

Validity and Reliability of the “Oral Health Assessment Tool” Applied by Speech-language Therapists in a Population of Older Chilean People

Camilo Morales (✉ camilo.morales@uct.cl)

Universidad Católica de Temuco

Felipe Henríquez

Universidad Católica de Temuco

Sergio Muñoz

Universidad de Frontera

Research Article

Keywords: Older people, Oral Health, Validity, Reliability, Validation, Speech, Language Therapist, Chile

Posted Date: April 4th, 2022

DOI: <https://doi.org/10.21203/rs.3.rs-1498857/v1>

License:  This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Abstract

Background: A good state of oral health allows people to communicate and eat. This topic is relevant in older people given its close relationship with their general health. At present, health challenges are directed at detecting and preventing oral disorders and are seen to exclusively by dentists, because the existing instruments can only be applied by them. However, speech-language therapists undergo similar training, which would allow them to collaborate in these processes. In this context, the Oral Health Assessment Tool (OHAT) is a detection instrument with good psychometric properties that is currently available for non-dental use, and the objective of this study is the translation into Chilean Spanish of the OHAT and validation of that version for application by these professionals.

Materials and methods: A mixed qualitative-quantitative study was carried out. The OHAT instrument was adapted to Chilean Spanish and subsequently subject to construct validation and evaluation of internal consistency reliability, as well as a valuation of its reproducibility in 286 older people (138 female, 100 male) from different health contexts.

Results: The cultural adaptation of the instrument proved to be semantically consistent with the original instrument. Its application was considered to be speedy and simple in the pre-test. The minimum rank factor analysis evidenced the unidimensionality of the OHAT, explaining 64.4% of the common variance. In addition, the instrument shows good internal consistency and test-retest reliability.

Conclusions: The OHAT instrument was considered to possess adequate validity and test-retest reliability properties. Its usefulness in the context of oral health disorders of this population in Chile is discussed.

Background

Oral health is defined as the ability to speak, smile, smell, taste, touch, chew and swallow, as well as to transmit emotions through facial expressions with confidence, without pain, discomfort and/or craniofacial disorders (1). It allows people to communicate and feed themselves effectively (2). This construct is particularly important given its implication and close relationship with overall health (3); for this reason, poor oral health (usually expressed by the presence of caries, periodontal diseases, oral pain or cancer) affects the self-perception of a person both in terms of self-esteem and self-confidence (4).

The progressive understanding of the consequences associated with this construct has given rise to the implementation of oral health promotion plans and programs at a local and international level. At the end of the 20th century modest reductions in the prevalence of dental caries were achieved in children (5, 6); however, focus on older people is still incipient. Considering current demographic changes at a global level, promotion and prevention efforts vis-à-vis this latter group has become increasingly relevant. As people reach older age, their needs, including oral health issues, require continual attention. The aging process and associated changes affecting the population pose major challenges to maintain an optimal state of health throughout the lives of individuals and populations (5, 7). In this context, several research efforts have sounded the alarm regarding the risks that poor oral health and mouth diseases have on

general health, particularly in older people (3, 8, 9). The literature describes a link between oral health and systemic diseases. For example, an association between the number of missing teeth with heart disease has been reported; periodontal disorders have been related to cardiovascular disease, atherosclerosis, subclinical lower artery disease, strokes, metabolic and lipid disorders and obesity (3, 10). Additionally, pathologies such as diabetes and respiratory ailments can be related to poor oral health conditions (11); Chalmers (10), reported that state of dental health, loss of teeth and temporomandibular disorders are associated with auditory impairment. These various relationships acquire greater relevance because older people seem prone to present oral health problems (12). The data indicate that the elderly population tends to have poor oral health largely due to dental care deficiencies during their entire lifetime. Elderly people with some degree of dependence or limited autonomy tend to present worse oral conditions (13). Therefore, the risk of developing these problems in older people with attention needs is high, particularly for those with severe dependence problems living in nursing homes or who are hospitalized. This risk is also related to social patterns in the older population, such as income level, knowledge regarding oral health care or access to health facilities (14), and therefore its prevalence varies depending on these variables. Although several studies have tried to look into and establish oral health intervention programs for older people, this is still described as insufficient or jeopardized (3, 14)

Although the detection of alterations or their oversight are carried out through clinical examinations performed by dentists, these methods are increasingly more difficult to use due to the high cost and scarcity of human resources, even in high-income countries (4, 15). Therefore, alternative and less resource-demanding approaches are needed. In this context, it is important to mention the existence of self-report questionnaires, associated mainly with the oral health dimension in relation to quality of life. However, because it is based on the ability of a person to report any adverse dental symptom, it increases the risk of bias, especially in people with some kind of cognitive impairment (16). Moreover, the majority of clinical instruments or oral health indices are designed to be used by dentists and dental hygienists, but they are not suitable for use by non-dental professionals (17, 18), even though, given their disciplinary similarity, speech-language therapists would be suitable for this purpose. Therefore, the availability of valid and reliable instruments enabling the evaluation of oral health through the observation of structures by trained professionals would be especially relevant.

In this sense, at an international level there are tools available to evaluate and detect oral health problems, such as the Oral Health Assessment Tool developed by the World Health Organization (19) in its version for adults; the Geriatric Oral Health Assessment Index (20) specifically targeted at older people, and the Oral Health Impact Profile (OHIP) (5). However, these last two measure the perception of individuals regarding their own oral health (21), with their respective limitations.

Conversely, reports in the literature point to the Oral Health Assessment Tool (OHAT) as an instrument that measures oral health intended as an interdisciplinary valuation of this condition. That is to say, its application by other professionals, specifically nurses and speech-language therapists has been signaled as feasible (17, 18), making it possible for this tool not to be linked solely to dentists. The OHAT consists of eight categories aimed at identifying oral health impairments as well as pinpointing the need for

prevention actions or referrals for dental intervention, making it a useful instrument for the detection of possible disorders and their early management in elderly adults, whether or not dependent. On the basis of the original (Australian) instrument, validation studies of similar instruments have been conducted in Germany, Japan, Brazil, Indonesia, the Netherlands and Turkey (22–27). At present, the OHAT has not been translated or validated in the Spanish language in any country, including Chile

Given the relevance and usefulness that this instrument represents for health policies and clinical approaches regarding oral health of the older adult population in different contexts, the objective of this study is to determine the validity and reliability of the OHAT instrument in the Chilean older adult population.

Materials And Methods

Study design

This study has a mixed qualitative-quantitative design, using a methodological approach to validating a measurement instrument. Qualitative, because it aims to establish the cultural validation of the OHAT questionnaire, contemplating phases of translation and evaluation of the coverage and façade of the scale. The quantitative approach is analytical and relational.

Recruitment of participants

The participants were people aged 60 years or more, proceeding from residences or groups for the elderly, health care groups for prostrated and hospitalized patients from different institutions in the La Araucanía Region of Chile, during years 2019 and 2020. Excluded from the study were older people presenting difficulties regarding responsiveness or the ability to follow simple instructions in the context of the application of the instrument, given a situation of severe dependence, dementia or impaired level of consciousness, which were determined via clinical records, the application of the Barthel index and the Pfeiffer Short Portable Mental State Questionnaire.

Instruments

a) For the sociodemographic characterization and subsequent descriptive statistical analysis, a general information record of the participants was drawn up, which included gender, age, diagnosis of pathologies such as dementia, diabetes or hypertension, level of dependence and type of nutrition, among others.

b) Oral Health Assessment Tool (OHAT): Measurement instrument, which on this occasion was administered by a speech-language therapist. It is made up of eight items (lips, tongue, gums and tissues, saliva, natural teeth, dentures, oral cleanliness and dental pain), the answers to which are organized according to a Likert scale from 0 to 2 points, where 0 indicates absence of oral health issues (healthy) and 2 suggests possible disease (unhealthy). The score of each item reflects a description of the

observed structures (healthy, signs of possible disease and unhealthy). For its application, a professional with competence in the discipline or formal training is required. Flashlight, gloves and mask should be used in the case of hospitalized patients or people with poor oral hygiene of orofacial structures. The instrument can also be applied to persons with cognitive alterations but who are responsive to simple instructions (18).

Sample size

The estimation of the sample size required to achieve construct validity was conducted following the criteria proposed by Streiner et al. (28), consisting of 10 individuals participating per item of the measurement instrument, with a minimum of 200 persons when the number of items is small. Consequently, a non-probabilistic convenience sampling was implemented, with a total of 286 participants recruited.

The test-retest reliability estimation was carried out as proposed by Donner et al. (29), with an Intraclass Correlation Coefficient (ICC) of 0.6 as the acceptable minimum and 0.8 expected, a significance level of $\alpha = 0.05$ and a power ($1-\beta$) of 80%, for two measurements with a dropout rate of 10%. In this case, the calculated minimum sample was 49 persons. In this study, 91 persons were finally included for the purpose of this analysis.

Procedure

This study was carried out in two phases. In the first place, the original version of the OHAT was translated into Chilean Spanish and adapted to its culture. In the second phase, its psychometric properties were assessed in a sample of older people. This study received the approval of the scientific ethics committee of the Universidad Católica de Temuco, under resolution No. 40/20. The participation of the subjects was completely voluntary or authorized by a family member or tutor, and they were at liberty to drop out of the study without this involving any detriment to the daily care provided in their respective facilities. Consequently, each participant or tutor signed an informed consent form, evidencing their free and voluntary participation in accordance with the principles of the Helsinki Decalogue (30).

1) *Cultural adaptation:*

First of all, authorization to adapt the instrument was requested from the Iowa Geriatric Education Center by e-mail. The cultural adaptation consisted of the following (31):

a) Direct translation: undertaken by two independent bilingual translators whose mother tongue is Chilean Spanish. The first addressed the study blind and the second was informed of its objective. In addition to translating, they identified comprehension and translation problems arising from semantic elements that were difficult to understand or confusing. After this, the translators got together to analyze their texts, detect discrepancies between them and produce the consensus version. They were also asked to maintain the conceptual equivalence of terms rather than a literal translation, when necessary.

b) Reverse translation: Translation of the consensus version produced by the bilingual translators back to the original language. This was carried out by a bilingual speech-language therapist whose mother tongue is English. This person rated each of the translated items in terms of (1) Semantic/conceptual equivalence (maintaining most of the linguistic-semantic terms as expressed in the original translation); (2) Functional equivalence (grammatical modification of the original idea, maintaining the conceptual equivalence) and (3) Non-evident equivalence (major departure from the concept). Whenever any translated word or phrase fell into the third category, an alternative tending toward equivalence or a justification for the change was reached by consensus by the experts.

c) Consolidation and final production of the instrument. A committee was formed made up of the translators who generated the consensus version, a speech-language therapist trained in gerontology and a dentist, who were presented the two initial versions provided by the translators, the consensus version and the reverse translation submitted by the speech-language therapist. Discrepancies regarding the translation of the instrument were discussed in terms of quality of translation, maintenance of the linguistic or functional equivalence and the modifications associated with contextual pertinence made to arrive at the final instrument.

d) Pre-test: Three speech-language therapists applied the OHAT to a group of 30 persons. After this they were asked for feedback, to allow them to identify difficulties experienced with regard to understanding some item(s) of the instrument, or aspects related to the instructions, semantics, grammar or comprehension regarding the type of answer required.

2) *Collection of data for construct validation*

To carry out this procedure, the participants were first required to answer a brief questionnaire in order to collect information regarding their sociodemographic background. After this, the Short Portable Mental Questionnaire and the Barthel index were used to complement the general data. Once the base characteristics and eligibility of the subjects had been checked, the OHAT instrument was applied. Given the diversity of contexts, its application took place in a speech-language attention booth in the respective physical space of the participating centers or in the residences themselves, safeguarding the lighting conditions and absence of distractors, and the delivery of clear (protocolized) instructions by the evaluator, who was trained for this purpose.

3) *Procedure for obtaining evidence of reliability*

After the first application of the OHAT, the participants in the study were asked to answer it on a second occasion, within a maximum period of 7 days, to determine the test-retest reliability.

4) *Statistical Analysis*

A sociodemographic characterization of the study population was carried out, using descriptive statistics, specifically central tendency measures and dispersion for quantitative variables, and absolute and relative frequencies for categorical variables.

To achieve the objective regarding the construct validation, an Exploratory Factor Analysis (EFA) (32) was carried out to corroborate the factor structure of the dimension “status of health and disease”, which is part of oral health as reported by the literature through the correlation between the studied variables. Initially, the Bartlett sphericity test (significant p-value) and Kayser-Meyer-Olkin (KMO) statistical test were considered to establish whether it was pertinent or not to perform an EFA with the data obtained. Values higher than 0.70 were considered to be acceptable.

In terms of the selection of the factor(s) to be obtained, the Minimum Rank Factor Analysis (MRFA) was used (33). The MRFA is a procedure for obtaining factors used as an alternative to the traditional Principal Component Analysis (PCA), and is advisable when the evaluation instruments use ordinal rating scales. Factor extraction was also carried out based on a reduced correlation matrix, as recommended by Timmerman et al. (34). In this context, the “Distinct Eigenvalue Criterion” (32) was used, whose values seek to determine the percentage of explained common variance. Based on this criterion, all factors with Eigenvalues higher than 1 were retained.

VARIMAX orthogonal rotation was performed to verify the properties of the factor matrix arising from the previous analysis (35).

To obtain evidence of test-retest reliability, the Intraclass Correlation Coefficient (ICC) was estimated with its respective 95% reliability interval, in order to determine the degree of consistency between measurements. In this context, a mixed effects model was used to achieve measures of “absolute agreement”. Although no consensus was reached regarding the interpretation of this coefficient, some guidelines were established. For the purposes of this study, values higher than 0.75 were considered acceptable reliability values. Values between less than 0.75 and 0.5 were considered moderately reliable and those below 0.5 insufficiently reliable (36).

The internal consistency reliability was obtained through standardized Cronbach’s Alpha. This procedure allows an appropriate analysis to be made of questionnaires using Likert-type scales that are unidimensional (37). Values higher than 0.7 were considered acceptable for each of the possible factors or dimensions obtained.

The above-described processing and subsequent statistical analysis were carried out exporting the database to the Statistical Package for the Social Sciences (SPSS) version 24 for the descriptive statistics and the test-retest reliability estimation. In terms of construct validity and calculating the internal consistency reliability, the FACTOR software, version 11.05.01 was used.

Results

Cultural adaptation of OHAT

In general terms, no difficulties were encountered in the translation of the original instrument. Some conceptual terms were modified by consensus, among which were the concepts ‘patchy’, ‘swollen’, ‘rope-

like', and the concept 'changes' (second category of the instrument), which was replaced by "signs of possible disease".

The reverse translation report contemplated a comparison with the original instrument subsequent to the process, together with a valuation of the linguistic equivalence of the translation produced. In this context, a majority of the elements of the intercultural sensitivity scale were categorized within a semantic-conceptual equivalence framework, except for the items tongue, gums and tissues and dentures, which were categorized as functional equivalences given the previously reported modifications.

In the case of dentures, the content of the text was modified at the time of producing the final version of the instrument, where the experts analyzed whether to include "name on dentures" in all categories of the item, because this is not usual practice in Chile in any context. It was decided to maintain the descriptor, but in conditional form (in contexts where it might be necessary). Figure 1 shows the final consensus version, translated into Spanish. The pre-test of the instrument was undertaken by three selected evaluators, speech-language therapists by profession, experienced in attending to older people for this purpose. Each one was interviewed to get to know their opinion about the general and conceptual comprehensibility of the test and its applicability within the context of speech and language assessment. After this, they were asked to evaluate a total of 30 persons (10 each). Consulted regarding their experience using OHAT, all the professionals stated that the application of the instrument is not difficult in general, the description of the items is clear and leaves no room for doubt, and reported an estimated average duration of 7 minutes in its application.

Descriptive analysis

The total initial population consisted of 293 participants. Of these, seven persons were excluded from the study – three for not signing the informed consent form and four because they presented dementia as a base condition, which did not allow them to comprehend or follow simple instructions in the application of the instrument – leaving 286 persons as the total end sample. The characteristics of the population participating in the study are described in Table 1.

Table 1
Sociodemographic characterization of the study population

Characteristic	n (%)
Gender	
- Female	138 (58)
- Male	100 (42)
Provenance	
- Urban	176 (73.9)
- Rural	62 (26.1)
Type of residence	
- Hospitalized	36 (12.6)
- Geriatric residence (State-funded/Private)	59 (20.6)
- Residential care for prostrated patients	74 (25.9)
- Older persons group	43 (15.0)
- Day center	61 (21.3)
- Home visit	13 (4.5)
Dependence level	
- Independent	50 (17.5)
- Mildly dependent	134 (46.9)
- Moderately dependent	15 (5.2)
- Severely dependent	27 (9.4)
- Fully dependent	60 (21.0)
Cognitive performance	
- No deterioration	111 (38.8)
- Mild/moderate deterioration	110 (38.5)
- Severe deterioration	65 (22.7)

The average age of the participants in the study was 75.01 ± 9.4 years. With regard to a background of pathologies or associated conditions, of the total number of participants 68.5% have arterial hypertension (n = 196), 27.3% type 2 diabetes (n = 78), 17.8% stroke (n = 51), 4.9% concussion (n = 14), 5.2% some type of cancer (n = 15, more specifically prostate and stomach), 12.6% hypo or hyperthyroidism (n = 36), 24.5%

hearing loss or impairment (n = 70), 11.5% present dementia (n = 33) and 5.9% have Parkinson's disease (n = 17).

With regard to nutrition, 77.6% (n = 222) of the participants eat normally, 11.2% (n = 32) eat pureed food and 11.2% are subject to some modification in their nutrition as a result of a medical or speech-language indication (only liquids, only solids, chopped food, etc.). None of the participants were absolutely restricted from ingesting orally, with 5.2% (n = 15) currently using a feeding tube to complement their nutrition process and 1% (n = 3) fed via gastrostomy.

Study of psychometric properties

Validity

The diagnostic checks carried out to verify the pertinence of the data to perform an Exploratory Factor Analysis (EFA), the Bartlett sphericity test and the Kayser-Meyer-Olkin (KMO) index, resulted in a chi-squared value of 747; $p < 0.001$ in the first, and an indicator equal to 0.769 in the second, which is considered to be acceptable.

The Minimum Rank Factor Analysis was used to obtain the communalities of each of the items. Table 2 summarizes these values.

Table 2
Communality values obtained for
the OHAT instrument.

Item	Extraction
Lips	0.506
Tongue	0.665
Gums and tissues	1.000
Saliva	0.643
Natural teeth	0.702
Dentures	0.433
Oral cleanliness	0.589
Dental pain	0.520

As shown, most of the communalities obtained values higher than 0.5, except for the dentures item. This would suggest *a priori* that the item be eliminated, however, due to clinical criteria it was decided to maintain it, considering it relevant for making up the scale. Moreover, its elimination did not improve the communality values for the rest of the items, which actually evidenced the opposite effect, so it was decided to continue with the analysis in these conditions and obtain a factor solution maintaining the original eight items reported.

Table 3 provides information regarding the factors to be extracted, according to the distinct Eigenvalue criterion.

Table 3
Extraction of factors according to the distinct Eigenvalue criterion.

Factors	Eigenvalue	Cumulative proportion of explained common variance
1	3.25893	0.64422
2	0.66476	0.13141
3	0.53895	0.10654
4	0.30406	0.06011
5	0.29196	0.05771
6	0.00002	0
7	0.00001	0

Consistent with the distinct Eigenvalue criterion, the MRFA made it possible to obtain a solution resulting in 1 factor, explaining 64.4% of the explained common variance.

Reliability

- a) Internal consistence: This was carried out calculating the standardized Cronbach's alpha (α), which resulted in a value of 0.82 for the evaluated dimension.
- b) Test-retest: A sample of 91 persons was contemplated for the test-retest reliability, and was subject to a second valuation that took place 7 days after the first application. The interclass correlation coefficient thus obtained was 0.82 (IC95% 0.752–0.867; $p < 0.001$).

Discussion

The translated and adapted Chilean version of the Oral Health Assessment Tool is presented initially as a tool that is easy to understand and apply. In general terms, the main goal was to achieve conceptual equivalence with the original instrument, safeguarding that any modification made of terms that were difficult to understand or not appropriate for implementation in the Chilean context in general, and more specifically in older adults, was as close as possible to the original meaning. Following this precept, the only concept that differed from the original text was the presence (or absence) of dentures marked with the name of the users, a usual practice in geriatric residences of other countries but currently not applicable to the Chilean reality. Thus, the general valuation of the instrument was not limited solely to the situation of institutionalized older people but to any evaluation context.

In terms of the validity of the instrument, the Exploratory Factor Analysis (EFA) of the OHAT produced one dimension. This is consistent with the Japanese study (25). The number of dimensions extracted did not concur with the dimension hypothesized in the model of the International Dental Federation (IDF) (1), but it is important to stress that the latent variables or constructs to be evaluated tend to differ from culture to culture and thus some variation is to be expected considering the modifications and contexts to which the instrument has been subject (28). Moreover, this factor explains 64.4% of the common variance. In this respect, there is no clear consensus regarding what values are adequate for this purpose. Hair et al. (38) report that for complex constructs, 60% common variance is acceptable to consider that the validity of an instrument is satisfactory.

It is important to take into account that the concept of oral health is complex and multidimensional and not only involves identifying affected structures or functions but also the perceptions of the individuals themselves regarding their health status, or the context that favors or obstructs maintaining their health (1). In this sense the OHAT is an instrument whose clinical usefulness lies in the observation of structures or consequences in oral functioning that increase risk or detect possible alterations that can lead to disease as a more objective measure than just self-perception or self-report. Consequently, according to the factor structure obtained, the explained variability of the OHAT is considered sufficient to deem it a valid instrument.

From a comparative point of view, this is the second study that aims to determine the factor validity of the OHAT. The first study, conducted in Japan (39), obtained a four-factor solution, explaining 57.64% of the variance. Notwithstanding, it is important to mention that, in that case, the instrument was based on the original OHAT and was subsequently developed specifically for older and diabetic people. In this case, the Chilean version of the OHAT maintained its original structure, obtaining a unidimensional structure. It is logical to expect this result, first of all because any construct can vary depending on the context of the population, and secondly because of the modifications in form and content made to the first validated instrument.

In terms of internal consistency reliability, the reported Cronbach's alpha was good ($\alpha = 0.82$) for the entire instrument, coinciding with the results obtained by Kuwamura et al. (39) but differing from the values obtained by Mello et al. (26), who evaluated the internal consistency of the instrument applied by a group of nurses and dentists to 50 older people, obtaining alpha values considered to be low. In this respect, the following should be considered: First of all, it is important to note the definition of this measure, which is frequently considered to refer to the degree in which all elements of a test or instrument measure the same attribute or dimension (37). In this sense, according to Bonett (40) and Charter (41), sample sizes of more than 250 subjects are required to obtain appropriate and precise values with this coefficient, both for determining the coefficient of the instrument and to validate any comparisons. In this study and that of Kuwamura et al. (39), the calculation of the coefficient was carried out in compliance with this condition.

In the same vein, another objective of the study was to determine the test-retest reliability or reproducibility of the instrument. This provides an indicator of the stability of the test measurements as a function of a specific interval between two evaluations taken in different time periods (42), which is also of clinical interest. In this study the Intraclass Correlation Coefficient value was 0.82 (IC95% 0.752–0.867), considered to be good. Similar values were obtained in the original validation (17) of the OHAT and the English validation directed at evaluators who were speech-language therapists by profession (18).

With regard to the limitations of this study, the aspect of representativity is mentioned. Although the calculation of the sample size is based on the number of measures per item, it is also necessary to safeguard that, from an epidemiological point of view, there are sufficient contexts available to encompass greater variability. In this sense, access to the population of older people receiving home care (n = 13) was lower, and therefore it is likely that such variability was not fully covered.

Another limitation has to do with the process itself. International guidelines on the validation of instruments contemplate other types of validation that are useful when considering whether or not an instrument is valid (and also reliable) (43, 44)}. In this sense, it would be useful to develop other studies that would make it possible to compare performance in terms of detecting the OHAT using a previously established criterion (such as, for example, the considered opinion or valuation of a professional dentist), its concurrent and discriminant validity, or likewise its predictive validity. From a methodological viewpoint, a prospective (cohort) study would be useful to test these hypotheses.

Although there is evidence available regarding the clinical usefulness of the OHAT in other contexts, especially in terms of its application by speech-language therapists and nurses, no certainty exists regarding the feasibility of its use by the latter professionals given that the training and application of this study was carried out solely by the former. It would be a mistake to assume that the formative processes or conceptual contents of nurses are identical to their similar counterparts in other countries or contexts. It is therefore considered relevant to undertake additional research efforts that will evaluate the feasibility of the use of the OHAT by these evaluators.

Conclusion

In light of the foregoing, it is considered that the Oral Health Assessment Tool is valid and possesses adequate properties of internal consistency and test-retest reliability for the population under study. Its orientation is initially clinical, aimed at favoring the detection of possible oral health problems in Chilean older people and referring them in a timely fashion to a professional dentist for their optimal care. The information provided could be useful also in possible actions of health promotion and disease prevention, not only directed at older adults but also their caretakers and treatment team, and could have an impact on indicators of oral health and particularly in the quality of life of older people. In turn, it is considered as an alternative or complement to the valuation of speech and language structures, and even the valuation of the swallowing process by the speech-language therapists, who could use the instrument

in future lines of research to determine its contribution to the diagnostic or decision-making process regarding the treatment of swallowing disorders in the elderly.

Finally, it is important to undertake further studies of different types of validity and reliability in order to collect more information about the psychometric properties of the instrument and extend or project its usefulness into the future. By the same token, it is useful to stress that no instrument is definitive in terms of its psychometric properties, thus making it advisable to review and enrich the instrument over time in order to improve its characteristics.

Declarations

Ethics approval and consent to participate: This study received the approval of the scientific ethics committee of the Universidad Católica de Temuco, under resolution No. 40/20.

Consent for publication: Not applicable.

Availability of data and materials: The datasets generated during and analyzed during the current study are not publicly available due to data protection regulations and ethical concerns but are available from the corresponding author on reasonable request.

Competing interests: The authors declare that they have no competing interests

Funding: This work was partially supported by Universidad Católica de Temuco, Chile.

Authors' contributions:

Conceptualization, C.M., and S.M; patient recruitment and sampling, C.M. and F.H.; C.M. and S.M; formal analysis; writing—original draft preparation, C.M, F.H. and S.M.; writing—review and editing C.M, F.H. and S.M.; supervision, C.M; project administration, C.M and F.H.; funding acquisition, C.M. and F.H. All authors have read and agreed to the published version of the manuscript.

Acknowledgements: Not applicable.

References

1. Glick M, Williams DM, Kleinman D V, Vujicic M, Watt RG, Weyant RJ. A new definition for oral health developed by the FDI World Dental Federation opens the door to a universal definition of oral health. *Int Dent J.* 2016;66(6):322–4.
2. Watt RG. Strategies and approaches in oral disease prevention and health promotion. *Bull World Health Organ.* 2005;83(9):711–8.
3. Petersen PE, Yamamoto T. Improving the oral health of older people: The approach of the WHO Global Oral Health Programme. *Community Dent Oral Epidemiol.* 2005;33(2):81–92.

4. Registered Nurses' Association of Ontario. Oral Health: Nursing Assessment and Interventions [Internet]. Nursing Best Practice Guideline. Toronto, Canada: Registered Nurses' Association of Ontario; 2008. Available from:
5. León S, Correa-Beltrán G, De Marchi RJ, Giacaman RA. Ultra-short version of the oral health impact profile in elderly Chileans. *Geriatr Gerontol Int.* 2017;17(2):277–85.
6. Ministerio de Salud. Gobierno de Chile. Plan Nacional de Salud Bucal 2018–2030 [Internet]. Chile; 2017. Available from: https://diprece.minsal.cl/wrdprss_minsal/wp-content/uploads/2018/03/PLAN-NACIONAL-DE-SALUD-BUCAL-2018-2030.pdf
7. Zarebski G. CME. Cuestionario Mi Envejecer. Un instrumento psicogerontológico para evaluar la actitud frente al propio envejecimiento. 1a ed. Buenos Aires: Paidós; 2014.
8. Ghezzi EM, Ship JA. Systemic Diseases and Their Treatments in the Elderly: Impact on Oral Health. *J Public Health Dent.* 2000;60(4):289–96.
9. Strömberg E, Hagman-Gustafsson ML, Holmén A, Wårdh I, Gabre P. Oral status, oral hygiene habits and caries risk factors in home-dwelling elderly dependent on moderate or substantial supportive care for daily living. *Community Dent Oral Epidemiol.* 2012;40(3):221–9.
10. Chalmers JM. Oral health promotion for our ageing Australian population. *Aust Dent J.* 2003;48(1):2–9.
11. Amar S, Han X. The impact of periodontal infection on systemic diseases. *Med Sci Monit.* 2003;9(12):291–9.
12. Mankekar G. Swallowing – Physiology, Disorders, Diagnosis and Therapy. 1st ed. New Delhi: Springer; 2015. 189–229 p.
13. Klotz AL, Hassel AJ, Schröder J, Rammelsberg P, Zenthöfer A. Oral health-related quality of life and prosthetic status of nursing home residents with or without dementia. *Clin Interv Aging.* 2017;12:659–65.
14. Petersen PE, Kjøller M, Christensen LB, Krusturup U. Changing dentate status of adults, use of dental health services, and achievement of National Dental Health goals in Denmark by the year 2000. Vol. 64, *Journal of Public Health Dentistry.* 2004.
15. Levine R, Stillman-Lowe C. The scientific basis of oral health education. Eighth Ed. *Community Dental Health.* West Yorkshire: Springer Nature Switzerland; 2019. 1–96 p.
16. Feasley JC. Health Outcomes Research for Older People. In: *Health Outcomes for Older People: Questions for the Coming Decade.* Washington D.C: National Academy of Sciences; 1996. p. 9–10.
17. Chalmers JM, King PL, Spencer AJ, Wright FAC, Carter KD. The Oral Health Assessment Tool – Validity and reliability. *Aust Dent J.* 2005;50(3):191–9.
18. Simpelaere IS, Van Nuffelen G, Vanderwegen J, Wouters K, De Bodt M. Oral health screening: Feasibility and reliability of the oral health assessment tool as used by speech pathologists. *Int Dent J.* 2016;66(3):178–89.

19. World Health Organization. Oral Health Surveys. Basic Methods. 5th ed. Who Library Cataloguing-in-Publication Data, editor. Numerical Methods and Optimization in Finance. Paris: World Health Organization; 2011. 1–125 p.
20. Sánchez-García S, Heredia-Ponce E, Juárez-Cedillo T, Gallegos-Carrillo K, Espinel-Bermúdez C, De La Fuente-Hernández J, et al. Psychometric properties of the General Oral Health Assessment Index (GOHAI) and dental status of an elderly Mexican population. *J Public Health Dent.* 2010;70(4):300–7.
21. Campos JADB, Zucoloto ML, Geremias RF, Nogueira SS, Maroco J. Validation of the Geriatric Oral Health Assessment Index in complete denture wearers. *J Oral Rehabil.* 2015;42(7):512–20.
22. Gita F, Wiryasmoro T, Sagala DM, Hendry, Hogervorst E, Kusdhany LS. Oral health status and oral health-related quality of life in Indonesian elderly (analysis using the Indonesian version of the oral health assessment tool and the geriatric oral health assessment index). *J Int Dent Med Res.* 2017;10(Specialissue):533–9.
23. Harderwijk H. Translating and Validating the Dutch version of the Oral Health Assessment Tool for Older [Internet]. University of Utrecht; 2019. Available from: <https://dspace.library.uu.nl/handle/1874/384287>
24. Klotz AL, Zajac M, Ehret J, Hassel AJ, Rammelsberg P, Zenthöfer A. Development of a German version of the Oral Health Assessment Tool. *Aging Clin Exp Res [Internet].* 2019;0(0):0. Available from: <http://dx.doi.org/10.1007/s40520-019-01158-x>
25. Matsuo K, Nakagawa K. Reliability and Validity of the Japanese Version of the Oral Health Assessment Tool (OHAT-J). *J Japanese Soc Disabil Oral Heal.* 2016;37(1):1–7.
26. Mello ALSF de, Zimmermann K, Gonçalves LHT. Avaliação da saúde bucal de idosos por enfermeiros: validade e confiabilidade do instrumento ASBTO. *Rev Gaúcha Enferm.* 2012;33(2):36–44.
27. Şahin NE, Jablonski RA. Psychometric properties of the Oral Health Assessment Tool Turkish version. *Cukurova Med J.* 2019;44(Suppl 1):513–20.
28. Streiner DL, Norman G, Cairney J. Health measurement scales: A practical guide to their development and use. 5th ed. Oxford: Oxford University Press; 2015.
29. Donner A, Eliasziw M. Sample size requirements for reliability studies. *Stat Med.* 1987;6(4):441–8.
30. Asociación Médica Mundial. Declaración de Helsinki de la AMM – Principios éticos para las investigaciones Médicas en seres humanos [Internet]. 2013. Available from: <https://www.wma.net/es/polices-post/declaracion-de-helsinki-de-la-amm-principios-eticos-para-las-investigaciones-medicas-en-seres-humanos/>
31. Ramada-Rodilla JM, Serra-pujadas C, Delclós-Clanchet GL. Adaptación cultural y validación de cuestionarios de salud: revisión y recomendaciones metodológicas. *Salud Públ Méx.* 2013;55(1):57–66.
32. Norman G, Streiner DL. Biostatistics. The bare essentials. 3rd ed. Hamilton, Ontario: BC Decker; 2008.
33. ten Berge JMF, Kiers HAL. A numerical approach to the approximate and the exact minimum rank of a covariance matrix. *Psychometrika.* 1991;56(2):309–15.

34. Timmerman ME, Lorenzo-Seva U. Dimensionality assessment of ordered polytomous items with parallel analysis. *Psychol Methods*. 2011;16(2):209–20.
35. Keszei AP, Novak M, Streiner DL. Introduction to health measurement scales. *J Psychosom Res [Internet]*. 2010;68(4):319–23. Available from: <http://dx.doi.org/10.1016/j.jpsychores.2010.01.006>
36. Portney LG, Watkins MP. *Foundations of Clinical Research. Applications to practice*. 3rd ed. Philadelphia: F.A Davis Company; 2012.
37. Cronbach LJ, Gleser GC. Interpretation of reliability and validity coefficients: Remarks on a paper by Lord. *J Educ Psychol*. 1959;50(5):230–7.
38. Hair JF, Black WC, Babin BJ, Anderson RE. *Multivariate Data Analysis*. 7th ed. Edinburgh Gate: Pearson Education Limited; 2009. 107 p.
39. Kuwamura Y, Sumikawa M, Tanioka T, Nagata T, Sakamoto E, Murata H, et al. Development of the Diabetes Oral Health Assessment Tool for Nurses. *Health (Irvine Calif)*. 2015;07(12):1710–20.
40. Bonett DG. Sample size requirements for testing and estimating coefficient alpha. *J Educ Behav Stat*. 2002;27(4):335–40.
41. Charter RA. Study samples are too small to produce sufficiently precise reliability coefficients. *J Gen Psychol*. 2003;130(2):117–29.
42. Koo TK, Li MY. A Guideline of Selecting and Reporting Intraclass Correlation Coefficients for Reliability Research. *J Chiropr Med [Internet]*. 2016;15(2):155–63. Available from: <http://dx.doi.org/10.1016/j.jcm.2016.02.012>
43. Mokkink LB, Terwee CB, Patrick DL, Alonso J, Stratford PW, Knol DL, et al. The COSMIN study reached international consensus on taxonomy, terminology, and definitions of measurement properties for health-related patient-reported outcomes. *J Clin Epidemiol [Internet]*. 2010;63(7):737–45. Available from: <http://dx.doi.org/10.1016/j.jclinepi.2010.02.006>
44. Mokkink LB, Prinsen CAC, Bouter LM. The COnsensus-based Standards for the selection of health Measurement INstruments (COSMIN) and how to select an outcome measurement instrument. 2016;20(2):105–13.

Figures

INSTRUMENTO DE EVALUACIÓN DE SALUD ORAL (OHAT)

Desarrollado por Chalmers et al. y modificado por el Departamento de Salud de la Región de Hailton

Usuario: _____		Completado por: _____		
Fecha: / /				
Categoría	0= sano	1= signos de enfermedad	2= enfermo	Puntajes de categoría
Labios	Suaves, rosados, húmedos.	Secos, agrietados o rojos en las comisuras.	Hinchados, con úlceras irregulares blancas o rojas; posible sangrado en las comisuras*.	
Lengua	Normal, húmeda, rugosa, rosada.	Cubierta de sarro, fisurada, roja.	Capa Irregular de color roja y/o blanca, ulcerada y con evidentes signos de inflamación*.	
Encías y tejidos	Rosadas, húmedas, suaves, no sangrantes.	Secos, brillantes, con evidentes signos de inflamación, hinchado alrededor de 1-6 dientes; con ulceración bajo la prótesis dental*.	Evidente aumento de volumen alrededor de 7 o más dientes (generalizado), ulcerado, con capa blanca/roja, sangrante y con inflamación generalizada bajo la prótesis dental*.	
Saliva	Tejidos húmedos, saliva acuosa y de flujo libre.	Disminución de la cantidad de saliva presente, tejidos secos y pegajosos. El usuario refiere sentir la boca seca.	Tejidos secos y rojos, escasa o nula presencia de saliva; la saliva es espesa o viscosa; el usuario se queja de sentir la boca seca.*	
Dientes Naturales	Sin dientes o raíces cariados o rotos.	1-3 dientes o raíces cariados o rotos	Cuatro o más dientes raíces cariados o rotos o dientes muy desgastados o menos de cuatro dientes sin prótesis dental*.	
Con/sin prótesis dental	No hay áreas o dientes rotos, prótesis dental usada regularmente, y marcada con nombre si fuera necesario.	1 área o un diente de la prótesis dental quebrado / prótesis dental usada sólo por 1 a 2 horas diarias o prótesis sin nombre (si fuera necesario) o desajustada.	Más de 1 área o un diente de la prótesis quebrado, o no uso de prótesis por pérdida o no uso de prótesis debido a desajustes, o solo se usa con adhesivo para prótesis dental* (no identificada si fuera necesario)*.	
Con/sin de higiene oral	Limpio y sin restos de comida o sarro en boca o prótesis dental.	Restos de comida o sarro o placa en 1 o 2 áreas de la boca o en una pequeña área de la prótesis dental o halitosis.	Restos de comida o sarro o placa en la mayoría de las áreas de la boca o en la mayor parte de la prótesis/ halitosis severa*.	
Dolor dental	No hay signos conductuales, verbales o físicos de dolor.	Signos verbales y/o conductuales de dolor, como hacer muecas, morderse los labios, dejar de comer o tener actitudes agresivas*.	Signos físicos de dolor (hinchazón de las mejillas o las encías, dientes rotos, úlceras), así como signos verbales y / o conductuales (muecas, dejar de comer, o tener actitudes agresivas)*.	
Derivación a un profesional de salud bucal	<input type="checkbox"/> Si <input type="checkbox"/> No			Puntaje Total: _____/16

Figure 1

Final version of the OHAT instrument translated and adapted to Chilean Spanish.

El asterisco * indica la necesidad de derivación a un profesional de la salud oral.