAL

The institutional ethics committees in Slovenia and Croatia approved the study under reference numbers 0120-219/2017-3 and 05-PA-26-6/2015, respectively.

INFORMED CONSENT

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

AVAILABILITY OF DATA AND MATERIALS

Yes, upon reasonable request.

AI USAGE STATEMENT

The authors used the software Grammarly to check for grammatical errors.

PREPRINT STATEMENT

There is no preprint of this manuscript.

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