



# Prevention of Oral Functional Decline

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## ABSTRACT

**Objectives:** The oral cavity functions in eating, speaking, socializing, and serving as a natural barrier to external pathogens. In the prevention of oral function decline in older people, oral health conditions should be maintained through public health actions.

**Methods:** This article discusses public health actions to prevent oral functional decline through addressing three major issues among older people: tooth loss, hyposalivation, and oral cancer. Negative impacts of tooth loss, hyposalivation, and oral cancer will be described, followed by describing public health approaches to prevent these problems

**Results:** Tooth loss, commonly caused by dental caries and periodontal diseases, affects one's ability to eat, speak, and socialize freely. Prevention of tooth loss can be done in clinical settings, community settings, and through national policies. Saliva plays an important role in eating, swallowing, and protecting oral mucosa from pathogens. The major causes of dry mouth are polypharmacy and the use of anticholinergic medications among older people. Public health actions to promote collaboration between dentists and doctors in the adjustment of drug prescriptions are warranted. Oral cancer can affect oral function largely both from the disease itself and from cancer treatments due to the destruction of oral structures and salivary gland function. Tobacco use and alcohol consumption are major risk factors for oral cancer; they also contribute to various systemic diseases and cancers of other organs.

**Conclusions:** Public health policies and interventions using the common risk factor approaches to tackle tobacco and alcohol consumption should be encouraged. Rather than focusing on older people, the prevention of oral function decline should be planned through a life-course perspective.

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## Introduction

Worldwide, the population is ageing. In many industrialised countries, as birth rates fall and life expectancy increases, the proportion of older adults within the general population has increased.<sup>1</sup> In parallel to this, dental epidemiologic research has also captured a significant shift in the oral health of older adults, with increasing levels of natural tooth retention.<sup>2</sup> However, this brings the challenges of preventing and managing chronic dental diseases in older adults.<sup>3,4</sup> Poor oral health can have significant impacts on older adults' quality of life, self-esteem, and general health, including malnutrition.<sup>5</sup>

In 2016, the Japanese Society of Gerodontology published a position paper on "Oral Hypofunction" outlining conditions where dental care interventions were advised to prevent the transition to whole-body frailty via deterioration of the oral

cavity.<sup>6,7</sup> Description of this condition means that preventative care can be planned for older adults to ensure that their oral health status does not continue to decline. Further public health interventions can also be provided to prevent oral functional decline. This paper will discuss public health interventions targeted towards older adults to prevent oral function decline by addressing three major issues: tooth loss, hyposalivation, and oral cancer. The negative impacts of tooth loss, hyposalivation, and oral cancer will be described, followed by a discussion of public health approaches to prevent these conditions.

## Natural tooth loss

The major causes for tooth loss are untreated dental caries and periodontal disease.<sup>8</sup> The negative impact of tooth loss without tooth replacement may lead to severe deterioration

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of oral functions such as masticatory performance, limited food choices, and malnutrition, affecting oral health–related quality of life.<sup>9,10</sup> Therefore, tooth loss prevention and oral health maintenance contribute to older adults' systemic health, well-being, and quality of life. A key behavioural risk factor in tooth loss is tobacco use, whilst poor oral hygiene, excessive use of alcohol, overweight, and high blood sugar are considered to be other modifiable risk factors.<sup>11</sup>

A key component to tooth loss prevention is a shift from treating disease to instituting effective prevention strategies.<sup>12</sup> This preventive approach to caries and periodontal disease management should be integrated into routine dental services. For older adults at high caries risk, preventative regimes should include oral hygiene instruction, assisted toothbrushing, daily toothbrushing with a high-fluoride-containing dentifrice, professionally applied fluoride varnish/solutions, and daily chlorhexidine mouthwash.<sup>13,14</sup> For older adults, powered toothbrushes can also be a good alternative to manual plaque control, particularly where manual dexterity is compromised.<sup>12</sup>

Poor oral health is a very common problem for older adults living in long-term care facilities (LTCFs).<sup>15</sup> The majority of older adults within LTCFs now retain their natural teeth, giving rise to a partially dentate population. The oral health of LTCF residents is much worse than their community-dwelling peers, as highlighted by caries prevalence data.<sup>16</sup> Oral care strategies for this population should focus on preventing disease and reducing pain and comorbidities.<sup>17</sup> However, evidence for interventions on promoting oral health amongst LTCF residents is weak.<sup>18</sup> In the United Kingdom, national guidelines were published by the National Institute for Health and Care Excellence (NICE) in 2016 that aim to maintain and improve the oral health of care home residents.<sup>14</sup> Unfortunately, a report by the Care Quality Commission in 2019 stated that 73% of United Kingdom LTCF residents' care plans either did not include or did not adequately address oral health; 52% of LTCFs had no oral health care policy; and 47% did not provide oral health training for staff.<sup>19</sup> Recent co-design work undertaken with LTCF staff and residents has developed a series of innovative resources to support oral care within LTCFs. The creation of practical tools which can be made available within the LTCF should better support the implementation of the national guideline.<sup>20</sup>

Further preventative interventions for dependent older adults have been shown to be effective in reducing development of chronic dental diseases, particularly caries, including the use of professionally applied fluoride products.<sup>21,22</sup>

Oral disease prevention should be integrated with general health programmes based on the common risk factor approach. Oral health care system modifications by establishing outreach services (eg, use of mobile dental units or portable equipment) and the use of teledentistry, particularly mHealth (messages and apps), can also facilitate and ensure that effective services are delivered to older adults.<sup>23,24</sup> These innovative approaches have been particularly welcome during the COVID-19 pandemic due to restrictions to care facilities.

National oral health guidelines focused on preventing chronic dental diseases are essential, and health authorities are thus urged to formulate oral health goals, targets, and oral health standards in measurable terms for older adults. The public health approach to prevent oral diseases is

considered in 3 core activities: assessment, policy development, and assurance/insurance.<sup>9</sup> For older adults, appropriate oral health surveillance systems should be established for measuring progress in oral health prevention and promotion.<sup>10</sup> Regarding the policy development activity, national evidence-based public health programmes' implementation should be advocated, and the life-course perspective for achieving better oral health, oral function, and quality of life must be considered in national guidelines and policies. National policy-related initiatives such as the US Medicare programme and 8020 campaign in Japan are promising oral health promotional efforts for older adults. Revisions to existing older adult insurance schemes and the introduction of financially fair oral care programmes should be an urgent priority in order to eliminate financial barriers exacerbating oral health inequalities amongst older adults.<sup>25</sup>

## Hyposalivation

In maintaining good oral health and oral function, saliva plays multiple roles. It helps prevent dental caries through bacterial agglutination and removal from the oral cavity and also helps with speech functions.<sup>25,26</sup> Saliva has a vital role in mastication because it is involved in chewing and swallowing through food maceration and bolus formation.<sup>25</sup> Saliva dissolves taste substances in the food and enables taste perception. Additionally, it contains specific digestive enzymes to support food digestion such as amylase, lipase, and proteases and immunoglobulins to defend against external pathogens including as bacteria, viruses, and fungi.

Compared with standard quantity salivation, hyposalivation is the objective reduction of salivary secretion, and it negatively impacts oral function by disturbing saliva functions. In a recent meta-analysis amongst older adults, the global prevalence of hyposalivation was estimated to be 20.0%.<sup>27</sup> The most common aetiology of hyposalivation is as a medication side effect, especially in older adults who are more likely to be taking multiple drugs to manage a range of chronic systemic diseases.<sup>28</sup> Salivary gland dysfunction and hyposalivation can be induced by the majority of prescription medications, but this effect is most pronounced with drugs including diuretics, beta blockers, and tricyclic antidepressants. Other causes of hyposalivation include radiation therapy to the head and neck region; systemic diseases including Sjögren's syndrome, rheumatoid arthritis, and diabetes mellitus; and salivary gland disorders caused by trauma and oncology.<sup>29,30</sup>

There is limited published evidence focused on prevention of hyposalivation, especially through public health interventions. To the best of our knowledge, in older adults, only one systematic review has been published with a meta-analysis focussed on the effects of oral health programmes on hyposalivation.<sup>31</sup> This review reported that completion of oral health promotion programmes was effective in improving salivary secretion rates amongst older adults. The oral health promotion programmes included oral exercises, toothbrushing, and salivary massage. The programmes were delivered to a group of participants by dental hygienists, nurses, dentists, and occupational therapists through lectures, videos, handouts, and demonstrations.

With more than 95% of cases of dry mouth (including hyposalivation) derived from medication usage, there is a need to raise awareness of the role of polypharmacy with pharmacists and other health practitioners including doctors and nurses. Polypharmacy reduction is thus a possible alternative method for preventing medication-induced hyposalivation. With an ageing population around the world, the prevalence of polypharmacy-induced xerostomia is expected to increase amongst older adults. Therefore, for pharmacists and other health practitioners, especially physicians, further education on the role of polypharmacy in hyposalivation should be provided.<sup>32</sup> Additionally, early hyposalivation detection allows for early resolution of the condition and less suffering to patients, thus leading to prevention of negative impact on oral functions. Therefore, in patients with hyposalivation, oral health practitioners should be educated in recognising the clinical oral signs of hyposalivation (Table). This information should be disseminated at a national level through dental associations in each country to increase oral health practitioners' awareness of hyposalivation.

## Oral cancer

Oral cancer includes cancers of the lip, other parts of the mouth, and the oropharynx. In 2020, 377,713 new oral cancer cases were detected, with 177,757 deaths globally.<sup>33</sup> Within these figures, the death toll in Asia was the highest, with 131,610 deaths.<sup>34</sup> Aetiologic risk factors for oral cancer include all forms of tobacco use, chewing areca/betel nut, excessive alcohol use, poor diets, and persistent infections of the upper aerodigestive tract with human papilloma virus (HPV).<sup>35</sup> Many of these aetiologic risk factors are in common with other diseases including dental caries, periodontal disease, hyposalivation, trauma, obesity, and heart disease (Figure).

Oral cancer can cause significant negative impacts on oral functions, especially following cancer treatment. The extent of the impairment depends on the treatment modalities, cancer sites, degree of progression, and extent of resection. Treatment consequences can lead to various kinds of oral functional decline including masticatory problems, swallowing, speech disorders, and dry mouth.<sup>36-38</sup> Particularly following surgical resection, facial aesthetics can be significantly impacted. Therefore, prevention and early detection of oral cancer is crucial.

**Table – Clinical oral signs in patients with hyposalivation.**

Dry, cracked, and peeling lips
Angular cheilitis
Dry, dirty, and coarse tongue
Erythematous tongue
Atypical or unusual dental caries (cervical, incisal, or in cusps tips)
Dental erosions
Mucositis
Oral candidiasis
Oral ulcers

Modified from Mese and Matsuo, 2007.

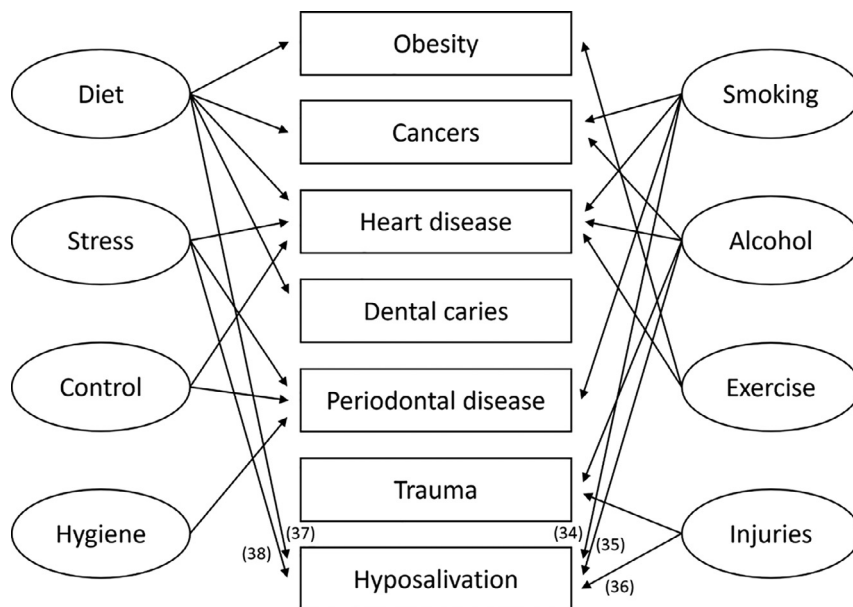
Educating the public and raising awareness about major risk factors and high-risk behaviours for oral cancer are vitally important. Raising public awareness of the harm, especially on oral health, caused by tobacco products should be encouraged via advertisement and campaigns and promoting smoking cessation support. The MPOWER measures introduced by the World Health Organisation (WHO) are useful to evaluate the progress of each tobacco control policy<sup>39,40</sup> and consist of 6 components: (1) monitoring tobacco use; (2) protecting people from tobacco smoke; (3) offering help to quit tobacco; (4) warning about the dangers of tobacco; (5) enforcing tobacco advertising, promotion, and sponsorship bans; and (6) raising taxes on tobacco.<sup>41</sup> In the same way, health care professionals have a responsibility to encourage the implementation of public policies to reduce harmful alcohol use. The WHO recommends the following strategies: regulating alcoholic beverage marketing (especially to young people), reducing demand through taxation and pricing mechanisms, raising awareness of public health issues caused by harmful alcohol use, and ensuring support for effective alcohol policies.<sup>41</sup> Further public health interventions, including administration of the HPV vaccine, may protect against oropharyngeal cancers.

Delayed health services consultation is considered to be a major factor for late diagnosis, which may lead to poor post-operative outcomes and further oral functional decline. This may be due to low oral cancer awareness, and raising the profile of oral cancer is an important goal. There are many population-based oral cancer awareness campaigns (eg, World Cancer Day) organised by international or national organisations and local communities. These campaigns can play a role in improving people's knowledge and motivation. However, longer-term impacts associated with increased service access and oral cancer diagnosis at an earlier stage have yet to be demonstrated.<sup>41</sup> National oral cancer screening programmes are also less common but do exist in some countries, with positive results.<sup>42</sup> There are insufficient data available to evaluate the cost-effectiveness of national screening programmes; however, there is evidence indicating that community-based oral cancer screening is effective in high-risk populations, such as tobacco users, and in developing countries where there is a high oral cancer incidence.<sup>43-45</sup> A self-check tool, Mouth Self-Examination (MSE), has been shown to be effective with high specificity for detecting oral malignant and/or premalignant lesions.<sup>46,47</sup> MSE consists of tactile perception and sense of sight checklists, and users can check with their hands and a mirror briefly for any findings that suggest cancerous or precancerous lesions. Therefore, MSE may be used as an effective tool to improve oral cancer awareness and for the early detection of suspicious lesions.

## Examples of public health programmes for prevention of oral functional decline

### Thailand

Public health programmes for prevention of oral function decline have been integrated within general health preventative programmes, as the Bureau of Dental Health had worked



**Figure – The common risk factor approach.**

Modified from Sheiham and Watt, 2000.

closely with other health care disciplines led by the Bureau of Elderly Health, Ministry of Public Health (MoPH).<sup>48</sup> Four main programmes have been developed:

1. The outreach screening program

An outreach screening program, utilising primary care providers and village health volunteers, has been established by the MoPH. The “Bluebook” is a personal health booklet designed specifically for older adults to record various health assessments and to track health behaviours.<sup>49</sup> A Bluebook smartphone application has now been introduced. The mobile application also runs along a web-based platform allowing primary care providers and the village health volunteers to fill in the assessment information and centralise the records. Therefore, the programme can still run even when some older adults do not own or use a smartphone. The Bluebook includes an assessment of oral health status, chewing, and swallowing functions.

2. The “individual wellness plan”

Derived from the idea of an individual care plan, adults aged 40 to 59 years are assessed for their general health and well-being, including oral health. Assessments undertaken include chewing difficulty, swallowing difficulty, dry mouth, sensitivity and pain, ill-fitting or broken dentures, broken teeth or lost restorations, and swollen or bleeding gums. Once the assessments have been completed, short-term and long-term goals are recorded alongside a prescribed list of daily activities for specific oral health issues. This includes personalised daily oral hygiene care, orofacial motor exercises, tobacco cessation advice, dietary (including alcohol) guidelines, and a reminder to attend a dentist on a regular basis.

3. The “4-Smart” curriculum for Senior Citizens’ Schools

By 2019, 1555 Senior Citizens’ Schools (SCSs) were established throughout the country led by the national policy of Department of Older Persons, Ministry of Social Development

and Human Security and operated by the local municipalities and the primary health care teams.<sup>50</sup> The SCSs were designed to promote and support education on various topics including health, welfare, financial, information technology, and vocational training.<sup>51</sup> Since 2019, the MoPH had created a “4-Smart” campaign made up of Smart Walk (fall prevention); Smart Brain (dementia); Smart Sleep and Emotional (insomnia and other mental health issues); and Smart Eating (nutrition and oral health).

4. Educational materials delivered through television and social media

Instructional video clips on orofacial motor exercise, salivary gland massage, caring for a dry mouth, and tips on oral hygiene care are available through YouTube and a dedicated Facebook page “Fun Young Dee” (translated literally as “teeth [are] still good”).<sup>52</sup> In addition, the Foundation of Thai Gerontology Research and Development Institute and Thai Health Promotion Foundation led a nationwide alliance to promote the oral health of older adults through a life-course approach under the campaign “80/20.”<sup>53</sup> The campaign’s official launch was covered by the media along with series of video clips showing older adults with healthy oral function as role models.

### Japan

The Kihon Checklist is a self-reported comprehensive questionnaire consisting of 25 simple questions, covering multiple activities of daily living (ADLs) including physical function, oral function, nutrition, cognition, social activity, and mental well-being.<sup>54</sup> The Kihon Checklist was originally developed by the Japanese Ministry of Health, Labour, and Welfare in 2006, when the long-term care insurance system, which had originally been started in the year 2000, was reformed to focus more on prevention.

This questionnaire has been widely used in the Japanese local municipal offices and public health centres as an initial screening tool to identify at-risk older individuals. According to their conditions, if necessary, interventional programmes and the facilitation of various long-term care and support services are initiated.<sup>55</sup> The intervention programme is provided by dental hygienists who provide oral function promotion exercises using a variety of educational materials focused on mastication, tongue mobility, and lip closure.<sup>56</sup> As these functions deteriorate with age, tongue and lip motion exercises and salivary gland massages to stimulate salivary secretion are commonly introduced. Older people are encouraged to practice self-exercises at least once a day, especially as the continuation of these exercises is a key factor in the maintenance and improvement of oral function.<sup>57</sup>

Sakayori et al conducted a longitudinal evaluation of the change in oral function in Japanese older persons participating in a programme to improve oral function that was implemented as a part of the long-term care prevention project. They reported that oral function improved after the completion of the program.<sup>58</sup> Regular oral exercises are recommended for older people who have not been officially categorised as requiring long-term care to prevent oral function impairment.

From the perspectives of prevention and health promotion, it is considered more effective to implement oral health promotion programmes before the occurrence of health problems and functional decline. Therefore, these programmes are provided at an early stage for independent older people before they begin to experience oral functional problems.

## Conclusions

This article has described public health interventions used to prevent oral functional decline. We have concentrated on examples of interventions focused on natural tooth loss, hyposalivation, and oral cancer. Prevention and management of these conditions should follow a common risk factor approach and should be implemented across the life course rather than simply waiting for the onset of old age. As illustrated with examples from Thailand and Japan, there are many innovative public health interventions that target oral functional decline and could be utilised in other countries. Given the disruption of dental services in many countries, a focus on prevention should be adopted to ensure that older adults do not suffer unnecessarily due to oral functional limitations.

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