Original Research
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Developing a protocol for a preventive oral health exam for elderly people (EDePAM) using E-Delphi methodology

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Abstract: The aim of this study was to develop a Preventive Oral Health Exam for Elderly People (EDePAM), using the e-Delphi technique, to diagnose oral health problems in people 65 or older. The e-Delphi technique was used with experts in multiple stages, and in a final workshop, where an agreement on an examination protocol was reached for diagnosing dental caries, oral mucosa lesions, periodontal diseases, and masticatory function disorders. Quantitative analyses of all the rounds of the e-Delphi method were conducted. It was agreed that the International Caries Detection and Assessment System (ICDAS) should be used together with a modified version of the Nyvad criteria to detect and assess caries lesions. It was also agreed that an assessment was needed of the different factors involved in determining caries risk, namely socioeconomic level, access to fluoride, level of dependence/functionality, salivary flow, history of head and neck cancer treatment, use of medications that decrease salivary flow, diet, use of removable dental prostheses, exposure of root surfaces, and caries history. Furthermore, patients would be required to undergo an examination of the oral mucosa, where any existing lesion should be described in terms of its clinical appearance, location, and risk potential. It was also agreed that an assessment of masticatory function should be performed using the Leake index, together with chewing-gum combined with a color scale to categorize masticatory performance. The number of pairs of occluding antagonist teeth was considered as the best predictor of masticatory function. The 2018 classification by the American Academy of Periodontology (AAP) / European Federation of Periodontology (EFP) was accepted as the standard to assess periodontal status, and it was agreed that this assessment should include an evaluation of clinical attachment loss and bleeding on probing. The novel EDePAM was considered as appropriate for conducting a functional assessment of oral health by providing a comprehensive diagnosis of oral diseases.

Keywords: Dental Caries; Periodontal Diseases; Diagnosis; Aged.

Introduction

Oral diseases are a pandemic, and one of the most challenging public health issues worldwide.[1] The number of people affected by oral diseases increases as the population gets older,[2] with a higher prevalence in the

most vulnerable groups, thus engendering a significant source of social inequality.[3] Poor oral health affects the ability to eat properly, and diminishes self-esteem and quality of life.[4,5]

Today's global population is aging rapidly. In Chile, the elderly population increased from 6.6% in 1992 to 11.4% in 2017.[6] It is predicted that a demographic crossing will take place by 2025, where the population aged older than 60 will outnumber the population aged younger than 15[6]. One of the tools recommended by the World Health Organization (WHO) to evaluate the health of older adults is a functional ability assessment.[7] Therefore, one of the goals of public policies for this population should be to increase the number of disability-free years of life.[8]

The elderly population in Chile has access to the Elderly Preventive Medicine Exam (EMPAM), a periodic examination for monitoring and evaluating health and functionality.[9] However, this exam does not include an evaluation of oral health or oral functionality. When an oral diagnosis tool for elderly people is lacking, consensual methods can provide a way to synthesize information, by determining to what extent the experts in the field agree on a given situation.[10] One of the most commonly used consensual methods in health is the Delphi technique.[11] Generally, this method entails a group of experts responding to a questionnaire, and then receiving feedback based on the collective responses.[11] Thus, within a Delphi study, the results of earlier iterations regarding specific statements and/or items can change or be modified by individual panel members in later iterations based on their ability to review and assess the comments and feedback provided by the other Delphi panelists.[11] One of the primary characteristics and advantages of the Delphi process is subject anonymity, which can reduce the effects of dominant individuals, often a concern when using group-based processes to collect and synthesize information.

In Chile, there is no examination protocol to diagnose the oral health of elderly people; therefore, the aim of this study was to create a Preventive Oral Health Exam for Elderly People (EDePAM), to be applied in the public health system, based on an electronic Delphi survey (e-Delphi), to enable the diagnosis of oral health problems using a single protocol. This proposal is the response to a call for action that recommends prioritizing research on how to preserve oral health, quality of life, and nutrition in older adults.[12]

Methodology

Study design

The Delphi method, a method based on expert opinion to achieve a consensus, was used in this study.[13] The Local Research Ethics Committee of the Western Metropolitan Health Service approved this methodological study that has a quantitative approach (Decision number 60: Code 41 / 12.21.2018). The protocol construction process was organized in three phases: a) determining the diseases to be included in the EDePAM, and forming an advisory group, b) conducting an e-Delphi survey, and c) holding a consensus workshop (Figure 1).

Determining the diseases to be included in the EDePAM

The following steps were taken to determine the diseases to be included in the EDePAM: a) a review of the epidemiological studies conducted in Chile to establish the most prevalent, severe and widespread oral conditions in the country, b) an analysis of the national health surveys performed in Chile, c) a review of the scientific literature to establish the most prevalent oral diseases in the elderly population worldwide. A narrative review search was conducted for all the publications related to epidemiologic studies conducted in Chile, whose "Aims" or "Methodology" sections included data on the prevalence of oral diseases among the Chilean elderly. The search was carried out in the Medline (Pubmed), Embase, Cochrane Collaboration and SciELO databases. The inclusion criteria were cross-sectional and longitudinal studies published from 2000 onwards. The exclusion criteria were conference publications, animal and *in vitro* studies, questionnaire adaptations, and self-reported questionnaires. The search terms were chosen among the Medical Subject Headings of the U. S. National Library of Medicine (NIH-MeSh), namely "Prevalence Study," "Longitudinal Study," and also "Local and National Chilean Study." In addition, international scientific publications related to the

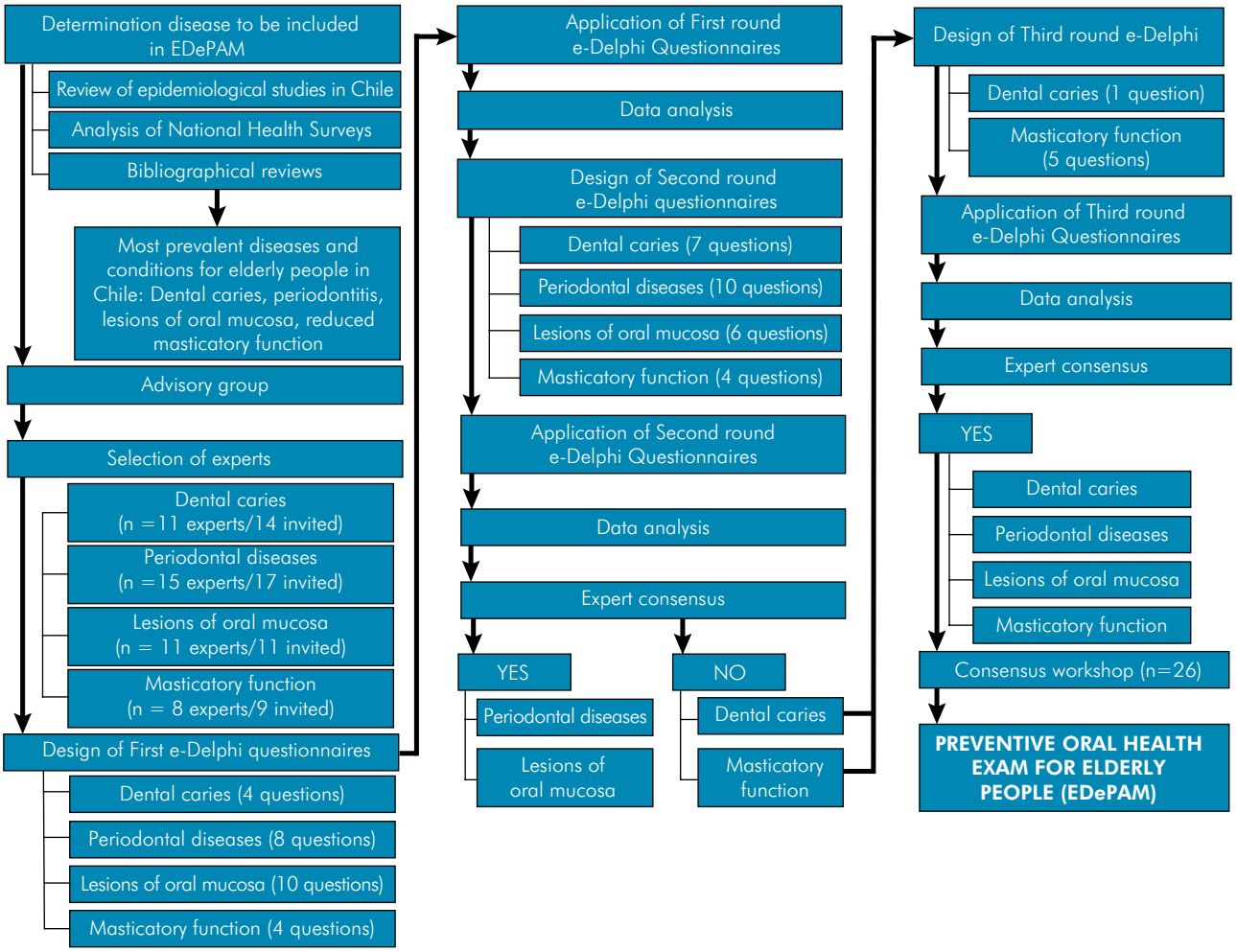

Figure 1. Flow chart of the experimental design

global burden of oral diseases from 1990 to 2015 were included in the search, in order to collect data from the conditions of interest in the world population. The results of the National Survey of general health, commissioned by the Ministry of Health for the 2016-2017 period, were retrieved from the corresponding database published on the website of the Ministry of Health, and reviewed for the study.

Advisory group

Prior to starting the e-Delphi survey, an advisory group was created (including authors AM, CC, IE, GM, FC, ADF, and JG), which held several meetings designed to: a) define the appropriate context, b) develop the questionnaire, c) select a list of experts, d) explain the method and objectives to all of the selected experts, and request their collaboration.

e-Delphi survey

Selection of experts

Only national experts were included in the study. Each level had a representation of experts with four possible profiles: dental practitioners in the public or private sector, faculty members of dental schools, and members of scientific societies. These profiles were defined according to several factors, such as number of scientific publications in the area, peer recognition at the national and international levels, positions of responsibility in the government of the country, decision-making capacity within public health services, and positions in scientific societies, among others. Overall, 51 Chilean experts were invited to participate, 14 specializing in dental caries, 11 in lesions of the

oral mucosa, 9 in masticatory function, and 17 in periodontal diseases.

This was a convenience sample, with experts representing all sectors of the country, most of which also conducted research in their area of expertise, who spoke Spanish, and who were aware of the current status of existing public policies for the elderly in Chile. Maintaining a balance between the players from state institutions, public and private healthcare providers, members and/or directors of societies of related specialties, as well as those of educational institutions, is essential to maintain a balance between academia and public policy makers and policy implementers in each area. The minimum number of experts per study area included in the Delphi survey was 7, and the final number depended on the availability of experts in each study area.[14]

The experts were formally invited to participate by means of a letter sent by email, and the Google Forms platform was used to collect and record the participants' responses to the questionnaires. The average time required to complete each questionnaire was 30 minutes. The whole process was carried out between August 30 and October 23 for cariology, between August 27 and October 15 for masticatory function, between September 6 and November 11 for oral mucosa lesions, and between August 12 and September 12 for periodontal diseases, all during the year of 2019. The system designed allowed keeping the responses private, and the participants, anonymous.

e-Delphi questionnaires

The 1st round consisted of a questionnaire with open-ended questions developed by the advisory group, based on the previously proposed and developed objectives. The questions of the 2nd round were formulated based on the responses provided by the experts in the 1st round. The questions had the following objectives, according to the area of study:

a. dental caries: to reach an agreement on the methods of detection/classification of caries lesions, and on a risk assessment method for elderly people (1st round: 4 questions; 2nd round: 7 questions) (Table);
b. lesions of the oral mucosa: to reach an agreement on an examination method for the oral mucosa, including recommended tools, examination time, and a proposed method for recording oral mucosal lesions (1st round: 10 questions, 2nd round: 6 questions) (Table);
c. masticatory function: to determine the materials and methods to assess masticatory performance, to define a questionnaire to assess chewing ability, and to determine the variables or clinical characteristics with the highest predictive value to assess masticatory function (1st round: 4 questions, 2nd round: 4 questions) (Table);
d. periodontal diseases (two complementary objectives): to assess the feasibility of implementing the American Academy of Periodontology (AAP) / European Federation of Periodontology (EFP) 2018 classification during periodontal examination, and to collect the opinion of experts on the possibility of implementing this new classification by general practitioners (1st round: 8 questions; 2nd round: 10 questions) (Table).

A 3rd round was required only for the dental caries group (1 question) and the masticatory function group (5 questions), because of the lack of consensus on some of the questions. A consensus was achieved only when agreement was higher than 60%. In the 2nd and 3rd rounds, most of the questions had closed-ended answers to be selected by the participants (example: "totally disagree," "disagree," "neither agree nor disagree," "agree," "totally agree") or were dichotomous ("Yes/No").

Consensus workshop

After the results of the e-Delphi survey were obtained, a consensus workshop was held (November 2019). Twenty-six professionals took part in the consensus workshop, including eight experts who participated in the previous stages, as well as professionals in charge of dental programs in health centers, professional specialists, and general dentists working in both the public health system and private dental practices in different Chilean cities. The objectives of the consensus workshop were: a) to review and analyze the results obtained, b) to broaden the discussion on the topics requiring further explanation, and c) to carry out a final discussion

Table. Question and answers from the 1st round.

Question	Answer	Frequency (%)
Dental caries		
Which method do you consider more appropriate to assess caries risk in elderly people?	Cariogram	27
	Evaluation of risk and protective factors	27
	CAMBRA	18
	Caries risk assessment form, University of Bern	18
	ICCMS	9
	Clinical evaluation	9
Which method do you consider more appropriate to detect/classify coronal caries lesions in elderly people?	ICDAS II	64
	ICDAS-LAA	18
	ICCMS	9
	ICDAS with merged codes	9
Which method do you consider more appropriate to detect/ classify root caries lesions in elderly people?	ICDAS II	73
	ICDAS-LAA	18
	ICCMS	9
Which method do you consider more appropriate to assess caries activity in elderly people?	Nyvad criteria	91
	Clinical appearance	9
Lesions of oral mucosa		
Briefly describe how you perform a clinical examination of the oral mucosa:	Following a systematic order	100
	From the outside to the inside of the oral cavity	54.5
	Visual inspection and palpation	36.4
Name the clinical features that you typically include when describing an oral mucosa lesion:	Color	90.9
	Size, consistency	81.8
	Location	72.7
	Shape, surface and margin features	54.4
	Single/multiple, relation to neighboring structures, lesion type	36.4
	Time since appearance, symptoms	27.3
Do you know any proposal for recording oral mucosa lesions for use in the public or private health system for elderly people? Briefly describe:	No proposal known	63.6
	Others (registration forms from the University of Chile, Universidad Nacional Autónoma de Mexico, Chile Digital Hospital)	9.1
Do you know any proposal for recording oral mucosa lesions for clinical records in epidemiological studies? Briefly describe:	No proposal known	72.7
	Others (registration forms from Universidad de Valparaíso, Universidad Nacional Autónoma Metropolitana de Mexico, EPIMAULE in Chile)	9.1
How do you record the findings of oral mucosa lesions in your clinical activity?	Recording in digital or paper format	100
	Recording in a specific section for the description of oral mucosa lesions	81.8
	Adding a photographic record	18.2
Do you think that an oral mucosa examination should be performed at every dental appointment with older adults in primary health care services?	Yes	100

Continue

Continuation

What instruments and / or items do you use to perform an oral mucosa examination?	Basic examination kit (mirror, probe, periodontal probe and tweezers), gauze and tongue depressors	100
	Photographic record	36.4
How long (on average) does it take you to perform an oral mucosa exam?	5 minutes (median), 2 - 15 minutes (range)	
Mention between 4 to 6 clinical changes or alterations in the oral mucosa that should be recorded in a clinical record of an examination of the oral mucosa of older adults.	Changes in color, size, shape, presence / absence of pain	100
	Ulcers, tumors, nodules	54.5
	Others (such as fistulas, decreased salivary flow, lichenoid lesions, burning mouth, angular cheilitis)	9.1
Mention oral mucosa pathologies that you consider should be referred with high priority to the evaluation of a specialist in oral pathology, oral medicine and / or stomatology	Premalignant or suspected oral cancer lesions	100
	Leucoplakia, erythroplasia	63.6
	Lichen planus	36.4
	Pemphigus, pemphigoid and candidiasis	18.2
	Cheilitis, lichenoid lesions	9.1
Masticatory function		
What variables or clinical characteristics do you consider to have the greatest predictive value for oral functionality in the elderly population (over 60 years)?	Pairs of occluding antagonist teeth	62.5
	Number of teeth	50
	Pain	37.5
	Stability of dental prosthesis	37.5
	Salivary flow	37.5
	Cognitive function	25
	Others (muscle, bone, TMJ status, periodontal disease, dental prosthesis, taste alteration, smell alteration, chewing performance, time since onset of tooth loss, chewing difficulty, chewing force)	12.5
What methods for the evaluation of chewing performance (objective evaluation) do you consider most appropriate to apply in the population of older adults (over 60 years)?	Sieving	50
	Photocolorimetry	25
	Others (color pattern, scanning, electromyography, and chewing force measurement)	12.5
What test materials for the evaluation of chewing performance (objective evaluation) do you consider most appropriate to apply in the population of older adults (over 60 years)?	Bicolor chewing gum	37.5
	Peanuts	25
	Erythrosine capsules	25
	Others (paraffin, chewing gum, jelly sweet, almond, color-changing chewing gum and digital gnathodynamometer)	12.5
What questionnaires for the evaluation of chewing ability (subjective evaluation) do you consider most appropriate to apply in the population of older adults (over 60 years)?	Leake index	22.3
	Geriatric Oral Health assessment Index (GOHAI)	11.1
	Ageberg and Carlsson Test	
	Osterberg Test	11.1
	Oral Health Impact Profile (OHIP)-14Sp	11.1
	Oral Health Impact Profile (OHIP)-7	11.1
	A simple questionnaire	11.1
	There is no validated questionnaire	11.1

Continue

Continuation		
Periodontitis		
Which clinical parameters do you consider in the periodontal examination?	Clinical attachment loss	100
	Probing depth	100
	Bleeding on probing	100
	Tooth mobility	46.6
	Furcation involvement	26.7
	Local factors	6.7
	Mucogingival conditions	6.7
Which clinical parameter do you use to diagnose "periodontitis" in an adult patient?	Clinical attachment loss	93.3
	Probing depth ≥4mm	6.6
Which clinical parameter do you use to diagnose "gingivitis" in an adult patient?	Bleeding on probing	80
	Inflammatory characteristics	20
	Clinical attachment loss	6.7
Is complete periodontal examination necessary to diagnose "periodontitis"?	Yes	80
	No	20
Are you familiar with the Classification of Periodontal and Peri-implant diseases and conditions (2017)?	Yes	93.3
	No	6.7
Do you use the Classification of Periodontal and Peri-implant diseases and conditions (2017)?	Yes	80
	No	20
How long does it take you to diagnose periodontal diseases in adults?	≤30 minutes	86.7
	>30 minutes	13.3
Which periodontal probe do you use to diagnose periodontal diseases in adults?	U. North Carolina probe	80
	Goldman-Fox probe	6.6
	Williams probe	6.7
	OMS probe	6.7

and analysis of the conclusions. A flow chart of the study design is presented in Figure 1.

Data analysis

Quantitative analyses were conducted of all the rounds of the e-Delphi survey. In the 1st round, the responses were grouped according to common categories, and summarized in the form of percentages. For all of the questions, a consensus was considered as "reached" when more than 60% of the experts selected the same response. In the case of questions with different levels of agreement, a consensus was considered as "reached" when more than 60% of the experts selected the "agree" or "totally agree" options. The related literature reports agreement rates between 51% and 80% among experts as representing a consensus.[15,16]

Results

Determining the diseases to be included in the EDePAM:

The results showed that the most prevalent diseases and conditions for elderly people were dental caries, periodontitis, lesions of oral mucosa, and reduced masticatory function.[17-22]

e-Delphi survey

Experts/professionals

The response/participation rate was 88.2% (45 of 51 experts). The panels were composed of 11/14 experts in the area of dental caries, 11/11 in lesions of the oral mucosa, 8/9 in masticatory function, and

15/17 in periodontal diseases. The 45 professionals were distributed as follows: 24 were university professors, 12 belonged to the public sector, 1 to the private sector, and 8 to different scientific societies.

e-Delphi Questionnaires

a. Dental caries: It was agreed that the International Caries Detection and Assessment System (ICDAS) was appropriate for the detection/ classification of coronal and root caries lesions, and that the Nyvad criteria were appropriate for the classification of caries lesion activity in older adults. Furthermore, it was agreed that the most relevant factors for the assessment of caries risk in older adults were access to fluoride, use of salivary flow–decreasing medications, diet, root surface exposure, salivary flow, level of dependence/functionality, history of head and neck cancer treatment, socioeconomic level, use of removable dental prosthesis, and past caries experience (Table, Figure 2, and Figure 3).

b. Lesions of the oral mucosa: it was agreed that all the patients should undergo an oral mucosa examination, consisting of inspection and palpation from the outside to the inside of the oral cavity, using a basic examination tool (mirror), gauze and tongue depressor, taking 3-5 minutes, and describing each lesion clinically by reporting its type, location, and malignancy potential. Any suspected oral cancer, pemphigus, oral pemphigoid or candidiasis should prompt a high priority referral to a specialist in oral pathology (Table). In addition, there was agreement on the importance of making a photographic record of any lesion and using the topographical register proposed by the WHO and modified by Roed-Petersen (WHO 1980) to record oral mucosal lesions. The essential lesions to be considered were ulcer, plaque, and node, followed by vesicular lesion, tumor, macula and papule.

c. Masticatory function: there was a consensus among the experts that the Leake index should be used to assess chewing ability (Table, Figure 4, Figure 5). In the 3rd round, a color-changeable chewing gum (Masticatory Performance Evaluating Gum XYLITOL®, Lotte, Tokyo, Japan) and associated color scale reached the highest level of agreement to assess masticatory performance, according to the criteria of technical, operational, economic, and clinical time feasibility (Figure 6). The number of pairs of occluding antagonist teeth was considered the clinical variable with the highest predictive value for masticatory function.

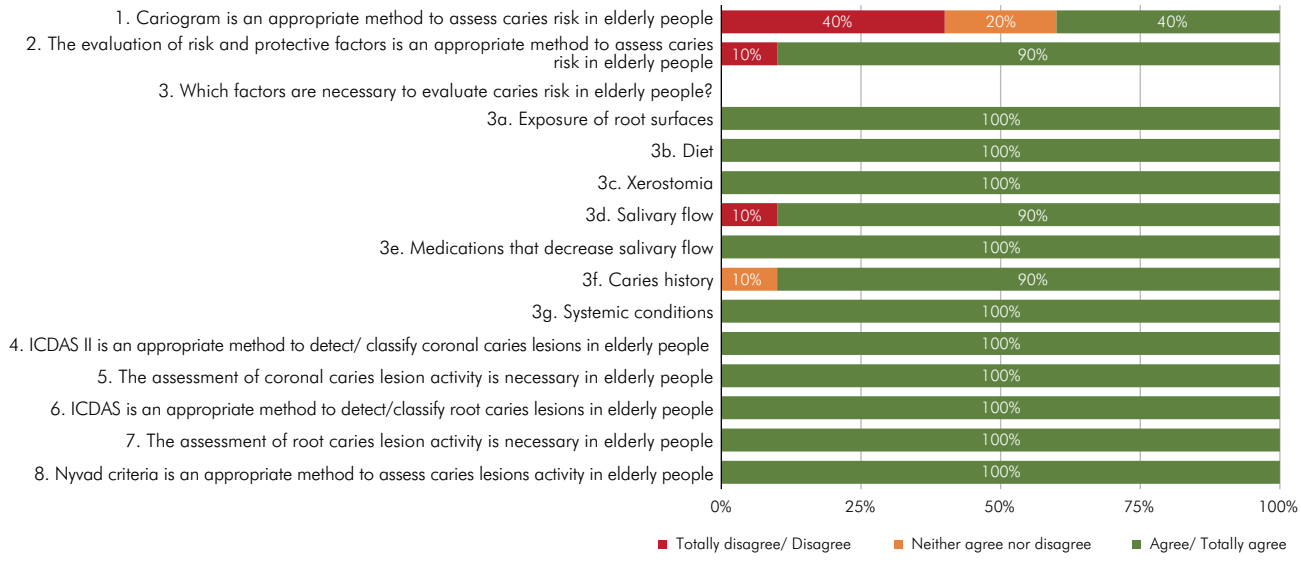

Figure 2. Questions and answers of the e-Delphi survey for dental caries, 2nd round

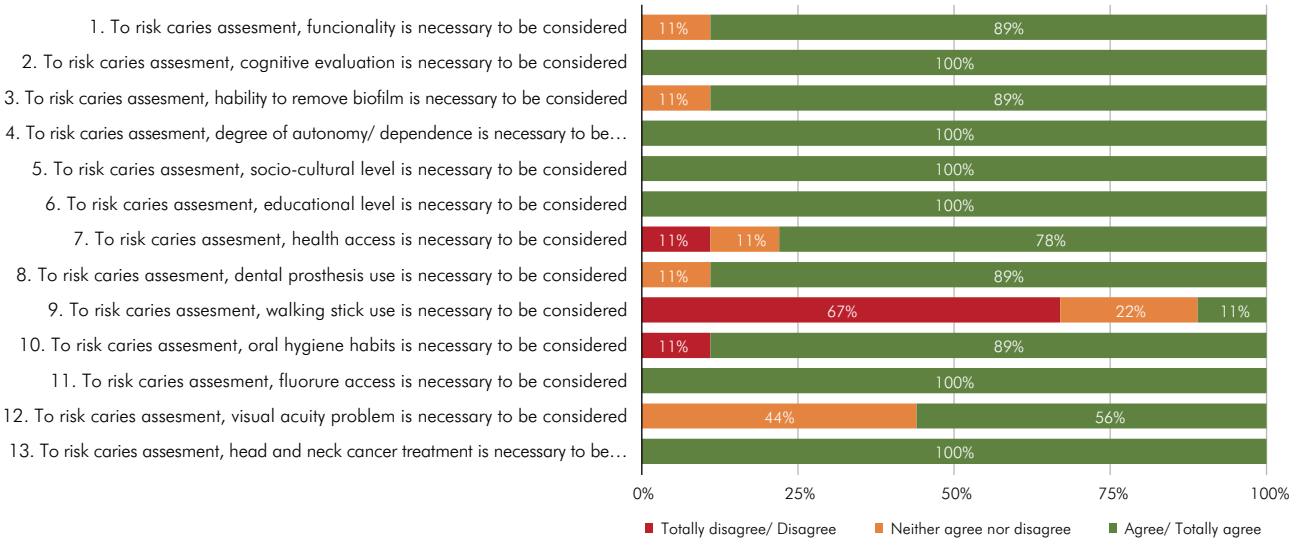

Figure 3. Factors to be considered in the assessment of caries risk among older people, e-Delphi survey for dental caries, 3rd round

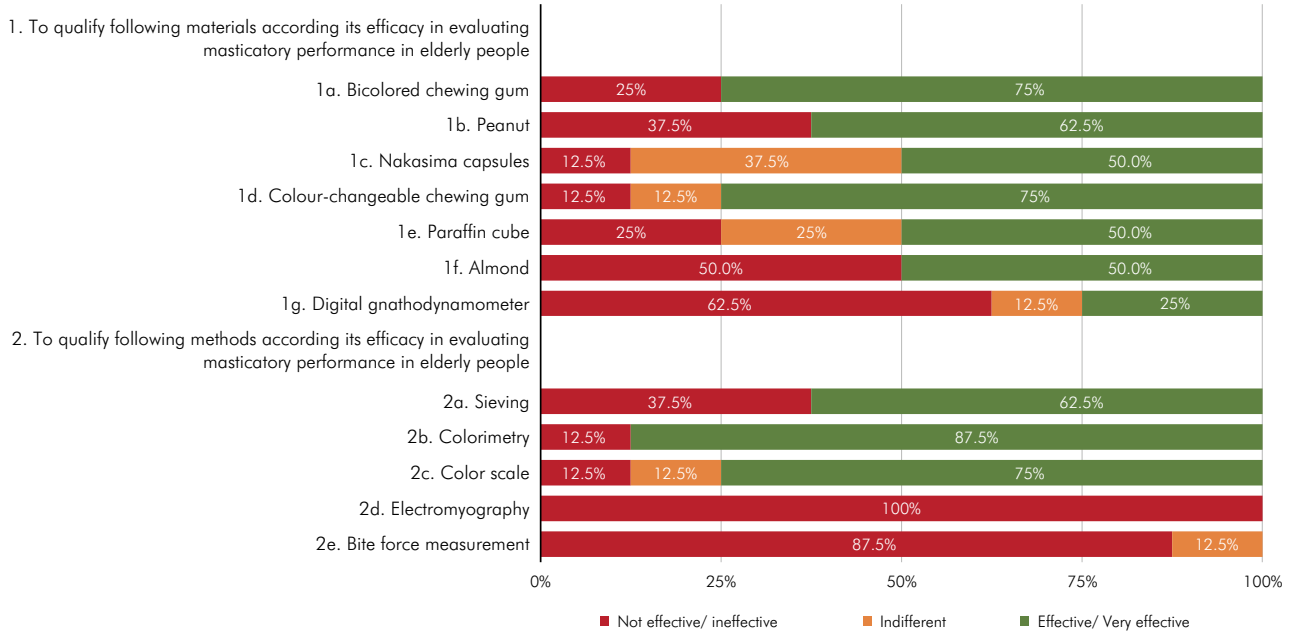

Figure 4. Materials and methods used to assess masticatory performance, e-Delphi survey for chewing functionality, 2nd round

d. Periodontal diseases: expert consensus was reached on the following points: the imperative adoption of the AAP/EFP 2018 classification system, the need to perform a full-mouth periodontal examination to reach a diagnosis, the use of the North Carolina periodontal probe as a standardized tool to measure periodontal clinical parameters, the recognition of clinical attachment loss (CAL) as the appropriate clinical parameter to diagnose periodontitis, and the selection of bleeding on probing (BOP) as the appropriate clinical parameter to diagnose gingivitis, the need to record periodontal parameters in a periodontal chart, and the need to perform a full-mouth radiographic examination to establish the

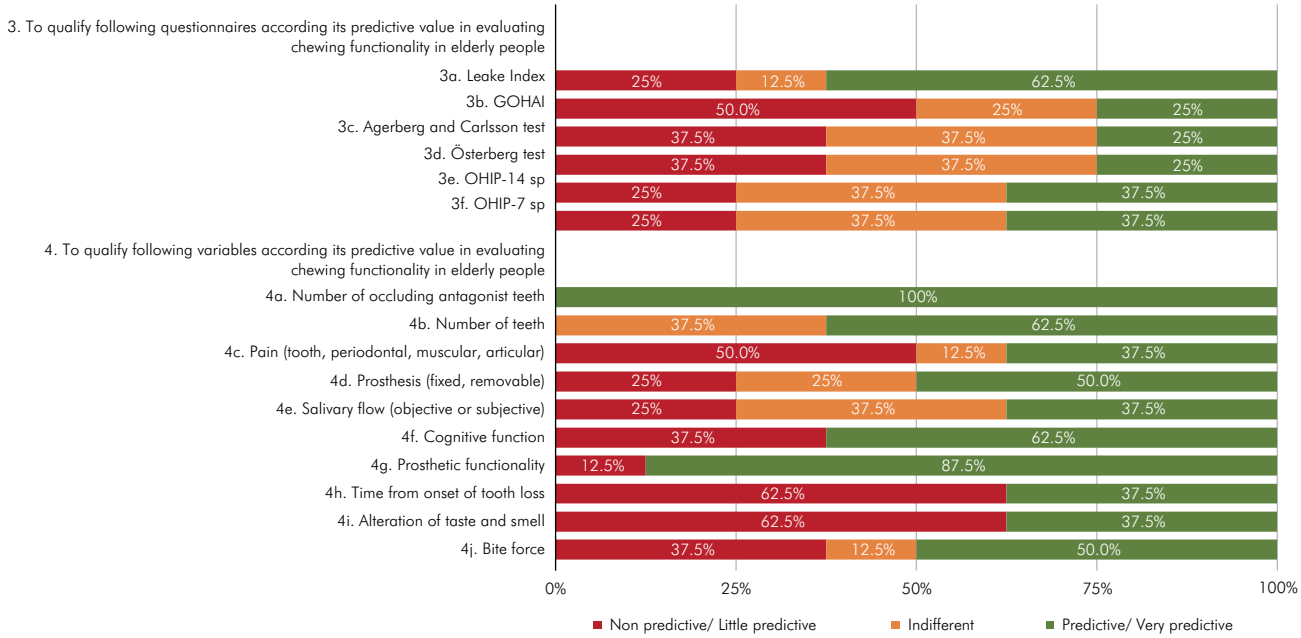

Figure 5. Questionnaires and variables used to assess chewing functionality, e-Delphi survey for chewing functionality, 2nd round

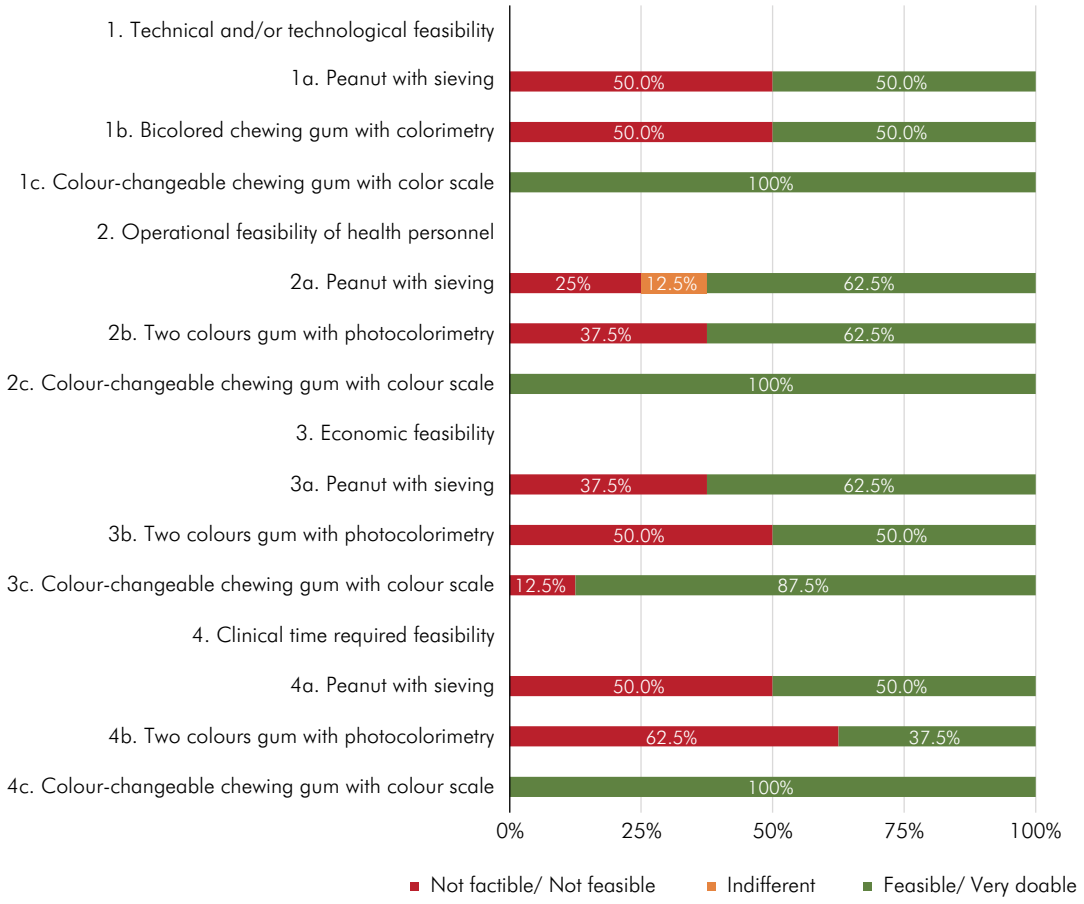

Figure 6. Masticatory performance tests to be implemented as a public health policy, according to different levels of feasibility, e-Delphi survey for chewing functionality, 3rd round

different stages and grades of periodontitis (Table). The experts also agreed that the mean duration of a periodontal examination should be 30 minutes (Figure 7), and commented on the need for providing specific training to general practitioners to ensure successful implementation of the AAP/EFP 2018 classification system.

Consensus workshop

A total of 26 professionals participated in the Consensus Workshop, including eight experts who participated in the previous stages, and 18 new professionals who were in charge of dental programs in health centers, professional specialists, and general dentists working in the public health system or in private dental practices in different Chilean cities.

A consensus was reached on the need to categorize the caries risk assessed by the EDePAM in older adults, in order to address this risk using appropriate therapies. A tool was developed for the assessment of caries risk based on the factors agreed upon by the experts, on the available scientific evidence, and on the feasibility of using it in clinical practice. It was also agreed that 4 levels of risk should be considered during the oral mucosa examination, to determine the priority of referring the patient to an oral and maxillofacial pathology specialist, or to a professional from another medical/dental specialty, as follows:

a. High risk: suspicion of oral cancer, potentially malignant disorders or autoimmune lesions in the oral mucosa;
b. Moderate risk: benign neoplasm, chronic traumatic or infectious injuries, among others;
c. Low risk: other changes or vascular malformations.

A consensus was reached on the need to categorize masticatory function, and to provide guidance for the rehabilitation treatment. It was agreed that a questionnaire should be included assessing the presence of temporomandibular disorders or orofacial pain, and that this would be useful to determine the need for referral to secondary care by a specialist. The questionnaire included a TMD-pain screener, validated in Spanish, which is part of a DC/TMD protocol[23]. Finally, it was suggested that an assessment of prosthetic function be included, consisting of an evaluation of prosthesis support, retention, stability, aesthetics, occlusion and usage time. It was also agreed that several parameters should be considered in the examination of patients rehabilitated with

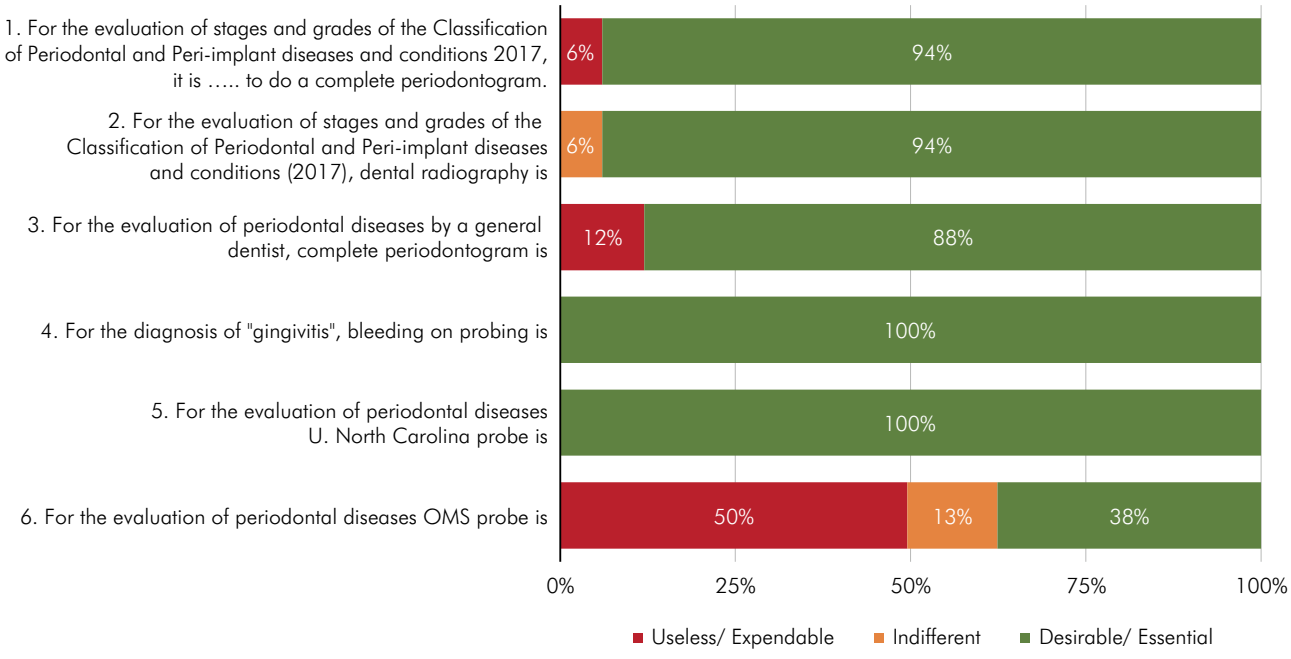

Figure 7. Questions and answers of the e-Delphi survey for periodontology, 2nd round

removable prostheses, and that these should be categorized as adequate or inadequate, according to clearly defined criteria. The parameters were: a) Type of prosthesis; b) Material of manufacture and its condition; c) Aesthetic control, including gingival dental contour, color and size; d) Prosthesis integrity and limits, including posterior extension of the maxillary prosthesis, posterior extension of the mandibular prosthesis, buccal flange of the maxillary and mandibular prostheses, lingual limit, and relief areas; e) Retention and occlusion complex, including retention complex, *i.e.* Integrity-retention-passive-support-stabilization, and occlusion, recorded in maximum intercuspation (MIC) and during excursive movements; f) Response to functional forces, including support, retention, and stability. Should any of these parameters be assessed as inadequate, the possibility of addressing them satisfactorily should be evaluated, and should this prove not possible, a new prothesis should be made.

Finally, any repair made to the prosthesis should be noted and assessed as adequate or inadequate, according to the parameters described above, hence allowing a decision to be made on whether further repair is possible, or whether a new prosthesis should be made. In addition, it was agreed that a peri-implant assessment should be included as part of the periodontal diagnosis, following the criteria of the new classification of periodontal and peri-implant diseases. The complete Protocol for the Preventive Oral Health Exam for Elderly People is presented in Figure 8.

Discussion

This study, using e-Delphi methodology, resulted in the creation of the Preventive Oral Health Exam for Elderly People (EDePAM). As described above, the elderly population in Chile has access to a periodic examination for monitoring and evaluating their general health and functionality (EMPAM); however, this exam does not include an evaluation of their oral health and functionality. The rationale underlying our proposal, aimed at strengthening public policies for the elderly, was that the EDePAM could be used to complement the EMPAM, by providing an assessment of the oral functionality of the elderly assisted at the primary health level. To the best of our knowledge, there is no such exam elsewhere in the world capable of providing this assessment of oral functionality among the elderly, through a Preventive Oral Health Exam for Elderly People. We believe that this oral dimension should be part of other general health examination protocols carried out worldwide for older adults, and included in a public policy proposal at the international level.

Detecting and assessing caries lesions, as well as ascertaining caries risk, are required to create and implement dental care programs capable of addressing prevention, treatment and follow-up, with a patient-centered approach.[12,24] The present study agreed on the use of ICDAS criteria for coronal and root caries lesions. ICDAS allows classifying caries lesions from a very early stage up to an advanced caries process, with extensive cavitation.[25] However, it fails to provide criteria for the entire caries lesion process, which includes more advanced stages, from pulpally involved teeth to caries-associated tooth loss, as do other systems, such as the Caries Assessment Spectrum and Treatment (CAST) or PUFA.[26,27] These detection and assessment systems also fail to support an assessment for caries lesion activity. For that reason, it was agreed that lesion detection was to be supplemented by using the Nyvad's criteria to assess lesion activity.[28] There is limited evidence on how well existing models can assess caries risk to the extent of predicting the occurrence of new lesions.[29,30] No agreement among the experts was reached in this e-Delphi survey regarding the use of a pre-existing tool; rather, it was agreed that an assessment of specific risk and protective factors should be conducted separately. Furthermore, access to fluoride, use of salivary flow–decreasing medications, diet, exposed root surfaces, salivary flow, level of functionality, history of head and neck cancer treatment, socioeconomic level, use of removable dental prostheses, and past caries experience were considered the most relevant factors for assessing caries risk in this age group. Therefore, based on this consensus, it was decided

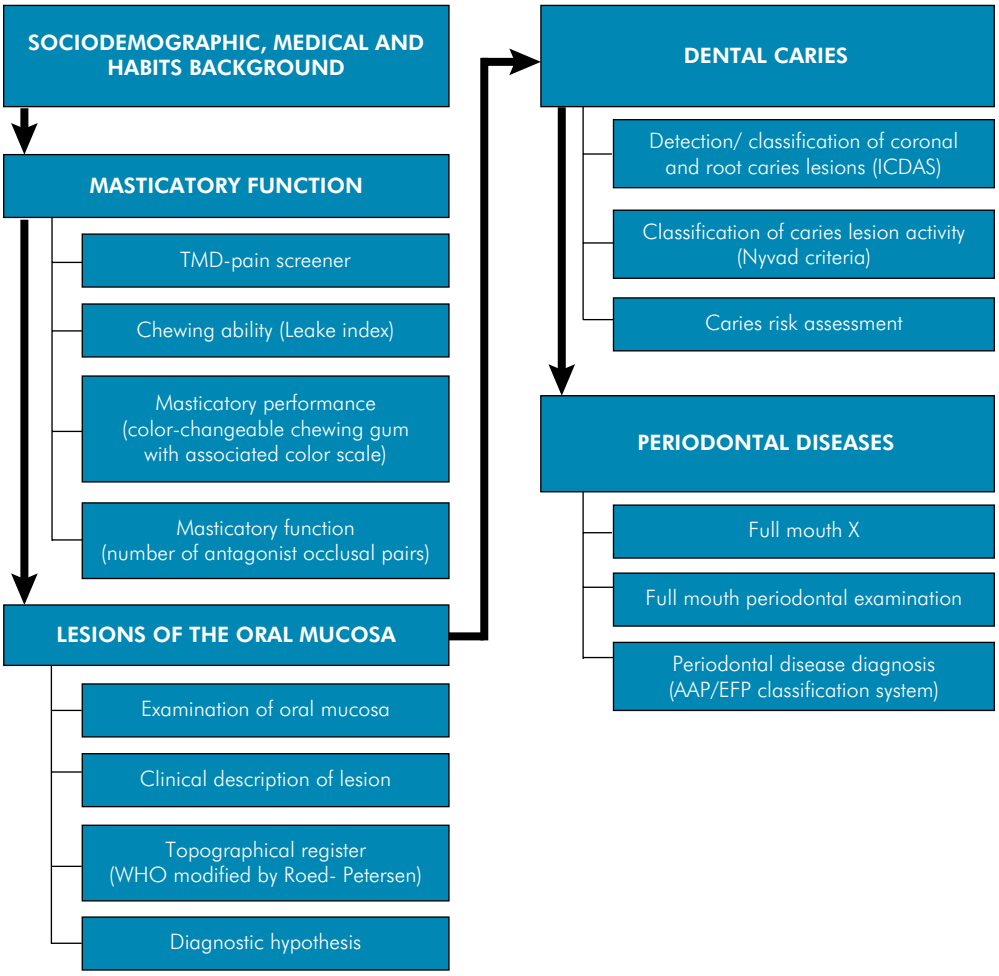

Figure 8. Protocol of the Preventive Oral Health Exam for Elderly People

that a caries risk assessment tool should be created to be used in association with the EDePAM.

There was a significant agreement in the expert group on the need to perform an examination of the oral mucosa of the elderly, and on the importance of a systematic process whereby clinical appearance, location (based on the WHO topographical register), specific diagnoses, and anatomical references can be recorded. Studies in Chile have ascertained that the prevalence of one or more lesions of the oral mucosa is high among older adults, ranging between 53%[17] and 67.5%.[31] The most frequent oral mucosa lesions are traumatic lesions,[32] but oral cancer and manifestations of systematic diseases may also be diagnosed. One concern of the panel was the need for referring patients to specialists, and for providing a classification of risk levels, later recommended. Potentially malignant disorders and oral cancer were among the oral mucosa lesions highlighted. This is in agreement with the evidence that shows that older adults have the highest incidence of oral cancer and associated mortality rates in Chile,[33] and the worst survival rates.[34] It is of paramount importance to improve the methods to systematize the examination protocol and the referral to specialists. To this end, the present study offers its contribution by providing straightforward recommendations for implementing these measures in routine oral exams.

There was a significant agreement in the expert group on the need to implement the AAP/EFP 2018 classification system.[35] To be fully implemented, this

classification system requires the use of a standardized measuring tool (North Carolina periodontal probe), full mouth periodontal examination recorded in an *ad hoc* periodontal chart, and full mouth x-ray examination. The expert panel considered the use of the CAL and BOP indexes as essential for establishing the diagnoses of periodontitis and gingivitis, respectively. The classification system is straightforward in its application, but requires special training to be correctly implemented. The expert panel agreed that general practitioners would require some formal training to use the classification system in their routine practice.

The average amount of time required for applying the EDePAM was estimated to be 60 minutes, considering a completely dentate older person. The first 15 minutes are to be used by a dental hygienist, and the other 45 minutes, by a dentist. However, it was estimated that the time would be considerably lower for edentulous and for partially dentate older adults, which are prevalent in Chile (where there is an average of 20.6 missing teeth among the population in this age range[20]).

The elderly population has poor oral health, and this is related to the process of becoming frail.[36,37] Therefore, it is essential that objective tools be developed and validated to assess oral function. One of the main oral functions is chewing, a complex process related to digestion, nutrition, and, for the elderly, even to higher functions of the central nervous system, such as learning and memory.[38] Not all the methods used to evaluate masticatory function fulfill the requirements for direct application while providing dental care to elderly people.[39-42] The opinion of the e-Delphi panel of experts coincided with the opinion prevailing in the scientific literature regarding the use of a color-changeable chewing-gum[43] associated with a color scale[44] as the most appropriate test material and method to assess masticatory performance in the dental clinic, without having to have additional equipment, in a short period of time and at a low cost.[45,46] Self-reports or visual analogue scale questionnaires are currently the most commonly accepted ways to evaluate masticatory ability, and provide a subjective assessment of chewing.[47] Among these methods, the Leake index[48] was considered by the experts as simple, fast and easy to use in the clinical environment.[49,50] Finally, the number of pairs of occluding antagonist teeth was chosen as the clinical variable with the highest predictive value of masticatory function, which is related to the incidence of frailty in elderly people.[37]

An important limitation of this study is that the results obtained only represent the opinions and beliefs of a subgroup of experts in the areas of cariology, oral medicine, physiology, and periodontics. The selection of these experts and their opinions can be considered a source of bias. However, this is something inherent in the e-Delphi methodology, and this bias is expected to be reduced by specific measures provided for in the methodology itself. It should also be noted that about 10% of the experts selected did not respond, or declined to participate. Although an international pool of experts would have been desirable, we chose national experts, since this instrument is intended for use in Chile. After having reached a consensus among the experts, we held a consensus workshop in which only eight experts had previously participated in an e-Delphi consensus. The objective of this session was to present the consensus already reached by the experts to other professionals from different Chilean cities, who could provide us with other perspectives on the proposed exam. Thus, the eight experts were assigned to different work tables where they explained the study findings to professionals in charge of dental programs in health centers, professional specialists, general dentists working in the public health system and in private dental practices.

The strength of this study was the original contribution of a group of experts to creating a unique protocol for an oral health exam for elderly people, thus enabling the development of specific measures of health promotion, prevention, treatment and clinical follow-up to be validated and implemented in a future clinical trial. In the present study, we established a minimum consensus of 60% of the answers given by the experts, and the range of agreement obtained was 60% to 100%. These percentages are within the ranges reported by the scientific literature, namely 51% to 80%.[15,16]

Conclusion

Considering the high prevalence of dental caries, oral mucosal lesions, periodontal diseases, and reduced masticatory function among the elderly in Chile, the Preventive Oral Health Exam for Elderly People (EDePAM) proposed in this study will enable comprehensive assessment of their oral health and function, by providing accurate diagnoses of oral diseases. This, in turn, will enable more effective treatments to be provided, hence improving the quality of life of this segment of the population of the country.

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