

Research Progress on the Current Status of Oral Frailty in Elderly Patients with Chronic Diseases

Mengli Zhang¹, Xia Zhang², Yu Zeng^{2*}, Ying Wu², Hengyu Liang², Ruijie Li²

¹Shanghai Jian Qiao University, Shanghai 201306, China

²The First Affiliated Hospital of Nanchang University, Nanchang 330006, Jiangxi, China

*Corresponding author: Yu Zeng, 865494812@qq.com

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Abstract: With the accelerated aging process of China's population, the number of elderly patients with chronic diseases is constantly increasing. As a crucial manifestation of the deterioration of oral health in the elderly, oral frailty not only affects patients' eating and nutrient absorption but also is closely related to their overall health and quality of life. This article systematically sorts out the domestic and international research results on oral frailty in elderly patients with chronic diseases in recent years, and conducts a review from four aspects: the definition and assessment tools of oral frailty, the prevalence status of oral frailty in elderly patients with chronic diseases, influencing factors, and intervention directions. It aims to provide references for clinical nursing practice and subsequent research, and offer a theoretical basis for reducing the incidence of oral frailty and improving the oral health status of elderly patients with chronic diseases.

Keywords: Elderly chronic diseases; Oral frailty; Current status; Influencing factors

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1. Introduction

It is predicted that by 2050, the number of elderly people in China will reach a peak of 487 million, accounting for 34.9% of the total population ^[1]. Along with population aging, the proportion of elderly patients with chronic diseases has increased significantly. The number of elderly patients with chronic diseases in China has exceeded 180 million, and the proportion of those with at least one chronic disease is as high as 75.80% ^[2]. Due to long-term suffering from diseases, polypharmacy, and decline in physical function, elderly patients with chronic diseases face increasingly prominent oral health problems, and the incidence of oral frailty is significantly higher than that of the general elderly population ^[3]. The concept of oral frailty was first proposed by Japanese scholars in 2013 ^[1], and the Japan Dental Association further clarified its definition in 2020: it refers to the deterioration of oral function that occurs with age, manifested as tooth loss, poor oral hygiene, chewing difficulties, swallowing disorders, etc. It not only affects social and mental health but also leads to eating disorders, thereby affecting physical health. At present, domestic research on oral frailty in elderly patients with chronic diseases is gradually deepening, but a

systematic summary has not yet been formed. Therefore, this article reviews the progress of relevant research to provide references for clinical intervention.

2. Definition and assessment tools of oral frailty

2.1. Definition of oral frailty

Oral frailty refers to the age-related progressive decline in oral function, involving the reduction of abilities in chewing, swallowing, oral cleaning, and other aspects, accompanied by problems such as tooth loss, xerostomia, and imbalance of oral flora. Ultimately, it affects nutrient intake and overall health. Its core characteristics include the progressiveness of functional decline, multidimensionality (physiological function, hygiene status, social psychology), and relevance to overall health. It interacts with geriatric syndromes such as comorbidity of chronic diseases, malnutrition, and sarcopenia.

2.2. Assessment tools of oral frailty

Currently, the commonly used clinical assessment tools for oral frailty are mainly scales, among which the Oral Frailty Index-8 (OFI-8) is the most widely used. This scale was developed by Tanaka *et al.* [4] in 2021 and promoted in China after being localized by Tu *et al.* [5]. It includes 8 items: whether it is more difficult to eat hard food than half a year ago, whether one is sometimes choked by tea or soup, whether one uses dentures, whether one has xerostomia symptoms, whether the number of outings has decreased compared with half a year ago, whether one can chew hard foods such as peanuts or pickled radishes, whether one brushes teeth at least twice a day, and whether one visits a dentist at least once a year. The total score of the scale ranges from 0 to 11, and a score of ≥ 4 indicates oral frailty. The Cronbach's α coefficient of the Chinese version is 0.602–0.949, showing good reliability and validity [6]. In addition, other scales are also used in combination in studies to comprehensively assess factors related to oral frailty, such as the Mini Nutritional Assessment-Short Form (MNA-SF), which is used to assess the nutritional status of elderly patients, including 6 items such as weight change, activity ability, and appetite, with a total score ranging from 0 to 14, and a score of ≤ 7 indicates malnutrition, which is an important risk factor for oral frailty [7]; social support scales like the 3-item Oslo Social Support Scale (OSSS) and the Social Support Rating Scale (SSRS), which are used to evaluate the social support level of patients, and low social support is associated with an increased risk of oral frailty [8]; and the Frailty Scale, which includes 5 items such as fatigue and increased exercise resistance, with a score of ≥ 3 indicating frailty, and the frailty state can accelerate the deterioration of oral function [2].

3. Prevalence status of oral frailty in elderly patients with chronic diseases

Due to differences in survey regions, sample characteristics (such as inpatient/community, type of chronic disease), and assessment tools in different studies, the incidence of oral frailty in elderly patients with chronic diseases fluctuates to a certain extent, but on the whole, it shows a high prevalence trend.

3.1. Inpatient elderly patients with chronic diseases

Inpatients have a significantly higher incidence of oral frailty than community residents due to more severe conditions, a higher proportion of polypharmacy, and limited physical activity. A survey by Shao *et al.* [2] on 490 elderly inpatients with chronic diseases in a tertiary first-class hospital in Wuhu showed that the incidence

of oral frailty was as high as 60.20%, which was significantly higher than the 44.70% found in the survey of rural community elderly by Tang *et al.* [9], and this is speculated to be related to the reduced saliva secretion and decreased oral self-cleaning ability of inpatients caused by long-term medication. Wu *et al.* [1] selected 388 elderly inpatients with chronic diseases from two tertiary first-class hospitals in Wuhu, and the results showed that the incidence of oral frailty was 30.4%. Although this is lower than the study by Shao *et al.* [2], it is still higher than the survey results of elderly populations in the UK and Japan (about 20%) by Albani *et al.* [10], and the difference may be attributed to the weak awareness of oral health maintenance among the elderly in China and the uneven distribution of medical resources. For inpatients with specific chronic diseases, the incidence of oral frailty is also relatively high. For example, a study by Guo *et al.* [8] on 508 elderly inpatients from 4 hospitals in Henan Province found that the comorbidity rate of oral frailty and sarcopenia was 22.8%, and the comorbidity risk of patients with hypertension and stroke was significantly increased; a study by Chen *et al.* [11] on elderly maintenance hemodialysis patients showed that oral frailty was highly prevalent in this group and was closely related to malnutrition.

3.2. Community-dwelling elderly patients with chronic diseases

Although the incidence of oral frailty in community-dwelling elderly patients with chronic diseases is lower than that in inpatients, it still requires attention. A survey by Tu *et al.* [5] on community-dwelling elderly people showed that the incidence of oral frailty was approximately 35.27%, and the incidence in patients with two or more chronic diseases was significantly higher than that in patients with a single chronic disease. In addition, a study by Tian *et al.* [6] on elderly patients with type 2 diabetes in Taiyuan found that the incidence of oral frailty in this group was approximately 38.5%, and poor blood glucose control would further increase the risk of oral frailty, suggesting that the management of chronic diseases and the maintenance of oral health need to be promoted simultaneously.

3.3. Latent profile characteristics of oral frailty

Wu *et al.* [3] used latent profile analysis to divide 418 elderly patients with comorbid chronic diseases (suffering from ≥ 2 chronic diseases) into 3 heterogeneous groups based on their oral frailty status. The first group is the Severe Oral Frailty - Low Oral Function Group, accounting for 60.53%. The patients in this group had a total oral frailty score of 9.22 ± 1.33 , with obvious chewing difficulties, swallowing disorders, and denture dependence, and most of them were elderly, taking multiple medications (≥ 3 kinds), and had low family care. The second group is the Moderate Oral Frailty - High Social Behavior Group, accounting for 8.85%, with a total oral frailty score of 5.05 ± 1.60 . The patients here had high social participation but low frequency of oral cleaning, and the proportion of married patients was high (86.49%), and spousal support may delay the progression of oral frailty. The third group is the Mild Oral Frailty - High Oral Health Behavior Group, accounting for 30.62%, with a total oral frailty score of 3.86 ± 1.20 . The patients in this group had good health behaviors such as daily teeth brushing and regular dental visits, and most of them were younger and had a short course of chronic diseases (< 3 years). This classification provides a basis for precise intervention, suggesting that personalized nursing plans should be formulated according to the different characteristics of patients.

4. Influencing factors of oral frailty in elderly patients with chronic diseases

The influencing factors of oral frailty in elderly patients with chronic diseases are complex, covering multiple dimensions such as demographic characteristics, health status, behavioral habits, and social psychology. These

factors interact with each other and jointly affect oral function.

4.1. Demographic and socioeconomic factors

4.1.1. Age and gender

Age is an independent risk factor for oral frailty. With the increase in age, oral mucosa atrophy, salivary gland function decline, and dental nerve sensitivity decrease, leading to weakened oral defense capabilities. A study by Wu *et al.* [3] showed that the probability of patients aged ≥ 80 years being classified into the severe oral frailty group was 3.968 times that of patients aged 60–69 years; Guo *et al.* [8] also found that the comorbidity risk of oral frailty and sarcopenia in elderly inpatients aged 75–79 years and ≥ 80 years was 2.530 times and 3.968 times that of patients aged 60–69 years, respectively. Gender differences are also significant, with a higher incidence of oral frailty in women than in men. A study by Wu *et al.* [1] showed that the incidence of oral frailty was 72.03% in women and 27.97% in men ($P < 0.001$), and the reason may be that the decrease in estrogen levels in women after menopause leads to alveolar bone osteoporosis and reduced saliva secretion from the oral mucosa, which is prone to xerostomia, periodontal disease, etc. [12].

4.1.2. Educational level and income

Patients with low educational levels have an increased risk of oral frailty due to the lack of oral health knowledge and poor compliance with health behaviors. A univariate analysis by Shao *et al.* [2] showed that the incidence of oral frailty in elderly patients with primary school education or below (38.31%) was significantly higher than that in patients with senior high school education or above (21.36%) ($P < 0.001$); Wu *et al.* [1] also found that patients with low educational levels had low e-health literacy, making it difficult for them to obtain oral health care knowledge through the Internet, which further exacerbates oral health problems. Income is related to the accessibility of oral medical services. The incidence of oral frailty in patients with a per capita monthly family income of $< 2,000$ yuan (30.51%) was significantly higher than that in patients with an income of $> 6,000$ yuan (5.08%), and low-income patients have difficulty in receiving regular oral examinations and treatments due to economic burdens, resulting in the accumulation and aggravation of oral problems [2].

4.1.3. Occupational status and social support

Being currently employed is a protective factor against oral frailty in elderly patients with chronic diseases. A binary logistic regression analysis by Shao *et al.* [2] showed that the risk of oral frailty in employed patients was 0.319 times that of unemployed patients ($OR = 0.319$, 95% CI : 0.199–0.512, $P < 0.001$), and the reason is that occupational activities can promote patients to maintain oral hygiene habits, and the increase in income can improve the accessibility of dental treatment [13]. Insufficient social support significantly increases the risk of oral frailty. A study by Wu *et al.* [1] showed that the incidence of oral frailty in patients with low social support was 53.3%, while that in patients with high social support was only 6.7% ($P < 0.001$); Guo *et al.* [8] also found that for each 1-point decrease in the social support score, the comorbidity risk of oral frailty and sarcopenia increased by 5.9% ($OR = 0.941$, 95% CI : 0.906–0.978, $P < 0.001$). Good social support (such as family members reminding patients to brush their teeth and accompanying them to see a doctor) can help patients maintain oral health behaviors and reduce oral problems.

4.2. Health status and disease-related factors

4.2.1. Type of chronic disease and number of comorbidities

The higher the degree of comorbidity of chronic diseases, the greater the risk of oral frailty. A study showed ^[3] that the probability of patients with ≥ 5 chronic diseases being classified into the severe oral frailty group was 6.729 times that of patients with 2 chronic diseases ($OR = 6.729$, 95% CI : 1.683–26.901, $P = 0.007$); the comorbidity risk of oral frailty and sarcopenia in elderly inpatients with ≥ 3 chronic diseases was 2.371 times that of patients without chronic diseases ($P < 0.001$) ^[8]. The coexistence of multiple chronic diseases leads to the aggravation of systemic inflammatory reactions and metabolic disorders, thereby affecting the oral microenvironment. For example, patients with hypertension have a higher incidence of periodontitis, and patients with stroke reduce the intake of hard foods due to swallowing disorders, which accelerates the atrophy of masticatory muscles ^[14,15]. Patients with specific chronic diseases have a higher risk of oral frailty. For instance, in the case of diabetes, the state of hyperglycemia reduces the resistance of the oral mucosa and increases the incidence of periodontal disease and dental caries. A study by Tian *et al.* ^[12] on elderly patients with type 2 diabetes in Taiyuan showed that the risk of oral frailty in patients with poor blood glucose control was 1.8 times that in patients with normal blood glucose. For maintenance hemodialysis patients, toxin accumulation and malnutrition caused by renal failure make the oral mucosa vulnerable to damage, and a study by Iwasaki *et al.* ^[16] showed that the incidence of oral frailty in this group was approximately 45%, and it was positively correlated with the incidence of malnutrition.

4.2.2. Polypharmacy

Polypharmacy is an important risk factor for oral frailty in elderly patients with chronic diseases. Patients who take ≥ 3 drugs for a long time may experience side effects of drugs (such as antihypertensive drugs and antidepressants), which can lead to reduced saliva secretion, decreased oral self-cleaning ability, and an increased incidence of xerostomia. A study by Wu *et al.* ^[3] showed that the probability of patients taking ≥ 3 oral drugs being classified into the severe oral frailty group was 20.441 times that of patients not taking drugs ($OR = 20.441$, 95% CI : 3.064–136.359, $P = 0.002$). In addition, drug interactions may exacerbate the imbalance of oral flora and induce oral inflammation ^[17].

4.2.3. Frailty and malnutrition

There is a two-way interaction between the frailty state and oral frailty. A study showed ^[2] that the incidence of oral frailty in frail patients was 2.8 times that in non-frail patients ($P < 0.001$). Frailty leads to a decrease in the muscle strength of the oral and maxillofacial region and a reduction in immunity, increasing the risk of oral bacterial growth; conversely, oral frailty causes chewing difficulties, which further aggravate malnutrition and exacerbate frailty ^[18]. Malnutrition is an independent risk factor for oral frailty. A binary logistic regression analysis by Shao *et al.* ^[2] showed that the risk of oral frailty in malnourished patients was 2.316 times that in well-nourished patients ($OR = 2.316$, 95% CI : 1.528–3.508, $P < 0.001$). Guo *et al.* ^[8] also found that the comorbidity risk of oral frailty and sarcopenia in malnourished patients was significantly increased ($OR = 0.212$, 95% CI : 0.074–0.609, $P = 0.004$). Nutrient deficiencies (such as protein and vitamins) can lead to a decrease in the activity of periodontal ligament cells and gingival atrophy, affecting the repair of oral tissues ^[19].

4.3. Behavioral and health literacy factors

4.3.1. Oral health behaviors

Poor oral health behaviors directly increase the risk of oral frailty. A study showed ^[1] that the incidence of oral

frailty in patients who brushed their teeth <2 times a day and did not visit a dentist every year was 68.6% and 72.1%, respectively, which was significantly higher than that in the group with good behaviors (31.4%, 27.9%, $P < 0.001$). Wu *et al.* [3] found that the proportions of patients in the mild oral frailty group who “brushed their teeth ≥ 2 times a day” and “visited a dentist every year” were 82.1% and 76.5%, respectively, which were significantly higher than those in the severe oral frailty group (45.8%, 32.4%, $P < 0.001$). In addition, the low frequency of chewing hard foods leads to insufficient exercise of oral muscles, accelerating the decline of masticatory function.

4.3.2. Lifestyle

Regarding diet structure, patients whose diet is mainly meat and who have a preference for salty, spicy, or greasy foods have an increased risk of oral frailty. A study showed [1] that the incidence of oral frailty in patients with a meat-based diet was 42.1%, which was significantly higher than that in patients with a vegetable-based diet or a balanced diet of meat and vegetables (19.0%, 38.9%, $P < 0.05$), and an unreasonable diet can lead to a lack of vitamins and minerals, affecting the health of oral mucosa [15]. In terms of physical exercise, a low frequency of weekly exercise increases the risk of oral frailty. Wu *et al.* [1] found that the incidence of oral frailty in patients who exercised <1 time a week was 57.6%, which was significantly higher than that in patients who exercised 1–3 times a week (31.4%, $P < 0.05$). It is speculated that exercise can improve oral function by increasing social interaction and promoting the activity of oral muscles [17].

4.3.3. Health literacy

Patients with low e-health literacy have a higher risk of oral frailty. A study using the eHealth Literacy Scale (eHEALS) showed [1] that the incidence of oral frailty in patients with low e-health literacy (<26 points) was 68.6%, which was significantly higher than that in the high literacy group (31.4%, $P < 0.001$). Patients with high e-health literacy can obtain oral health care knowledge through WeChat, popular science videos, etc., and attach more importance to the prevention of oral diseases; however, patients with low literacy have difficulty in forming scientific oral care habits due to the lack of information retrieval ability [6]. In addition, public health enthusiasm is also related to oral frailty. A study by Wu Min *et al.* [3] showed that for each 1-point increase in the public health enthusiasm index, the probability of patients being classified into the mild oral frailty group increased by 5.6% ($OR = 1.056$, 95% $CI: 1.037$ – 1.075 , $P < 0.001$), and patients with high health enthusiasm are more willing to actively cooperate with oral care interventions.

5. Intervention directions for oral frailty in elderly patients with chronic diseases

5.1. Precise screening and assessment

It is recommended to conduct regular oral frailty screening for elderly patients with chronic diseases (especially inpatients, the elderly, and those taking multiple medications). The OFI-8 scale, combined with the MNA-SF and frailty scale, should be used for comprehensive assessment to identify high-risk groups at an early stage [8]. For example, oral frailty screening should be completed within 24 hours of admission for inpatients, and personalized intervention plans should be formulated for those with a score of ≥ 4 ; in the community, family doctor contract services can be used to conduct oral frailty screening for elderly people with chronic diseases once a year.

5.2. Oral function and hygiene

For oral function training, aiming at patients with decreased chewing and swallowing functions, tongue pressure

resistance training, cheek puffing training, and training in chewing hard foods (such as pickled radishes and sugar-free chewing gum) are carried out to improve the strength of oral muscles^[20]. In terms of oral cleaning guidance, for patients with poor self-care ability, family members are guided to assist in brushing teeth using the “Bass method” and clean the interdental spaces with dental floss; for denture wearers, the adaptability of dentures is checked regularly, and denture cleaning methods (such as soaking in denture cleaner every day) are guided. For xerostomia management, for patients with xerostomia caused by drugs, the medication plan is adjusted under the guidance of doctors, the use of artificial saliva is recommended to relieve symptoms, and patients are encouraged to drink water in small amounts and frequently^[17].

5.3. Nutritional support and dietary guidance

For malnourished patients, personalized nutritional plans are formulated. The intake of high-quality protein (such as eggs, milk, and fish) is increased, with a daily protein intake of ≥ 1.2 g/kg body weight to promote the repair of oral mucosa and muscle maintenance^[7]; the texture of food is adjusted, such as making meat into minced meat and chopping vegetables, to facilitate consumption by patients with chewing difficulties, and overly salty, spicy, and greasy foods are avoided to reduce irritation to the oral mucosa; for patients with swallowing disorders, thickeners are used to adjust the viscosity of food to prevent choking and ensure nutrient intake^[20].

5.4. Social support and health education

To strengthen family support, family members are encouraged to participate in the oral care of patients, such as reminding them to brush their teeth and accompanying them to see a doctor; for elderly patients living alone, they are connected with community resources (such as home care services), and regular home visits are provided to assist in oral cleaning. In terms of diversified health education, for patients with low e-health literacy, oral health care knowledge is popularized through popular forms such as offline lectures, graphic manuals, and short videos; for patients with high literacy, digital resources such as WeChat official accounts and online courses are pushed to improve their self-management ability. For psychological intervention, for patients with comorbid depression, cognitive behavioral therapy and relaxation training are conducted to improve their emotional state and enhance compliance with oral care^[21].

5.5. Multidisciplinary collaborative management

A multidisciplinary team consisting of “doctors-nurses-dietitians-dentists” is established to formulate comprehensive plans for patients with comorbid chronic diseases. Doctors optimize the medication plan to reduce drugs that cause xerostomia and oral mucosa damage; nurses conduct oral care and health education; dietitians assess the nutritional status and formulate dietary plans; dentists conduct regular oral examinations and timely treat problems such as periodontal disease and dental caries.

6. Research limitations and prospects

Although progress has been made in the research on oral frailty in elderly patients with chronic diseases, there are still some shortcomings. In terms of research design, most studies are single-center cross-sectional studies, which can only reveal correlation relationships and cannot determine causality (such as the two-way influence mechanism between frailty and oral frailty), so multicenter longitudinal studies are needed for verification. In terms of sample representativeness, most studies focus on inpatients, with less attention paid to elderly patients

with chronic diseases in communities and nursing homes, and the research regions are mostly in Anhui, Henan, and other places, lacking national data. In terms of intervention research, existing studies mainly focus on status surveys and analysis of influencing factors, and there is insufficient verification of the effectiveness of intervention measures for different latent profiles (such as the severe oral frailty - low function group), so randomized controlled trials are needed.

Future research can be advanced in the following directions: conducting multicenter, large-sample longitudinal studies to explore the long-term development trend and causal mechanism of oral frailty; formulating specific intervention plans for different types of chronic diseases (such as diabetes and dialysis patients); developing a convenient oral frailty risk prediction model (such as a nomogram) to assist in the rapid identification of high-risk patients in clinical practice; combining “Internet +” technology, such as intelligent oral cleaning equipment and remote oral consultation, to improve the accessibility of interventions.

7. Conclusion

The incidence of oral frailty in elderly patients with chronic diseases is high, and it is affected by multiple factors such as demographic characteristics (advanced age, female gender, low education level), health status (comorbidity of chronic diseases, polypharmacy, frailty, malnutrition), behavioral habits (poor oral hygiene, unreasonable diet), social support, and health literacy, and there is also significant population heterogeneity. In clinical practice, it is necessary to strengthen the screening of oral frailty, formulate personalized intervention measures according to the characteristics of patients, and reduce the incidence of oral frailty and improve the oral health and quality of life of elderly patients with chronic diseases through measures such as oral function training, nutritional support, and strengthening of social support.

Disclosure statement

The authors declare no conflict of interest.

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