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Comprehensive geriatric assessment for oral care in older adults: a focus group study

Nattariya Wongiam[1], Kearkiat Praditpornsilpa[2] and Anjalee Vacharaksa[3,4,5*]

Abstract

Background An increase in the aging population underscores the need for oral healthcare practice guidelines. Comprehensive geriatric assessment (CGA) includes multidimensional evaluation and integrates oral health into overall healthcare. However, a framework for CGA in dental setting has not been clearly structured. This study aimed to identify the components of CGA essential for proper oral care in older adults based on the perspective of multidisciplinary experts.

Methods A scoping review was conducted to provide insights into CGAs that are mentioned in treatment plan models for oral healthcare (Protocol registration number 10.17605/OSF.IO/EZRDV). The findings were used as basic information for focus group discussion among the multiple healthcare professions. The first focus group included 6 medical experts of 6 disciplines, and the second focus group included 6 dental experts. Focus group discussion aimed to provide a rationale for selecting CGA components and assessment tools that were essential. Thematic analysis was used to synthesize expert perspectives and build an agreement on the application of CGAs in dental practice.

Results The scoping review revealed four dental treatment planning models, including the OSCAR model, rational treatment model, the Seattle Care Pathway, and the risk of oral health deterioration (ROHD). These models suggested the key CGA components, including systemic conditions for any risks of comorbidities, oral health conditions, socioeconomic status, dependency, cognitive and mental health, communication, and life expectancy. Data from both focus groups consistently agreed that dentists should evaluate complex oral problems of older adults in multiple dimensions. In addition, they also emphasized the importance of swallowing problems, nutrition, and fall risk. Nonetheless, the selection of assessment tools such as The Barthel Index for Activities of Daily Living, water swallow screening test, Mini Nutritional Assessment, Mini-Cog, Patient Health Questionnaire, and three key questions for fall risk assessment should depend on the purposes and team expertise. The development of dental treatment plans must be individualized based on evaluation results of CGA. The rationale for different treatment levels, including comprehensive, limited, urgency care and no treatment, was discussed. The focus groups emphasized that dependency level, social support and systemic factors were important for selecting a level of care.

*Correspondence:
Anjalee Vacharaksa
Anjalee.v@chula.ac.th
Full list of author information is available at the end of the article

Conclusions CGA provides rationale for oral health problem analysis, treatment planning, and oral healthcare. The expert opinions underscore the importance of comprehensive and individualized care plans suggested in the oral treatment plan model. The multiple dimensions of CGAs include systemic and oral health, socioeconomic factors, dependency, cognitive and mental health, swallowing problem, nutrition, and fall risk. The selection of assessment tools should be optimized based on the purposes and team expertise. The multidisciplinary team has a crucial contribution in comprehensive evaluation of patient problems when formulating treatment plans for special-needed patients.

Keywords Geriatric dentistry, Comprehensive geriatric assessment, Dental treatment plan, Multidisciplinary, Older adults, Oral health care, Special needs

Background

The increase of elderly populations [1] highlights concerns of oral health in older adults. Older adults are particularly vulnerable to many oral problems such as poor oral hygiene, dental caries, periodontal infection and inflammation, tooth loss, and dry mouth [2]. Poor oral health significantly impacts the individuals' systemic condition and quality of life [2]. Importantly, many systemic conditions, such as polypharmacy, post-radiotherapy, diabetes, and cognitive impairment, could exacerbate oral health problems, leading to the need for comprehensive assessment and care [3]. Polypharmacy or radiotherapy in the head and neck region may compromise salivary gland function resulting in dry mouth and affecting oral hygiene and functions [4]. Individuals diagnosed with diabetes have an elevated risk of periodontitis [5, 6]. Older adults with cognitive impairment frequently demonstrate poor oral hygiene [7]. Thus, recognizing the strong connection of oral, systemic, and socioeconomic conditions is crucial for treatment planning and oral healthcare in older adults.

CGA is the multidimensional, interdisciplinary diagnostic process used to determine the medical, psychological, and functional capacities [8]. CGA is essential for identification of patients' needs, treatment planning for quality of care and patient safety, and consideration of quality of life [9]. It was demonstrated that when oropharyngeal dysphagia was evaluated with Eating Assessment Tool (EAT-10), aspiration pneumonia could be reduced [10]. In another example, cognitive impairment which could be assessed by Mini-Mental State Examination (MMSE) was associated with oral hypofunctions [11]. These examples suggested that CGA should be performed when addressing the complex problems of older adults to optimize treatment planning and improve health outcomes. Integrating CGA in dental practice may enlighten dentists to be aware of the strong relationship between oral and general health and engaged in oral disease prevention, and health promotion.

Older adults' perspectives and related behaviors for oral health care could be negatively influenced by frailty [12]. For example, community-dwelling older adults with cognitive decline demonstrated compromised oral care capacity associated with an increase in dental caries [13]. Therefore, professional oral health care remains necessary for oral health maintenance in older people [14]. Nonetheless, older adults might neglect follow-up dental visits due to many barriers including cost, fear, availability, accessibility and lack of perception of a need for dental care [15]. In older adults, an analysis of oral health problems in multiple dimensions is therefore essential for oral treatment planning, especially for patients with cognitive or communication impairment who may not be able to express treatment needs [16]. Complicated dental prostheses such as bridges or dental implants that may be difficult for self-care should be placed with careful consideration to avoid oral health complications consequently [17]. Despite its widespread use in other healthcare disciplines, the integration of CGA into dental treatment planning remains insufficient. A survey of special care dental professionals revealed that only a small percentage used standardized instruments like MMSE to assess cognitive function [18]. The scope of CGA components and suitable assessment tools for oral health care remains unclear. Therefore, this study aimed to identify the components of CGA essential for proper oral care in older adults based on the perspective of multidisciplinary experts.

Materials and methods

Scoping review

A scoping review based on PICO systematic search was conducted to gather in-depth information specifically on identifying treatment planning models and concepts relevant to elderly patients [19]. The protocol for the scoping review was registered at the OSF registries (Protocol number: https://doi.org/10.17605/OSF.IO/EZRDV). An electronic search was performed in PubMed and Scopus in June 2022, using the search strategy (Supplement Table 3): ("Aged" OR "elderly" OR "older people" OR "older adults" OR "older persons") AND "dental

care for aged" AND ("concept" OR "assessment") AND ("treatment").

Eligibility criteria for article selection

According to the inclusion criteria, the reports in any study design or review articles were included if they were published in English and focused on multiple assessment for oral treatment and care in older adults aged 65 years and above. During abstract and full text screening, the study was excluded if it exclusively addressed only a narrow aspect of oral health problems without connection to full mouth treatment, or lacking descriptions of patient assessment that link directly to dental treatment or planning. The studies without available full texts were also excluded.

Article screening process

After removing duplicates, two independent reviewers (NW and AV) screened the titles and abstracts of the identified articles based on the inclusion criteria. After screening through titles and abstracts, 128 records were not retrieved. The inclusion criteria allowed only studies published in English that related to multiple assessment for oral treatment and care in older adults aged 65 years and above. Then, research studies of any study designs or review articles that described patient assessment or dental treatment planning concepts in older adults that published in full text were considered for inclusion. Thus, 40 records were not retrieved after screening through full text. The manual search was performed by reviewing the reference lists of included studies to identify additional studies that might meet the inclusion criteria. For example, studies exclusively discussing dental treatment planning for narrow and specific aspects, such as only resin composite restoration, were excluded. Studies ($n=21$) were then assessed by NW and AV for a consensus of eligibility. When there were different opinions, KP was included in discussion until consensus was reached. Some reports ($n=4$) were excluded because they limited to specific subpopulations without comprehensive assessment. Some only demonstrated data on limited aspects such as only oral hygiene care ($n=2$), or lacking a description of patient assessment that links to treatment planning ($n=3$), were excluded. Finally, 12 reports were included for data extraction (Supplement Fig. 1). A standardized data extraction form (Supplement Table 2) for data management was created based on an iterative process for selection of articles.

Data synthesis and analysis

Data were collected from the selected studies ($n=12$) using a standardized data extraction form (Supplement Table 2). The data synthesis process was performed according to Popay et al., 2006 [13] on narrative synthesis frameworks for systematic reviews. For data extraction and categorization, data were systematically summarized in the extraction form and categorized into thematic domains including study design, dental treatment planning concepts, and assessment methods for analysis. The risk of bias and the quality of included study was discussed based on the findings and potential limitations. Studies with high risk of bias or concerns, were flagged for considerations in their contributions to final data synthesis. For narrative synthesis, studies were organized by thematic relevance, their findings were compared, and overarching patterns were identified. The synthesized information was integrated into a structured document (Supplement 1), which was shared with focus group participants. This document highlighted key findings of the treatment planning models and CGA tools suitable to be applied in older adults, gaps in the literature, and unresolved questions, forming the basis for expert discussions.

Focus groups

Participants

A focus group method [20] was used for collecting expert opinions on CGA for dental treatment planning and oral care in older adults. Two focus group sessions were held between October 2022 and May 2023. The first focus group aimed to collect opinions of non-dental healthcare professions on which CGA should be integrated in treatment planning for oral health outcomes and if there were any challenges in incorporating CGA into multidisciplinary care. The second focus group aimed to collect opinions of dentists on which CGA was beneficial for treatment planning and oral health outcomes and if there were any challenges in incorporating CGA into dental practice. A purposeful sampling was employed to recruit participants to ensure the inclusion of experts with diverse professional backgrounds and substantial experience in treating older adults, allowing for complete discussion on CGA.

The first focus group included six medical experts from multiple non-dental professionals specialized in geriatric medicine, rehabilitation medicine, gastro-intestinal medicine, neurology, family medicine, and geriatric nursing. The second focus group consisted of six dentists with at least five years of experience treating older adults. The experts invited for focus groups routinely worked with health problems of older adults. The professionals were approached by telephone or email and invited to participate in the study. Participants received a small amount of compensation for commuting. Arrangements were made to set up a suitable meeting room equipped with necessary amenities such as video and voice recorders,

microphones, paper, and pens. Informed consent forms were provided and signed by all participants. Their information remained confidential, and they had the option to withdraw at any time. This study was approved by the Human Research Ethics Committee of the Faculty of Dentistry, Chulalongkorn University (HRDC-DCU 2022 – 083).

Data collection

The sessions were conducted by two researchers with prior training in qualitative research. One of the researchers, NW in the first focus group and AV in the second focus group, moderated the sessions, while another researcher (KP) served as an observer during the sessions. The focus group guide was developed by NW and AV in consultation with the research team. One month before the scheduled focus group sessions, the researcher (NW) sent informed letters and the focus group topic guides to each participant. Comprehensive geriatric assessments were listed (Supplement Table 1) based on published literature, and the scoping review (Supplement 1) was provided to the experts. The focus groups were conducted in two sessions to identify key geriatric assessment tools used in dental practice. To mitigate potential bias, the discussion guide was designed to be open-ended, encouraging participants to share their own experiences and insights based on their clinical practices rather than simply reflecting the information provided in the literature. The first session gathered insights from non-dental healthcare professionals specializing in geriatrics, while the second session focused on collecting perspectives from dental professionals on implementing these assessments in routine practice.

Data collection involved recording the discussions and making field notes during interviews conducted by both the observer and moderators. Each focus group session continued for three hours. Following data collection, a meticulous transcription of recorded discussions was undertaken to ensure accuracy and completeness. Transcribing the discussions enabled a detailed review of content and facilitates subsequent analysis. Additionally, field notes provided supplementary context and insights into the dynamics of the focus groups. Transcripts were summarized and sent to all participants, who were allowed time to complete or refine their statements as a member check. This method followed qualitative research guidelines as outlined [21].

Data analysis

Thematic analysis was employed to identify recurring patterns, concepts, and ideas within the data. The analysis process entailed several iterative steps. The researchers began by familiarizing themselves with the data through repeated readings of transcripts and field notes, immersing themselves in the content to gain a holistic understanding of the discussions. For the initial template, NW performed the preliminary coding of the data, with a subset coded independently by AV. NW and AV discussed discrepancies until consensus was reached, with additional input from the research team (NW, KP, and AV). Initial codes were generated to label segments of data corresponding to specific topics or concepts. These codes were systematically applied to relevant sections of transcripts, facilitating the organization and categorization of data according to emergent themes. As coding progressed, patterns and connections between codes were identified, contributing to the development of higher-order themes. Emerging themes were organized into meaningful clusters, and hierarchical relationships were defined. Throughout the analysis process, the researchers-maintained reflexivity, acknowledging their own biases and preconceptions to ensure the integrity and rigor of findings. Regular discussions among the research team facilitated critical reflection and refinement of analytical interpretations.

Results

The results were divided into 2 parts including oral treatment planning concepts with the key considerations for CGA, and the expert opinions on CGA components and tools to be used in dental settings. In the first part, data collection was from a scoping review of 11 peer-reviewed articles, from PubMed and Scopus, and one online resource, that relates to the treatment planning for oral care in older adults. Four treatment planning concepts emerged from these studies including the OSCAR model, the rational treatment model, the Seattle Care Pathway, the Lucerne Care Pathway, and lastly the concept concerning a risk of rapid oral health deterioration (ROHD). These models emphasize the importance of holistic patient assessment while differentially describing various aspects important for oral care in older adults. Then, key components of CGA mentioned in oral treatment planning concepts were demonstrated (Table 1). In the second part, data collection was from expert opinions using a focus group method. Two groups of experts reviewed data collected from the scoping review. The first focus group of non-dental professionals and the second focus group of dentists provided their perspective on comprehensive geriatric assessment. Table 2 describes the expert characteristics and Table 3 summarizes the assessment tools mentioned in focus groups.

Table 1 Comprehensive geriatric assessment suggested in the treatment planning concepts for geriatric oral care

Model		Studied mention the model	Studies design	Outcomes and conclusion	CGA components for oral treatment planning
1.	OSCAR model	K. Shay, 1994 (Shay, 1994) [18]	Review article	- Identifying the needs of patients beyond the oral cavity - Provides recommendations for dentists to gather data and work with patients to establish a plan of care that best addresses dental needs and medical and functional limitations, given fiscal realities.	- Systemic conditions - Current medication - Oral health conditions - Socioeconomic factors - Dependency - Communication - Cognitive ability - Life expectancy
		R L Ettinger, 2015 (Ettinger, 2015) [22]	Review article	- Discusses various treatment planning concepts for the ageing patient (OSCAR model, minimal invasive dentistry, and rational dental care)	
2.	Rational dental care model	T. E. Johnson, et.al., 1997 (Johnson et al., 1997) [23]	Review article	- Discusses the concept of dental treatment planning for older patients, which can be a complex process due to the influence of multiple age-associated dental, systemic, and psychosocial factors. - Clinicians should focus on the issues of biologic age and life expectancy, rather than relying solely on chronological age, when identifying and weighing factors that can influence treatment planning.	- Oral health conditions - Systemic conditions - Current medication - Socioeconomic factors - Dependency - Communication - Cognitive ability - Life expectancy
		R. L. Ettinger, 2006 (Ettinger, 2006a) [24]	Review article	- Introduce the concept of "rational dental care" as a framework of decision-making that allows a clinician to develop the most appropriate care in the best interests of the patient after weighing all the underlying or modifying factors.	
		R. L. Ettinger, 2006 (Ettinger, 2006b) [25]	Review article	- Describes a case history that illustrates the use of a decision tree and a step-wise approach to treatment planning, which is an example of the rational treatment model in clinical use.	
		I. A. Pretty, 2014 (Pretty, 2014) [17]	Review article	- Emphasizes the significance of considering vulnerability in assessing oral health needs and proposes integrating vulnerability into needs assessments. - Suggests adopting a life course approach and a "rational dental care" approach that considers patients' desires, ability to maintain oral health, positive outcomes, and quality of life.	
		P. Stein, et.al., 2015 (Stein & Aalboe, 2015) [26]	Review article	- Emphasizing the need for dentists to consider modifying factors and attentively listen to patients to understand their chief complaint and expectations. - Risk assessment plays a critical role in identifying early intervention and implementing preventive strategies to minimize patient suffering.	
		R L Ettinger, 2015 (Ettinger, 2015) [22]	Review article	- Discusses various treatment planning concepts for the ageing patient (OSCAR model, minimal invasive dentistry, and rational dental care.	

Table 1 (continued)

Model		Studied mention the model	Studies design	Outcomes and conclusion	CGA components for oral treatment planning
3.	The Seattle Care Pathway and The Lucerne Care Pathway	I. A. Pretty, et.al., 2014 (Pretty et al., 2014) [17]	Review article	- The Seattle Care Pathway is a structured, evidence-based approach to care for older dental patients. - The pathway is presented in tabular form and further illustrated by examples in the form of clinical scenarios. - The paper emphasizes the need for effective prevention and treatment to be linked to levels of dependency and the need for a varied and well-educated workforce.	- Oral health conditions - Systemic conditions - Dependency - Frailty assessment - Communication - Cognitive ability - Socioeconomic factors
		P. Stein, et.al., 2015 (Stein & Aalboe, 2015) [26]	Review article	- Highlights the importance of treatment planning for frail and dependent older adults - Mentions the seattle care pathway as a framework that provides a detailed pathway for oral assessment, prevention, treatment, and communication in this population	
		A. Geddis-Regan, et.al., 2018 (Geddis-Regan & Walton, 2018) [27]	Review article	- Highlights the complexity of treatment planning for complex older adults, emphasizing the need for of comprehensive and tailored treatment planning for this population. - Recommends using resources such as the seattle care pathway and fgdp guidance for managing care effectively.	
		FDI World Dental Federation, 2019 ("FDI World Dental Federation, Managing older adults: Chairside guide. 2019 Sep;07,")	Clinical guideline	- The Lucerne Care Pathway, derived from the Seattle Care Pathway, aims to identify different levels of dependency in older adults that will guide interventions for securing oral health in this population. - This chairside guide offers recommendations for targeted service delivery, avoiding under- and over-treatment and promoting a life-course approach to oral health. - Emphasizes the link between oral and general health, highlights the vulnerability of older adults to oral diseases, and stresses the need for prevention and dependency-based management.	
4.	ROHD concept	L. Marchini, et.al., 2019 (Marchini et al., 2019) [28]	Review article	- Discuss ROHD concept which is a significant concern for older adults, especially those who are frail and dependent. - Risk factors for ROHD can be categorized into general health conditions, social support, and oral health conditions.	- Oral health conditions - factors related to oral health deterioration - Systemic conditions - Medication - socioeconomic factors - cognitive ability - mental health
		Marchini L, et.al., 2017 (Marchini et al., 2017) [29]	a mixed-methods approach, (qualitative and quantitative methods.)	- Introduces ROHD - Discusses the development and evaluation of a learning strategy using critical thinking to teach dental students how to assess this risk.	

Table 2 The expert characteristics

Number	Professional background	Working experience (years)	Additional information
A. First focus group participants			
1FGs1	Psychiatrist specializing in geriatric psychiatry	15	Ph.D. in Old Age Psychiatry, King's College London; currently works at Dementia Day Center, Chulalongkorn Hospital; involved in dementia research and WHO guidelines
1FGs2	Internal Medicine, Neurology, Geriatric Medicine	25	Diplomate in Geriatric Medicine (UK); Professor at Siriraj Hospital; expert in dementia and aging health research
1FGs3	Family Medicine, Palliative Care	25	Head of Family Medicine Department, Mahidol University; expertise in medical education and palliative care
1FGs4	Internal Medicine, Gastroenterology	21	Special interest in gastrointestinal motility
1FGs5	Neurological Rehabilitation, Rehabilitation Medicine	18	Expert in rehabilitation medicine and neurorehabilitation
1FGs6	Senior Registered Nurse	25	Experienced nurse in elderly care
B. **Second focus group participants**			
2FGs1	Geriatric Dentistry	15	Expert in geriatric dental care and researcher in older adults and special needed patients
2FGs2	Prosthodontics	30	Expert in oral rehabilitation and the lecturers of the department of prosthodontics
2FGs3	Operative Dentistry	28	Expert in restorative and conservative dentistry
2FGs4	Gerontology in Community Dentistry	30	Expert and the lecturer in aging studies in community dentistry; Contributing to a development of care policies for older adults
2FGs5	Periodontics	20	Expert in periodontics and researcher in oral health problems of older adults
2FGs6	Prosthodontics	22	Expert in geriatric dental care and prosthodontics

Table 3 Summary of patient factors requiring comprehensive assessment and tools mentioned in focus groups

Key Considerations (Theme)	CGA tools	Frequency
Understanding patient profiles	• History-taking • Questioning patient (caregivers of family, when necessary)	5
Social factors and caregivers	• Questioning patient (caregivers of family, when necessary) to identify the key person as a caregiver or decision maker	21
Overall health	• History-taking • Reviewing patient's chart of medical history	8
Dependency	• Basic activity of daily living (BADL)	14
Cognitive abilities	• Mini-Cog • MoCA test • Questioning patient (caregivers of family, when necessary) to understand comprehension, decisional making capacity, self-care abilities	21
Mental health issues	• PHQ-2 • PHQ-9 • Questioning patient (caregivers of family, when necessary) to understand well-being, happiness, and signs of depression	14
Dysphagia	• EAT10 • SDQ • Water swallowing test	18
Malnutrition	• Questioning patient (caregivers of family, when necessary) to monitor weight loss, appetite, body mass idex	18
Fall risk	• Questioning patient (caregivers of family, when necessary) about fall history, gait steadiness, fear of falling/ STEDI toolkit ○ Three key questions—Has the patient fallen in the past year? Is their gait unsteady? Do they fear falling?	20
Hand grip strength	• Hand grip strength test	7

Oral treatment planning concepts with the key considerations for CGA

The OSCAR model [18] may be the least complicated treatment planning concepts proposed by Shay K. OSCAR in 1994 considering 5 dimensions related to patients' problems including oral (O) and systemic conditions (S), patient capability (C), patient autonomy (A), and reality (R). Oral conditions are described as clinical conditions of the oral tissue such as remaining teeth, periodontium, pulp status, prostheses, oral mucosa, occlusion, and saliva. For systemic conditions, clinical conditions related to physiological changes in aging, body conditions related to diseases, medication, and effective communication between dentists and physicians. Patient capability is assessed by an evaluation of functional ability such as self-care, oral hygiene, caregivers, transportation to receive dental treatment, and mobility. The OSCAR model emphasized the importance of patient autonomy by an evaluation of the ability to give informed consent or dependence on others. Then, reality is the last concern of this model. A balance of oral health care needs should be justified with financial and other limitations. Patients' expectations of life and life expectancy should be anticipated.

Next is the model proposed by Ettinger RL. [22, 24], or the so-called rational treatment model, was Initially presented in 1983 [30] and subsequently updated in 1984 [31] and 2006 [24]. The model adopted a rational treatment concept [22] that offers a structured approach to developing a dental treatment plan appropriate for older adults. Rational dental care is defined as the decision-making process evolving from cost-effective care to minimal invasive dentistry to rational dental care. The model is based on the concept that oral health needs, medical, and medication problems vary among older adults and special patients. For example, the patients may range from functionally independent older adults to frail older adults who are partly dependent with some help from family and friends or using professional support services. The most challenging cases are functionally dependent older adults, homebound or living in institutions, who can no longer survive in the community independently. In the updated model [24], four domains of dental needs, including function, symptoms, pathology, and esthetics, are defined from patients' oral status and then treatment plan is considered together with factors relating to patient and dentist resources and the third party such as caretakers, financial status, or family influences. Five levels of dental care ranging from very limited to very extensive care would be offered for the best treatment after evaluating all modifying factors. Interestingly, this model advocates a dynamic process in treatment planning. Throughout the treatment and maintenance phases, patients and other factors must be continuously reassessed to anticipate changes in disease or ageing progression [24].

The third concept described by the Seattle Care Pathway, developed from a workshop held in 2013, Seattle, Washington, USA [32], and the Lucerne Care Pathway [33], offered by FDI World Dental Federation. The Seattle Care Pathway provided an overview of the key considerations in treatment planning including the demographic shift, the concept of frailty, and the need for effective prevention and treatment. Then, dental treatment planning is suggested based on different levels of dependency. The Lucerne Care Pathway describes appropriate interventions, possible strategies, and actions to be implemented to meet the needs of older adults with different levels of dependency. For treatment planning, the Lucerne Care Pathway recommended to integrate oral and general care, incorporate oral health promotion and prevention, use evidence-based practice, and anticipate financial, physical, and other barriers to healthcare. It is noted that oral health maintenance should be considered throughout patients' life course. Stakeholders should be mobilized, and community support should be prepared for the best achievement in oral healthcare. The need for a multidisciplinary and knowledgeable team is emphasized for best practice.

The fourth concept is the rapid oral health deterioration (ROHD) [29]. ROHD was first used as a teaching model for dental students to assess the risk in elderly patients. It employs a patient-centered and holistic approach and emphasizes critical thinking skills in patient assessment. The ROHD model focuses on the identification of risk factors related to oral health deterioration for diagnoses, prevention, and treatment. These risk factors are categorized into three main groups including systemic health conditions, social aspects, and oral health conditions. Older adults usually present with multiple chronic diseases that impact on their systemic health including arthritis, hypertension, diabetes, depression, neuro-degenerative conditions, dementia, stroke, and polypharmacy. Social conditions become one of the important risk factors because social factors could determine the dynamic of the aging process and quality of life. Therefore, insufficient social support such as a lack of dental insurance could accelerate the progression of ROHD. All remaining oral tissue conditions and other factors, such as oral hygiene, dry mouth, prostheses, restorations, and the presence of root exposure, could impact treatment planning, expected treatment outcomes, recall schedules, and the maintenance program. As a result, all these risk factors should be considered when developing appropriate treatment plans and offering dental treatment and maintenance programs.

The CGA components were mentioned in the treatment planning model. The components are systemic conditions such as hypertension, diabetes, osteoporosis, socioeconomic factors, oral conditions, current medication, dependency, communication, cognitive ability, and life expectancy. With a comprehensive medical history [18, 24, 29], the complete profile, social factors, caregivers, and access to dental services must be considered [18, 22, 32]. It is important to identify the key caregiver. Essential information such as contact details and transportation to the clinic was emphasized for management [24, 29]. Nonetheless, there is insufficient evidence for CGA tools suitable for assessment for dental practice. This gap formed the basis for the subsequent focus group discussions with multidisciplinary experts to provide a rationale for CGA tool selection.

Expert opinions on CGA components and tools to be used in dental settings

A summary of the scoping review was provided to experts before the focus groups. The key points from focus group discussion are summarized in Table 3. It became an agreement among the experts of both focus groups that dentists must evaluate general and oral health when providing oral treatment and care to older adults. Multiple medicine use, or polypharmacy, and frailty had been a common concern among older adults. It was recommended that dental geriatricians must understand oral health problems in multiple dimensions. This referred to assessment in physical, social, and psychological dimensions including changes in association with aging and self-care ability. In addition to the components identified from the scoping review, certain CGA components, including swallowing problem, fall risk, and nutritional status, were emphasized in a focus group.

Dependency and cognition

Both focus groups indicated that the assessment of activities of daily living (ADL) is essential because it reflects a patient's dependency level. During discussion, the phase "dependency" was mentioned with a general agreement on using basic activity of daily living as a determinant. Notably, cognitive ability and social factors were mentioned frequently. Assessment of cognitive functions was viewed to be crucial for oral care, because it impacted oral hygiene maintenance and treatment compliance. The choice of assessment tools should be practical and aligned with assessment purposes. In this part, it was mentioned by the family medicine expert (1FGs3; Table 2) that *'When evaluating primarily for dental treatment, it is preferable to select the shorter and simpler assessment option such as Mini-Cog for screening cognitive impairment. However, if the goal is to share the assessment results for the use of other healthcare professions, conducting the Montreal Cognitive Assessment (MoCA) may be preferrable."* On another occasion, the experts in geriatric medicine (1FGs2; Table 2) mentioned, *"I think a diagnosis of dementia or depression may not be necessary in dental settings. However, the impact of these conditions on oral health is important. This also relates to decisional capacity and self-care abilities of the patients. It's important to understand how well they comprehend daily activities and whether they are physically capable of performing them."*

Mental health, depression, and cooperative ability

Mental health considerations included addressing issues like psychosis, behavioral and psychological symptoms of dementia (BPSD), and depression. The expert (1FGs1; Table 2) raised that some patients with severe mental health conditions, particularly those with aggressive behavior, may require initial screening to assess their risk before dental treatment, as they could pose a danger to the dentist and other healthcare providers or potentially lead to incidents such as tissue trauma or other complications during dental procedures. However, an assessment of severity level might not be as important as cooperative level for dental procedures because it directly influenced the treatment approach and outcomes. Communication challenges with uncooperative patients were another concern. When patients could not tolerate dental procedures, behavior management strategies, such as physical restraint, minimal oral sedation or general anesthesia, should be considered in treatment planning. One dental expert (2FGs1; Table 2) raised the question, *"If a patient is uncooperative, what can be done to avoid physical restraint? Can minimal oral sedation be used? How can we prevent the need for general anesthesia, or is it necessary in certain cases?"* This statement raises awareness that these challenges were common, and they should be carefully evaluated and incorporated in treatment planning.

Depression was frequently mentioned and can be assessed through simple open-ended questions or by using standardized tools. The experts recommended tools such as Patient Health Questionnaire, PHQ-2 and PHQ-9, which are widely used by multidisciplinary teams. Nonetheless, PHQ was not a tool frequently used by dentists. A family medicine expert (1FGs3; Table 2) suggested an alternative of using simple, open-ended, questions such as, *'How have you been in the past three months? Are you happy at home or not?'* Based on these

simple questions, the patient may provide insightful information in a trusting patient-doctor relationship.

Swallowing problem, frailty, fall risk, and malnutrition

Dysphagia was brought into discussion because dysphagia was closely related to oral health. The experts in rehabilitation medicine (1FGs5; Table 2) mentioned that dentists should assess dysphagia, understand its etiology, and consider its impact on the treatment plan. Screening approaches, including Eating Assessment Tool (EAT-10) or the Swallowing Disturbance Questionnaire (SDQ), were acknowledged as beneficial when feasible, particularly in settings where time and resources are allowed. However, the experts also highlighted simple questions focusing on swallowing changes, weight loss, appetite, and body mass index could be sufficient for initial detection in resource-limited settings where comprehensive assessments are impractical. The discussion also emphasized the connection between oral health, dysphagia, and malnutrition. The medical experts raised a consideration for urgent care to have teeth substitution for nutritional sufficiency. Similarly, addressing malnutrition in dysphagia patients and referring them to specialists was underscored.

Falls were identified as a sign of frailty, impacting a patient's ability to attend future dental treatments. The causes of falls, including environmental factors, should be considered to prevent any incidence. The need for patient transport protocol focusing on high-risk patients coming for dental appointments, or movement within the clinic was emphasized. The expert in geriatric medicine (1FGs2; Table 2) suggested the standard three questions to evaluate the risk of fall: Does the patient have a history of falling in the past year? Is their gait unsteady, and do they fear falling? While the gait and balance test may be beyond the dentist's role, it could be recommended to be evaluated by multidisciplinary team. Regarding hand grip strength, the medical experts presented different opinions. Hand grip strength is often used to assess muscle mass and strength as part of sarcopenia evaluations, which are linked to malnutrition and fall risk. The expert in gastro-intestinal medicine (1FGs4; Table 2) noted that hand grip strength is a simple test, requiring only a device for measurement, but identified the need for supporting evidence to establish its relevance to oral health before implementation. Alternatively, the nurse suggested a more practical approach, recommending that dentists evaluate a patient's ability to perform oral hygiene tasks, such as brushing teeth or flossing, as this directly reflects their functional performance related to dental care. In conclusion, most experts in the first focus group agreed that it was irrelevant and beyond the scope of dental practice to assess hand grip strength. However, patients' capability to maintain oral hygiene should be assessed.

Socioeconomic factors and caregivers

Caregivers play a critical role in oral health maintenance of special-needed patients. However, they often lack proper understanding of oral care for dependent patients. Underachieved tasks like toothbrushing were common. Many examples were mentioned where dental home care failed because caregivers could not comprehend the oral hygiene care plan. *"Caregivers incorrectly delivered oral care in special-needed patient because of lacking knowledge. They thought that if the patient is not eating, why bother taking care of their teeth or mouth?"* the dental expert (2FGs3; Table 2) expressed. Socio-economic factors were also associated with caregiving ability, with concerns being lower for affluent groups but challenges arising for those unable to access premium services. Therefore, treatment goals must be accommodated by factors related to caregivers and family members.

Treatment options

During focus group discussion, rational dental care model [22, 24], specifically the 2015 version, was frequently mentioned and favored for its comprehensiveness and global recognition. Levels of treatment from simple to complex, including no treatment or very limited care, limited care, moderate care, and extensive care, were categorized. The Lucerne Care Pathway [33] also provides the rationale for differential treatment considerations according to general health and dependency level, emphasizing the importance of CGAs for treatment planning. However, the risk of oral health deterioration should go beyond dependency levels alone. Other factors like medication, bleeding tendency, and communication difficulties, were considered crucial. The geriatric medicine expert (1FGs2; Table 2) remarked, *"When discussing patient medical conditions, we evaluate whether certain factors are present. Do they have anti-platelet or anti-coagulant usage? Are there anti-resorptive involved? It's about weighing the benefits against risks. Will the procedure potentially lead to aspirate pneumonia? Could bleeding complications arise? Is jaw necrosis a possibility? Might there be a risk of myocardial infarction or stroke? Is there any risk of infection?"* Another dental expert (2FGs2; Table 2) stated that, *"I feel it is not straightforward to determine which type of treatment is suitable for each patient category. However, there are certain principles that can be applied universally to every case. For instance, if a patient has Parkinson's or a movement disorder, they should have dental procedures that allow freedom in centric relation, for example. Nonetheless, each*

case is unique, and treatment consideration should be individualized based on patient conditions."

The difficulty in judging whether the dental treatment might be too complicated for the patients' condition resulted in a call for a comprehensive evaluation. Alternative treatment might be necessary for patients who cannot tolerate complicated procedures. For example, a one-visit direct restoration may be selected instead of a multiple-visit indirect restoration to restore endodontically treated teeth. A discussion was stimulated among the dentists in the second focus group about the terms whether "comprehensive care," "rehabilitative care," or "reconstructive care" might be more suitable than "extensive care." Nonetheless, the dental procedures related to "extensive," "intermediate," and "limited care" should be clarified for clinical decision-making. It was concluded that rehabilitative treatment includes comprehensive dental procedures to restore oral health and functions (Table 4). This level includes surgical periodontal treatment or oral surgery, endodontic treatment, direct and indirect restorations, and prostheses. Limited treatment is more conservative procedures to maintain oral health and functions with simple approaches, such as non-surgical periodontal treatment or repairing existing restorations. Urgent treatment focuses on pain management, infection control, and addressing urgent dental concerns, such as extraction, caries control, or temporary restorations. No treatment refers to daily oral hygiene maintenance with no dental procedures. The discussion involved various examples of geriatric cases, highlighting challenges in treatment decisions, especially for frail patients. The dental experts (2FGs1; Table 2) mentioned that each case is unique due to different combinations of associating factors. Therefore, oral care plans should be tailored to individual conditions. Especially, the selection to provide "No treatment" which appears optimal for some cases. The balance of patients' desires and needs was also emphasized.

Settings and the selection of CGA tools

Expert opinions in the first focus group highlighted the diversity of settings from primary to tertiary care and stressed the need to adapt assessment approaches accordingly. They mentioned that *"It is crucial to consider who will perform the assessment. The issue of 'used by whom' is significant, as it varies depending on the setting. Different settings, such as a medical school, a faculty of medicine, or a rural area, have distinct contexts and considerations."* There are also challenges like time constraints and resource limitations when selecting assessment tools. Efficiency is vital to balance comprehensive evaluations with patient care demands. Cost challenges, particularly in geriatric clinics, underscore the importance of developing efficient comprehensive assessment. Family Medicine experts (1FGs3; Table 2) mentioned their experience that questionnaires are not commonly used in routine practice. Some also express skepticism about the extensive use of assessment tools, stating that a thorough medical history and cognitive evaluation may be sufficient in certain cases. When assessing specific conditions, the number of questions should be reduced and focused on using alarm features to detect certain conditions. The experts argued against heavy reliance on assessment tools but agree on the crucial role of multidisciplinary teams as a key consideration when formulating treatment plans for special-needed patients. The role of dentists in multidisciplinary teams was emphasized. Collaboration with other healthcare professionals and understanding team dynamics is essential. There was a consensus on selecting appropriate tools upon the setting. Comprehensive assessment could be more ideal in academic or tertiary care settings, while short and

Table 4 Levels of dental treatment

Level of Treatment	Description	Examples
Rehabilitative Treatment	Comprehensive dental interventions aimed at restoring oral health, function, and aesthetics. These procedures address advanced oral diseases, structural damage, and tooth loss to achieve full dental rehabilitation.	Surgical periodontal treatment, oral surgery, endodontic therapy, restorative procedures (e.g., fillings, crowns), prosthetic treatments (e.g., dentures, bridges, implants).
Limited Treatment	Conservative dental procedures designed to maintain oral health and function through minimally invasive techniques. These treatments focus on preserving existing structures and preventing disease progression.	Non-surgical periodontal therapy (e.g., scaling and root planing), repair of defective restorations, minor occlusal adjustments.
Urgent Treatment	Immediate dental care provided to manage acute pain, infection, or trauma. These procedures focus on stabilizing the patient's condition and preventing further complications.	Emergency tooth extractions, caries management (e.g., temporary fillings), drainage of dental abscesses, prescription of antibiotics or analgesics.
No Treatment	A preventive approach that excludes active dental procedures, focusing instead on daily oral hygiene maintenance and routine monitoring. Suitable for individuals without immediate treatment needs.	No professional dental interventions, emphasis on personal oral hygiene practices (e.g., brushing, flossing), routine dental check-ups for assessment.

simpler tools were suggested for routine service care (Table 3).

Discussion

In this study, four concepts of the treatment planning models for oral care in older adults, the key considerations for CGA in dental practice, and the expert opinions on the assessment and treatment planning approach are reported. Comprehensive geriatric assessment and treatment planning concepts from scoping review offer a framework for oral care in older adults. The focus groups identified important CGA components including systemic conditions, cognitive and mental health, dysphagia, nutritional status, fall risk, and socio-economic factors. Focus group discussion also highlighted challenges like patient cooperation, physical limitation, and systemic conditions that influence treatment planning. The strengths and weaknesses of CGA tools provided a rationale for the tool selection based on experience and clinical purposes of the examiners. The experts emphasized that a holistic assessment frequently indicates a unique problem in each case that needs to be addressed individually. The diversity of participants, non-dental healthcare professionals in the first session and dental professionals in the second, allowed for a broader range of perspectives. Additionally, the discussion encouraged sharing of expert experiences rather than simply reflecting the information provided in the literature to further minimize the potential influence from the pre-session materials. Among the four concepts reported in a scoping review, the Seattle Care Pathway and the Lucerne Care Pathway mainly concern a level of dependency for treatment planning. While ROHD model emphasized risk factors in systemic conditions, social aspects, and oral conditions, related to oral health deterioration. Social factors, dentist capability, and other risks were mentioned in OSCAR model. When incorporating these considerations in focus group discussion, there was an agreement that oral care plans should integrate dependency levels, medical, and socio-economic conditions for holistic view in treatment planning.

Based on the results of this study, a model of comprehensive assessment and treatment planning is proposed for dental settings. The experts' opinions are assembled in the context of tertiary to quaternary care. There are seven interrelated steps in the proposed model. The first step is an initial patient assessment when a preliminary evaluation based on observation of the physical manners and overall appearance. The second step is to determine whether the patient or caregiver initiated the visit to understand the level of dependency and engagement to future treatment. The next step is to understand patient problems through history taking and comprehensive assessment for holistic view, including socio-economic status, caregiver support, medical conditions, and dependency levels. This part is well-aligned with Ettinger's concept of rational dental care [24]. The CGAs included cognitive function using Mini-Cog, depression using PHQ-2, dysphagia using EAT-10, fall risk by questioning, and malnutrition by questioning, can be performed by dentists when possible, or by the multidisciplinary team. These CGAs must be assessed alongside oral health risk evaluation to ensure a multidimensional and patient-centered approach. The fourth step is therefore intraoral and extraoral examination for oral health problems such as infections, tooth loss, xerostomia, and other factors. The fifth step is to identify factors contributing to treatment success and prognosis, such as patient cooperation, physical limitations, and systemic health such as a risk of jawbone necrosis, perioperative cardiovascular or aspiration complications or other medical comorbidities. This step expanded consideration into family support and dentist capacity. The sixth step is to determine optimal care levels ranging from rehabilitative treatment to palliative care based on health status, functional capacity, and a quality-of-life goal. The final step involves a follow-up plan for oral health maintenance that is adaptable to coincide with alteration of current situations.

The goal of treatment planning is to address oral health needs, restore oral function and self-esteem, while enhancing the oral health-related quality of life in an optimal context of patients' situation. The level of oral care from comprehensive treatment, limited treatment, urgency treatment, and no dental treatment were identified in the scoping review [24, 32, 33]. Each level was discussed and clarified in focus group discussion. Nonetheless, dependency level remains a key factor in clinical judgment to select a level of care as suggested in the Seattle Care Pathway. In addition, the focus groups also emphasized social support and systemic factors as the important determinants for selecting the care level. Therefore, this result suggested the patient-centered treatment approach consistently aligned with Ettinger's concept of rational dental care [22, 24].

The focus group recommended that some CGAs are essential for oral healthcare. The recommendation includes screening for cognitive and mental health issues to assess their impact on oral health, maintenance, and patient compliance. Related to cognitive function, decisional capacity and self-care abilities were important because they indicated the ability to perform oral hygiene maintenance and treatment cooperation. However, the experts suggested that short and easy assessment tools such as Mini-Cog might be more efficient than a time-consuming tool such as MoCA. Mini-Cog should be

practical in dental practice while providing sufficient result for clinical judgement in cognitive decline. This result aligns with the survey from special care dental professionals suggesting that MoCA as a cognitive assessment tool may be too complicated for dental settings [11, 34]. Decision-making capacity is known to be crucial for informed consent and critical consideration of treatment options in geriatric dentistry [35, 36]. Therefore, the focus group agreed that evaluation of decision-making capacity is critical when treating older adults with cognitive decline.

Assessment of dysphagia and its risk factors was underscored in focus groups because it closely relates to oral functions. Poor oral health increases the risk of aspiration pneumonia; therefore, dysphagia could be an associated risk [37]. The critical role of dental geriatricians is to identify the risk of dysphagia and make appropriate referrals. Screening methods such as the Eating Assessment Tool (EAT10) or Swallowing disturbance questionnaire (SDQ) were recommended in the results of this study for evaluation of swallowing difficulties. This result was consistent with previous studies that these tools demonstrated high sensitivity to detect swallowing problems and prevent aspiration [38]. The association between dysphagia and malnutrition was also demonstrated [39, 40]. Thus, the experts recommended evaluating nutritional status by taking history of current weight changes, appetite, and body mass index (BMI). The experts also viewed patient nutritional status as an urgent indication for the needs of tooth substitution and dental prostheses.

Some CGAs including fall risk and sarcopenia screening, were common, but considered lower priority in dental settings. The experts recommended that fall risk should be screened, when possible, to ensure comprehensive care, because fall-related morbidity or mortality is high. Consistently to previous report [41], the STEDI tool, or screenings by questions, was recommended by the experts in this study. For sarcopenia screening, expert opinions varied on whether dentists should perform the hand grip strength test for diagnosis. Although existing literature shows a weak relationship between oral health and sarcopenia [42], fall risk, sarcopenia, malnutrition, and mastication may be related in frail older adults [43, 44]. Sarcopenia, the age-related loss of muscle mass and strength, directly increases the risk of falls due to weakened muscles and impaired balance [43]. Malnutrition exacerbates sarcopenia by limiting the intake of essential nutrients needed [45]. Mastication, or the ability to chew food effectively, is crucial in this context, as poor mastication often results from dental problems or weakened jaw muscles, leading to insufficient nutrient intake and contributing to malnutrition [46, 47]. This creates a vicious cycle where poor nutrition accelerates sarcopenia, further increasing fall risk. Therefore, addressing malnutrition and improving mastication can be vital in reducing sarcopenia and fall risk in the elderly population [46, 47].

The strength of this study was the integrated evidence from a scoping review and expert opinions. The evidence was extracted from a variety of oral care concepts from previously published literatures which appeared to be relatively restricted to some opinionated groups. Therefore, data from the scoping review alone may be insufficient, but it becomes comprehensive with expert opinions from a focus group to make it useful. The scoping review also identified a knowledge gap which determinants should be incorporated for clinical judgement in selecting the level of oral care. Although there was not yet a consensus, a focus group of expert opinions provided important rationale for clinical practice. Nonetheless, several limitations exist. The experts were limited in number and lacked input from primary care practitioners. This can affect the generalizability of the findings, and the results could be applicable only in the context of tertiary or quaternary care. Additionally, the role of dentist in multidisciplinary team is important for holistic care in older adults. However, this aspect was not the primary objective of this study. It emerged in focus group discussion but was not further explored.

Although multidisciplinary teamwork was not the primary aim of a focus group, the role of dentist in the multidisciplinary team was mentioned in both focus groups. Dentists should contribute to the team for comprehensive geriatric assessment and holistic view of health problems [16]. However, the role of dentists in healthcare for special needed patients such as hospitalized patients or palliative care remains lacking. In palliative care, dentists can play a crucial role, including training oral care to other professionals, managing complex oral problems, and emergency treatment [48]. Oral health could not be neglected in patients with advanced diseases. Poor oral health increase risks of morbidity and affects physical and psychological well-being [48]. Collaboration of dental professionals is therefore encouraged to support multidisciplinary care in older adults and special-needed patients. Active participation in disease prevention and health promotion within a multidisciplinary team is a focal point [16, 48].

Future studies therefore should aim to validate the model in diverse clinical settings such as primary care, or palliative care, or any resource-limited environments, to assess its feasibility, adaptability, and impact on overall outcomes. Cultural adaptability can be explored in different contexts, especially in regions with differing healthcare infrastructures and socio-cultural norms. Lastly, the integration of this model within a multidisciplinary team

could provide insights into its broader application and effectiveness.

Conclusions

- The integration of CGA is beneficial for problem analysis and development of holistic view of patient problems for oral treatment planning that is beyond oral healthcare.
- The CGA results considers the whole person, not just their illness. Therefore, CGA can improve the quality of oral care, ensure patient safety, and contribute to better overall healthcare outcomes in older adults.
- The key CGA components include systemic conditions for any risks of comorbidities, oral health conditions, socioeconomic status, dependency, cognitive and mental health, communication, and life expectancy. In addition, the focus groups suggested assessing swallowing problems, nutritional status, and fall risk, to be completed.
- Some CGA tools, including The Barthel Index for Activities of Daily Living, water swallow screening test, Mini Nutritional Assessment, Mini-Cog, Patient Health Questionnaire, and three key questions for fall risk assessment, were suggested for consideration.
- The experts disagreed with heavy reliance on assessment tools. The thoroughness of assessments with the practical constraints of time must be well balanced.
- The multidisciplinary team has a crucial contribution in comprehensive evaluation of patient problems when formulating treatment plans for special-needed patients
- Dependency level, social support and systemic factors may determine the level of oral care including comprehensive, limited, urgency and no treatment.

Abbreviations

CGA	Comprehensive Geriatric Assessment
ROHD	Risk of Oral Health Deterioration
MoCA	Montreal Cognitive Assessment
MMSE	Mini-Mental State Examination
EAT-10	Eating Assessment Tool-10
SDQ	Swallowing Disturbance Questionnaire

Supplementary Information

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Supplementary Material 1

Supplementary Material 2

Supplementary Material 3

Supplementary Material 4

Supplementary Material 5

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2. Assoc. Prof. Dr. Chanwit Prapinjumrune (Secretariate and Committee)
3. Prof. Dr. Thanaphum Osathanon (Associate Dean for Research)

Authors' contributions
N.W. and A.V. proposed research question, study design, and wrote a research proposal for funding. All authors planned and perform data collection and data interpretation. N.W. and A.V conducted the systematic search, selected and reviewed articles, performed preliminary data coding, and moderated the focus group sessions. K.P. acted as an observer during focus group sessions and contributed to consensus discussions on data coding. All authors participated in data analysis. N.W. and A.V. wrote the main manuscript text and prepared Tables and Supplement data. All authors critically reviewed and approved the manuscript.

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Data availability
Study protocol that support the findings of this study has been deposited in the OSFregistries (https://osf.io/) with the protocol number 10.17605/OSF.IO/EZRDV.The datasets generated and/or analysed during the current study are not publicly available due to data privacy preservation but are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
Ethical considerations were thoroughly addressed in this study, which received approval from the Human Research Ethics Committee of the Faculty of Dentistry, Chulalongkorn University (HRDC-DCU 2022-083). Participants were invited by the researcher and co-researcher to participate. Participants were informed of the methodology, objectives, benefits and disadvantages of the study. Participants had the option to decline participation at any time. Researchers and co-authors are committed to treating participants with respect and ensuring their rights and personal information are protected. Personal information that could affect participants was discarded after data analysis.

Consent for publication
The consent for publication is not applicable because there is no clinical data from patients reported in this study. The data included only participants' opinions on the discussed topics which do not compromise anonymity, and a statement of consent to the use of data was already declared in informed consent in the ethical approval process for human study.

Competing interests
The authors declare no competing interests.

Author details
[1]Department of General Dentistry, Faculty of Dentistry, Srinakharinwirot University, Wattana, Bangkok 10110, Thailand. [2]Geriatric Excellence Center, King Chulalongkorn Memorial Hospital, Bangkok, Thailand. [3]Master of Science Program in Geriatric Dentistry and Special Patients Care, Faculty of Dentistry, Chulalongkorn University, Pathumwan, Bangkok 10330, Thailand. [4]Department of Microbiology, Faculty of Dentistry, Chulalongkorn University, Pathumwan, Bangkok 10330, Thailand. [5]Research Unit on Oral Microbiology and Immunology, Faculty of Dentistry, Chulalongkorn University, Pathumwan, Bangkok 10330, Thailand.

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References

1. World population ageing 1950-2050. In. New York :: UN; 2002.
2. Petersen PE, Kandelman D, Arpin S, Ogawa H. Global oral health of older people–call for public health action. Community Dent Health. 2010;27(4 Suppl 2):257–67.
3. Berkey DB, Scannapieco FA. Medical considerations relating to the oral health of older adults. Spec Care Dentist. 2013;33(4):164–76.
4. Ship JA, Pillemer SR, Baum BJ. Xerostomia and the geriatric patient. J Am Geriatr Soc. 2002;50(3):535–43.
5. Wu CZ, Yuan YH, Liu HH, Li SS, Zhang BW, Chen W, An ZJ, Chen SY, Wu YZ, Han B, et al. Epidemiologic relationship between periodontitis and type 2 diabetes mellitus. BMC Oral Health. 2020;20(1):204.
6. Nascimento GG, Leite FRM, Vestergaard P, Scheutz F, López R. Does diabetes increase the risk of periodontitis? A systematic review and meta-regression analysis of longitudinal prospective studies. Acta Diabetol. 2018;55(7):653–67.
7. Ettinger RL. Dental management of patients with Alzheimer's disease and other dementias. Gerodontology. 2000;17(1):8–16.
8. Parker SG, McCue P, Phelps K, McCleod A, Arora S, Nockels K, Kennedy S, Roberts H, Conroy S. What is Comprehensive Geriatric Assessment (CGA)? An umbrella review. Age Ageing. 2018;47(1):149–55.
9. Dennehy K, Lynch A, Reddin C, Daly B, Dukelow T, Canavan M, Costello M, Murphy R. How comprehensive is our comprehensive geriatric assessment in clinical practice? An Irish perspective. Eur Geriatr Med. 2024;15(4):1007–15.
10. Logemann JA, Curro FA, Pauloski B, Gensler G. Aging effects on oropharyngeal swallow and the role of dental care in oropharyngeal dysphagia. Oral Dis. 2013;19(8):733–7.
11. Chen Y, Li C, Fan Y, Jiao L, Silverman M, Ishimaru M, Wang J, Van Pelt AJ, Wang R. Associations of oral health status and swallowing function with cognitive impairment in the aging population: a cross-sectional study. BMC Oral Health. 2023;23(1):912.
12. Niesten D, van Mourik K, van der Sanden W. The impact of frailty on oral care behavior of older people: a qualitative study. BMC Oral Health. 2013;13(1): 61.
13. Chen X, Clark JJ, Chen H, Naorungroj S. Cognitive impairment, oral self-care function and dental caries severity in community-dwelling older adults. Gerodontology. 2015;32(1):53–61.
14. Azami-Aghdash S, Ebadi SS, Sardareh M, Pournaghi-Azar F, Karami S, Pouyan SN, Derakhshani N. The impact of professional oral health care on the oral health of older people: a systematic review and meta-analysis. BMC Oral Health. 2024;24(1):1558.
15. Borreani E, Wright D, Scambler S, Gallagher JE. Minimising barriers to dental care in older people. BMC Oral Health. 2008;8: 7.
16. Shyu S-W, Lin C-F, Yang S-H, Chu W-M, Hsu C-Y, Lin S-Y, Yeh Y-H. Association of oral health with geriatric syndromes and clinical outcomes in hospitalized older adults. J Nutr Health Aging. 2024;28(11): 100385.
17. Pretty IA. The life course, care pathways and elements of vulnerability. A picture of health needs in a vulnerable population. Gerodontology. 2014;31(s1):1–8.
18. Shay K. Identifying the needs of the elderly dental patient. The geriatric dental assessment. Dent Clin North Am. 1994;38(3):499–523.
19. Mak S, Thomas A. Steps for Conducting a Scoping Review. J Grad Med Educ. 2022;14(5):565–7.
20. Krueger RA, Casey MA. Focus groups: a practical guide for applied research. Thousand Oaks: SAGE Publications; 2014.
21. Creswell JW, Poth CN. Qualitative Inquiry and Research Design Choosing among Five Approaches. 4th ed. Thousand Oaks: SAGE Publications Inc; 2018.
22. Ettinger RL. Treatment planning concepts for the ageing patient. Aust Dent J. 2015;60(Suppl 1):71–85.
23. Johnson TE, Shuman SK, Ofstehage JC. Fitting the pieces together: treatment planning in the geriatric dental patient. Dent Clin North Am. 1997;41(4):945–59.
24. Ettinger RL. Rational dental care: part 1. Has the concept changed in 20 years? J Can Dent Assoc. 2006;72(5):441–5.
25. Ettinger RL. Rational dental care: part 2. A case history. J Can Dent Assoc. 2006;72(5):447–52.
26. Stein P, Aalboe J. Dental care in the frail older adult: Special considerations and recommendations. J Calif Dent Assoc. 2015;43(7):363–8.
27. Geddis-Regan A, Walton G. A guide to treatment planning in complex older adults. Br Dent J. 2018;225(5):395–9.
28. Marchini L, et al. Oral health care for patients with Alzheimer's disease: An update. Spec Care Dent. 2019;39(3):262–73.
29. Marchini L, Hartshorn JE, Cowen H, Dawson DV, Johnsen DC. A teaching tool for establishing risk of oral health deterioration in elderly patients: development, implementation, and evaluation at a U.S. Dental School. J Dent Educ. 2017;81(11):1283–90.
30. Ettinger RL, Beck JD. Geriatric dental curriculum and the needs of the elderly. Spec Care Dentist. 1984;4(5):207–13.
31. Ettinger RL. Clinical decision making in the dental treatment of the elderly. Gerodontology. 1984;3(2):157–65.
32. Pretty IA, Ellwood RP, Lo EC, MacEntee MI, Müller F, Rooney E, Murray Thomson W, Van der Putten GJ, Ghezzi EM, Walls A, et al. The Seattle Care Pathway for securing oral health in older patients. Gerodontology. 2014;31(Suppl 1):77–87.
33. FDI World Dental Federation. Managing older adults: Chairside guide. Geneva: FDI World Dental Federation; 2019.
34. Li C, Friedman B, Conwell Y, Fiscella K. Validity of the Patient Health Questionnaire 2 (PHQ-2) in identifying major depression in older people. J Am Geriatr Soc. 2007;55(4):596–602.
35. Mukherjee A, Livinski AA, Millum J, Chamut S, Boroumand S, Iafolla TJ, Adesanya MR, Dye BA. Informed consent in dental care and research for the older adult population: A systematic review. J Am Dent Assoc. 2017;148(4):211–20.
36. Nitschke I, Wendland A, Weber S, Jockusch J, Lethaus B, Hahnel S. Considerations for the prosthetic dental treatment of geriatric patients in Germany. J Clin Med. 2021;10(2):304.
37. Awano S, Ansai T, Takata Y, Soh I, Akifusa S, Hamasaki T, Yoshida A, Sonoki K, Fujisawa K, Takehara T. Oral Health and Mortality Risk from Pneumonia in the Elderly. J Dent Res. 2008;87:334–9.
38. Rofes L, Arreola V, Mukherjee R, Clavé P. Sensitivity and specificity of the Eating Assessment Tool and the Volume-Viscosity Swallow Test for clinical evaluation of oropharyngeal dysphagia. Neurogastroenterol Motil. 2014;26(9):1256–65.
39. Fávaro-Moreira NC, Krausch-Hofmann S, Matthys C, Vereecken C, Vanhauwaert E, Declercq A, Bekkering GE, Duyck J. Risk Factors for Malnutrition in Older Adults: A Systematic Review of the Literature Based on Longitudinal Data. Adv Nutr. 2016;7(3):507–22.
40. Sura L, Madhavan A, Carnaby G, Crary MA. Dysphagia in the elderly: management and nutritional considerations. Clin Interv Aging. 2012;7:287–98.
41. Lee R. The CDC's STEADI Initiative: Promoting Older Adult Health and Independence Through Fall Prevention. Am Fam Physician. 2017;96(4):220–1.
42. Hatta K, Ikebe K. Association between oral health and sarcopenia: A literature review. J Prosthodont Res. 2021;65(2):131–6.
43. Güner Oytun M, Topuz S, Baş AO, Çöteli S, Kahyaoğlu Z, Boğa İ, Ceylan S, Doğu BB, Cankurtaran M, Halil M. Relationships of Fall Risk With Frailty, Sarcopenia, and Balance Disturbances in Mild-to-Moderate Alzheimer's Disease. J Clin Neurol. 2023;19(3):251–9.
44. Eglseer D, Eminovic S, Lohrmann C. Association Between Sarcopenia and Nutritional Status in Older Adults: A Systematic Literature Review. J Gerontol Nurs. 2016;42(7):33–41.

45. Calcaterra L, Abellan van Kan G, Steinmeyer Z, Angioni D, Proietti M, Sourdet S. Sarcopenia and poor nutritional status in older adults. Clin Nutr. 2024;43(3):701–7.
46. Ramsay SE, Papachristou E, Watt RG, Tsakos G, Lennon LT, Papacosta AO, Moynihan P, Sayer AA, Whincup PH, Wannamethee SG. Influence of poor oral health on physical frailty: a population-based cohort study of older British Men. J Am Geriatr Soc. 2018;66(3):473–9.
47. Suzuki M, Koyama S, Kimura Y, Ishiyama D, Otobe Y, Nishio N, Ichikawa T, Kunieda Y, Ohji S, Ito D, et al. Relationship between characteristics of skeletal muscle and oral function in community-dwelling older women. Arch Gerontol Geriatr. 2018;79:171–5.
48. Wiseman MA. Palliative care dentistry. Gerodontology. 2000;17(1):49–51.

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