

Prevention and Control of Common Chronic Oral Diseases and Related Lifestyle Management

Ying Ying Li¹, Shu Jing Ruan¹, Xue Jing Lin¹, Diwas Sunchuri², Zhu Ling Guo^{1,3,*}

¹School of Dentistry, Hainan Medical University, Haikou, PR China

²School of International Education, Hainan Medical University, Haikou, PR China

³Department of Health Management Center, The First Affiliated Hospital of Hainan Medical University, Haikou, PR China

Email address:

604569033@qq.com (Zhu Ling Guo)

*Corresponding author

To cite this article:

Ying Ying Li, Shu Jing Ruan, Xue Jing Lin, Diwas Sunchuri, Zhu Ling Guo. Prevention and Control of Common Chronic Oral Diseases and Related Lifestyle Management. *American Journal of Health Research*. Vol. 10, No. 6, 2022, pp. 206-212. doi: 10.11648/j.ajhr.20221006.11

Received: October 24, 2022; **Accepted:** November 8, 2022; **Published:** November 23, 2022

Abstract: Halitosis, oral ulcer and dental caries are three common chronic oral diseases. With the development of medical technology, the treatment level of chronic oral diseases has been continuously improving, but the number of patients with chronic oral diseases is still high. About 10%~65% of people in the world have suffered from halitosis, about 12.3% of people often suffer from oral ulcers, and about 5 billion people suffer from dental caries. Epidemiological studies have shown that the frequent occurrence of halitosis, oral ulcers and dental caries is related to people's poor awareness of oral health care and prevention and control of chronic oral diseases. This paper discusses the correlation between the causes or incentives of oral odor, oral ulcer, dental caries and oral hygiene habits, and clarifies the risk factors related to the occurrence of these three diseases. That is to say, the food residue in oral cavity and the change of oral micro-ecological environment caused by inadequate oral cleaning are positively correlated with the occurrence of chronic oral diseases. The author believes that long-term poor oral hygiene habits are an important factor leading to the occurrence of chronic oral diseases, and further analyzes the effects of oral cleaning methods, frequency and duration on the occurrence and development of the above diseases, emphasizing that maintaining good oral hygiene helps to reduce the incidence of the above three chronic oral diseases. At the same time, this paper points out that excessive mental stress, irregular work and rest and eating habits, lack of exercise, low immune function and other factors will also promote the development of chronic oral diseases. By strengthening people's awareness of oral health care and teaching correct oral cleaning methods, we can put forward targeted life management methods for the three diseases of halitosis, oral ulcer and caries in terms of eating habits, bad habits, mental health and sports.

Keywords: Chronic Oral Diseases, Oral Hygiene Habits, Lifestyle Management, Oral Prevention

1. Introduction

Halitosis, oral ulcer and dental caries are three common chronic oral diseases that endanger human health. Inadequate oral cleaning causes a large amount of plaque and soft scale to accumulate, and after being decomposed by bacteria, it produces hydrogen sulfide, indole and other smelly substances to form halitosis; Poor oral hygiene makes the body vulnerable to pathogens when the immune system is low, resulting in oral ulcer; dental caries is the result of the joint action of multiple factors, the sucrose in the food residue provides good living conditions for the

cariogenic bacteria, and the cariogenic bacteria play caries-causing role after a certain period of time. Reducing the related risk factors is crucial to the prevention and control of the above three chronic oral diseases, and maintaining good oral hygiene habits is the key. Besides, mental stress, work and diet habits, exercise and other factors are also closely related to the occurrence of chronic oral diseases. Therefore, guiding people how to manage their lifestyles can effectively prevent and control the above three chronic oral diseases. Proper cleaning to maintain oral hygiene, mainly includes mastering the Bass brushing method, insisting on flossing to clean the gaps between

teeth, and regular dental scaling at dental clinics. Then, we will propose targeted preventive and control measures for halitosis, oral ulcer and caries. The prevention and control measures for halitosis mainly include cleaning the thick and excessive tongue coating, regular oral examination, timely treatment of the occurred diseases, smoking cessation and focusing on mental health. It is also necessary to promptly treat the diseases that cause non-oral halitosis. The prevention and control of oral ulcer mainly starts from four aspects: developing good dietary habits, maintaining regular work and rest with mental health, ensuring the adequate intake of nutrient elements and strengthening physical exercise. The prevention of caries includes reducing the intake of sucrose, implementing pit and fissure in children, applying fluoride and insisting on adequate hydration. By introducing the above prevention and control measures in detail and specifically, we can guide people to effectively prevent halitosis, oral ulcer and dental caries.

2. Common Chronic Oral Diseases

Oral odor, also known as halitosis, refers to the odor emitted from the mouth or other air-filled cavities such as nose, sinuses, and pharynx. The main component of the gas is volatile sulfide [1]. Halitosis is caused by many factors, and the main cause is oral local diseases. It can be divided into physiological halitosis and pathological halitosis.

Physiological halitosis is temporary, not a sign of disease. During starvation, oral mucosal cells secrete substances with odorous gases; eating some drugs or onions, garlic and other heavy flavor irritating food; the amount of saliva secretion decreases during smoking and sleep, and bacterial metabolism is active. A large amount of decomposition of food residues causes physiological halitosis. And healthy people's halitosis may also be due to poor oral habits and oral hygiene caused by thickened plaque at the back of the tongue.

The course of pathological halitosis lasts for more than several months. According to the source of exhaled odor, it is divided into oral halitosis and non-oral halitosis. 80%~90% of halitosis is caused by oral factors, including tongue coating, periodontal disease and bad oral hygiene habits. The remaining 10%~20% of halitosis is caused by extra-oral factors associated with systemic diseases [2]. The rich food debris and exfoliated cells in the tongue coating are conducive to the growth, reproduction and metabolism of oral anaerobic bacteria, and are decomposed to produce volatile sulfide. Patients with periodontal disease are often accompanied by a large number of dental stones, plaque and bacteria in the periodontal pocket can ferment to produce volatile sulfides and organic acids, which can lead to halitosis and caries. In addition, dental caries, impacted teeth, oral ulcers, dry mouth disease can lead to bacterial accumulation and food residues can cause halitosis. Halitosis caused by systemic diseases includes respiratory diseases such as rhinitis, pharyngitis, tonsillitis and digestive diseases such as reflux esophagitis and gastritis. In addition, odorous substances produced by metabolic diseases such as diabetic ketoacidosis and cirrhosis

enter the blood, and exhaled from the respiratory tract after lung exchange can also produce oral odor.

Oral ulcer is an oral mucosal disease characterized by local oral mucosal defect and ulceration. Yellow-white pseudomembrane can be seen on the surface of ulcer, surrounding mucosa congestion. Because the mucosal tissue layer contains rich blood vessels and nerves, the affected area is prone to bleeding, and the pain is obvious during the attack. The incidence of oral ulcers is high, and the prevalence of the general population can exceed 20%, and women are higher than men [3]. In most cases, it can heal itself in a week or two. According to the etiology, it can be divided into recurrent aphthous ulcer (RAU), traumatic oral ulcer, and disease-associated oral ulcer. RAU is the most common ulcer disease in oral mucosal diseases. It has the characteristics of periodicity, recurrence and self-limitation. It mostly occurs in cheeks, lips and tongue margins. The pathogenesis of oral ulcer is still unclear, which often occurs under the combined action of multiple factors. The potential causes include genetic, immune, psychological and stress, oral hygiene, food allergy, vitamin deficiency and so on. RAU has a genetic tendency, and some studies have pointed out that the change of polymorphism at a certain locus of IL-1 β or IL-23R gene is an important factor leading to RAU susceptibility [4, 5]. Research and analysis of the immunological etiology of RAU, T lymphocyte subsets disorders, ulcer and healing period CD4/CD8 differences and sIgA content in saliva below normal levels, etc. illustrate the presence of RAU episodes of immune dysfunction. The maintenance of oral mucosal integrity depends on normal immune function. The change of oral microecology is also related to the occurrence of RAU. Scholars found that the number of *Streptococcus* and *Veillonella* in saliva of ulcer group was lower than that of healing group, and the distribution in oral cavity was unbalanced [6]. When the immunity is low, the risk of bacterial and viral infections increases. Traumatic ulcers can be caused by mechanical injury, chemical burns, cold and heat stimulation. Oral ulcer is a manifestation of a variety of malignant diseases or secondary damage. In particular, the incidence of oral ulcers after chemotherapy for malignant tumors can be as high as 24.8%~67% [7]. Antitumor drugs are cytotoxic and easy to cause oral mucosal reactions, making oral ulcers one of the common complications of tumor chemotherapy.

Dental caries is a disease that leads to the progressive destruction of dental hard tissue under the action of multiple factors such as bacterial infection. It is classified by the United Nations World Health Organization as one of the top three non-communicable diseases. At present, the accepted etiology theory of dental caries is quadruple factor theory. Modern concept holds that caries is a disease caused by the ecological changes of oral biofilm flora [8]. Due to the frequent intake of fermented carbohydrates, oral flora imbalance, acid-producing, acid-resistant bacteria become the dominant flora. The change of biofilm activity causes the imbalance of demineralization and remineralization, which leads to the demineralization of dental hard tissue, and the

clinical manifestation is caries [9]. Bacteria are the main cause of caries. The Orland experiment has found that even fed to sterile rats high sucrose carious food will not occur caries, but in the same feeding conditions can be induced by inoculation of bacteria. The complexity of caries makes the classification principle more, which can be classified according to its anatomical site or lesion depth, or the incidence and progression rate. Caries is a chronic progressive disease, the presence of which can promote the development of halitosis [10]. Initial tooth surface will appear white plaque or tawny spots, the middle and late to cold, heat, sweet, acid sensitive, and the emergence of cavities, pain gradually increased. Delayed treatment can produce many complications such as dental pulp disease, periapical disease.

3. Relationship Between Oral Habits and Chronic Oral Diseases

Correct oral hygiene habits can prevent the occurrence and development of chronic oral diseases. Studies have shown that [11], people with halitosis in the number of daily brushing, time and use of dental floss worse than those without halitosis. It shows that the condition of oral hygiene has a direct impact on the occurrence of halitosis, but the maintenance of oral health depends not only on brushing teeth and flossing, but also on the cleanliness of the back of the tongue. Studies have shown that the degree of halitosis and tongue coating thickness and area were significantly correlated [12, 13]. Furred tongue produces more volatile sulfides, which is an important factor in the formation of halitosis. The anatomical structure of the dorsum of the tongue leads to the accumulation of tongue coating in the posterior part, so the more volatile sulfide is generated to the tongue base. The surface area of the back of the tongue is large, with many grooves and depressions, providing a favorable environment for the growth of bacteria. Studies have shown that [13] patients with the habit of brushing the tongue, halitosis detection rate was significantly lower than patients without the habit. Although brushing the tongue can not reduce the bacteria on the tongue, but the accumulation of bacterial substrate in the tongue and fissure can be significantly reduced, thereby reducing the concentration of volatile sulfide in the oral cavity.

The presence of bacteria is the main condition of dental caries. Dental plaque is an important environment of dental caries. Inadequate oral cleaning can lead to plaque accumulation and increase the risk of caries. Saliva contains many organic and inorganic substances, which have the functions of cleaning, buffering and bacteriostasis, and can reduce plaque accumulation. Studies have found that the concentration of SIgA in saliva of people with high incidence of caries is low, and SIgA has antibacterial effect [14]. Therefore, saliva plays a regulatory role in the occurrence of dental caries. The high incidence of dental caries is childhood, oral health behavior intervention on children with dental caries has a positive impact [15]. In addition, oral hygiene

habits, living habits and caries are closely related. Studies at home and abroad have shown that the incidence of caries in people who like sweets and carbonated drinks is significantly increased, because the rich sucrose produces lactic acid under the action of bacteria, resulting in dental structure damage and caries [16-18]. The incidence of dental caries is significantly reduced in patients who brush their teeth more than twice a day and use fluoride toothpaste. The fluoride content of toothpaste needs to reach 1500 ppm [9, 10]. In addition, food residues in cavities and diastemata can lead to the generation of corrupt smells, resulting in halitosis. At the same time, there is an association between periodontal pathogens and halitosis [19]. Therefore, adjusting the balance of oral microorganisms can help to improve or eliminate the symptoms of halitosis.

Healthy oral hygiene habits effectively inhibit the growth and reproduction of various microbial bacteria in the mouth, and also reduce the incidence of oral ulcers. Studies have shown [20] that the occurrence of oral ulcers and brushing time are related to the length of time, sufficient brushing time can reduce the occurrence of oral ulcers independent risk factors. Although there is no correlation between the number of brushing teeth per day and the occurrence of oral ulcers, studies have confirmed that, it is negatively correlated with the recurrence rate of refractory oral ulcers [20, 21]. Rough brush, hard bristles can damage the oral mucosa, and improper brushing can lead to oral bacteria breeding, the above incentives can increase the probability of relapse of intractable oral ulcers. Recurrent aphthous ulcer (RAU) is the most common oral mucosal disease. Poor eating habits can affect the composition and physiological function of oral mucosa. Epidemiological studies have shown that smoking, alcoholism, betel quid chewing are risk factors for oral mucosal disease, which can significantly increase the possibility of oral mucosal lesions. The risk factors superimposed on each other will increase its harm [28]. A case-control study reported that combination of chewing tobacco, betel nut, smoking and alcohol, increases the risk of oral cancer by 11 times [22]. The International Association for Research on Cancer classifies areca nut, tobacco and alcohol as a class of carcinogens. Among them, areca nut is the most important cause of oral submucous fibrosis (OSF), which belongs to precancerous lesions. Hunan, Hainan and other places are rich in betel nut and have the habit of chewing betel nut, so the occurrence of OSF is mostly regional. In addition, the survey showed that the proportion of oral cancer patients with a history of smoking was significantly higher than the control group and there were statistical differences. The longer the smoking time, the greater the amount of smoking, the higher the risk [23]. Usually 98% of patients with oral ulcers will have food intolerance, mainly manifested as increased specific IgG antibodies. [24] Once ingestion is stopped, oral ulcers tend to improve. Studies have shown that the content of iron, zinc, folic acid and vitamin B in the serum of patients with oral ulcer is low [25]. Appropriate supplementation of trace elements in patients with oral ulcers has been found to reduce

or alleviate the occurrence and development of oral ulcers.

4. Prevention and Control of Halitosis, Oral Ulcer, Caries and Lifestyle Management

4.1. Proper Cleaning to Maintain Oral Hygiene

4.1.1. Correct Toothbrushing Method

A clinical study on children's oral health education and brushing effect showed that the plaque clearance rates of children's oral cavity before and after oral health education were 9.98 % and 30.97 %, respectively ($P < 0.05$), indicating that oral health education is helpful for children to master correct brushing methods and improve oral cleaning efficiency [26]. Some scholars have compared the modified Bass method and the vertical brushing method through experiments. The results show that the modified Bass brushing method is significantly better than the vertical brushing method for the entire oral cavity, especially the central gingival margin ($P < 0.05$) [27]. It shows that the modified Bass brushing method is a more effective method for removing plaque and is worth promoting. In addition, the time of brushing teeth also needs to be paid attention to. One experiment found that the longest 180 seconds removed the most plaques, and the comparison of plaque index before and after brushing teeth for 30 ~ 180 seconds was $P < 0.0001$. Therefore, the brushing time should last 3 minutes or even longer to achieve better cleaning effect [28].

4.1.2. Use Dental Floss Consistently

Studies have shown that brushing and flossing is one of the simplest ways to prevent dental caries [29]. Because brushing teeth for two teeth contact surface cleaning force is low, daily brushing can only remove 65% of dental plaque, there are 35% of dental plaque in the adjacent surface. Tooth floss is an oral cleansing tool that removes food debris and plaque where toothbrushes cannot reach [30]. Studies have shown that compared with the no interdental cleaning group, interdental cleaning ≥ 7 times / week was prospectively associated with the probability of self-rated good oral health, and the probability of gingival bleeding was lower [31]. Adherence to the use of dental floss can accurately remove dental plaque between teeth and reduce the incidence of oral diseases.

4.1.3. Periodic Supragingival Scaling

The Fourth National Oral Epidemiology Survey released by the National Health Commission shows that the detection rate of dental stones in residents aged 35-45 in China is as high as 96.7 %, and the detection rate of gingival bleeding is 87.4 %. Because the formed dental calculus cannot be removed by brushing teeth, supragingival scaling should be performed regularly. It is an oral cleaning method that uses an ultrasonic device to wash the dental calculus on the surface of the tooth or 2 ~ 3mm below the gingiva. Supragingival scaling can effectively remove the formed dental plaque and dental calculus, and can also polish the

tooth surface, so that the dental plaque and dental calculus are not easy to attach on the smooth tooth surface, maintaining tooth cleanliness. The ' Chinese Oral Health Guide ' advocates supragingival scaling once a year.

4.2. Targeted Prevention and Control Measures and Lifestyle Management

4.2.1. Halitosis

Cleaning tongue coating. Studies have shown that [32], patients with periodontitis and gingivitis who cleaned their tongues daily in the morning before brushing their teeth reduced their oral odor parameters after seven days ($P < 0.05$), cleaning the tongue helps reduce halitosis. The degree of halitosis is positively correlated with the existence of tongue coating, the thickness and range of tongue coating [1]. Overly thick tongue coating is also a source of halitosis, therefore, patients should pay attention to the cleaning of tongue dorsum in daily oral cleaning. For patients with periodontitis, cleaning tongue coating and periodontal treatment can effectively reduce halitosis, while for patients with gingivitis, only cleaning tongue coating can effectively reduce halitosis [32].

Regular oral examination. Regular oral examination can detect dental caries, periapical periodontitis, pulpitis and other diseases in time, perform root canal treatment and filling restoration on diseased teeth, relieve gingival bleeding, maintain dental surface cleaning and root surface leveling. Treatment of oral diseases can effectively prevent and control oral halitosis.

Smoking cessation. Studies have found that [33], halitosis exists in 80 % of smokers, smoking and halitosis have statistically significant correlation ($P < 0.05$). The reason why smoking can increase the incidence of halitosis is that free radicals in smoke can be converted into thiol compounds in the mouth, and can also destroy oral mucosal cells and degrade into volatile sulfides. Therefore, quitting smoking can effectively reduce halitosis. It is recommended that patients with halitosis who have a smoking habit should quit smoking as soon as possible [34].

Focus on mental health. Studies have shown that patients with halitosis have a negative correlation between halitosis sensory test scores and psychological status scores assessed using the Cornell Medical Index [35]. In addition, there was a significant correlation between the degree of halitosis and the tendency of neurosis ($P < 0.05$) [36]. Combining work and rest, maintaining regular life and adequate sleep can prevent halitosis caused by neurological disorders caused by anxiety, depression and other negative emotions caused by excessive stress.

Treating diseases that cause non-oral halitosis. Experiments have shown that 75% of patients with abnormal halitosis (abnormal halitosis determination=285.2ppb) were detected with tonsil stones, and patients with tonsil stones increased the risk of halitosis by 10 times compared with normal people [37]. Halitosis is significantly associated with gastroesophageal reflux disease ($P < 0.05$) [38]. Halitosis is a common symptom of gastroesophageal reflux disease and is

considered as a clinical manifestation of gastroesophageal reflux disease outside the esophagus [39]. Studies have shown that gastritis caused by *Helicobacter pylori* may affect the oral environment and aggravate halitosis. [40] It can also produce urease to decompose urea to produce odorous ammonia. In addition, some scholars have pointed out that *Helicobacter pylori* can induce high expression of cystathionine γ -lyase, cystathionine β -synthetase and interleukin (IL) such as IL-1 β , IL-6 and IL-8 genes. Cause the body to produce more H₂S and cause halitosis [41]. Therefore, the treatment of the above diseases can reduce the occurrence of non-oral halitosis.

4.2.2. Oral Ulcer

Maintaining mental health and regular work and rest. A large-scale GWAS summary statistics and two-sample two-way MR analysis have shown that [42] autism spectrum disorder, insomnia, major depression and emotional instability increase the risk of oral ulcers, while subjective well-being plays a protective role in preventing the occurrence of oral ulcers. Learning to adjust the good mentality, relieving stress, keeping a happy mood can effectively prevent mental factors caused by oral ulcers. At the same time, mental health also helps to maintain regular work and rest and ensure good sleep quality, so that the body's immune function can be exercised normally, reducing the chance of pathogen invasion.

Developing good eating habits. Avoiding sharp food entrance, such as shrimp, crab, shellfish and other shelled edible can not only prevent oral ulcers caused by traumatic factors, but also avoid the formation of oral ulcers increased. Daily diet less spicy stimulation and hot food, light diet, eating when chewing slow throat, can effectively reduce the damage of oral mucosa.

Adequate nutrient elements intake. Studies have shown that the lack of zinc, iron, copper, folic acid, vitamin B12 and superoxide dismutase, etc., can lead to the occurrence of oral ulcers. In the daily diet should pay attention to the supplementation of these nutrients to prevent oral ulcers [43].

Strengthening physical exercise. Adhering to physical exercise in daily life helps to enhance physical fitness, improves the body's immunity, and can effectively prevent the invasion of pathogens. Moreover, people should choose suitable sports according to their own health condition to avoid damage from irrational exercise.

4.2.3. Caries

Sucrose intake reduction. Some oral bacteria can use sugars in food and beverages to produce lactic acid-like acid. Acid accumulation reduces the pH of the tooth surface to below 5.5 and causes the enamel demineralization. In addition, experiments have shown that the content of Ca and F in plaque decreases with the increase of sugar intake frequency, which reduces the ability of plaque minerals to inhibit enamel demineralization and promote remineralization [44]. Reducing the intake of foods with high sucrose content such as candy, carbonated drinks, and

desserts in the daily diet and cleaning the teeth regularly and effectively helps to prevent the formation of plaque [45], thus preventing cariogenic bacteria from producing acid to destroy the inorganic material that dissolves the teeth.

Pit and fissure sealing in children. Experimental studies have found that the children in the reference group were given routine health knowledge propaganda, oral care and routine oral cleaning. The children in the study group were given pit and fissure sealing. The dental caries rate and dental caries incidence of the children in the reference group at 3, 6 and 12 months after treatment were significantly higher than those in the study group ($P < 0.05$). The results showed that pit and fissure sealing was effective. Pit and fissure sealing was performed by applying sealant to the pit and fissure of the children's teeth. The sealant became harder after drying, resulting in a protective barrier, which could protect the teeth from erosion and destruction of foreign bodies such as acidic metabolites and bacteria, and avoid the damage of dental hard tissue [46]. Therefore, pit and fissure sealing can play a better role in protecting dental tissue.

Fluoride application. Fluoride can inhibit bacterial glycolysis, prevent enamel demineralization and promote remineralization of early enamel lesions, and enhance the anti-caries ability of teeth. The use of fluoride toothpaste is the easiest way to apply fluoride. Studies have shown that [47] using fluoride toothpaste in daily brushing can reduce the risk of caries by about 25 %. Most of the studies on fluoride dentifrice to prevent permanent tooth decay are aimed at children and adolescents. A meta-analysis of one study showed that the use of fluoride standard dentifrice containing 1000-1450 ppm reduced caries by 22% [48]. In addition, dental fluoride is also a common way of local fluoride caries prevention in clinical practice. This method is to add fluoride to the organic solution on the surface of the tooth. The fluoride in the coating can release fluoride ions on the enamel surface, thus playing an anti-caries effect.

Adequate hydration. Insisting on drinking more water in daily life can flush the mouth and take away food debris. At the same time, drinking more water can also stimulate the secretion of saliva and keep the mouth moist, thus playing a role in cleaning the surface of the teeth and protecting them.

4.3. Suggestions

It is recommended that dentists and oral hygienist can add lifestyle management measures related to chronic oral diseases to daily education and medical orders after treatment, improve people's awareness of managing lifestyles to prevent and control chronic oral diseases, and gradually establish a complete lifestyle management system for oral diseases and even other systemic diseases from prevention to treatment.

5. Conclusion

The risk factors of halitosis, oral ulcer and caries are

reflected in many aspects of daily life. Reasonable management of related lifestyles can effectively prevent and improve these three common chronic oral diseases.

Funding

This research was funded by Teaching Achievement Award Cultivation Project of Hainan Medical University (HYjcp202217), High-level Talents Project of Hainan Natural Science Foundation (821RC687), Education Department of Hainan Province (Hnjg2021-60), Course Construction Project of Hainan Medical University (HYZD202215), Education Research Project of Hainan Medical University (HYJW202117).

References

- [1] Fan-Xing X U, Xiao-Yu L I, Liu H, et al. Etiology and Treatment of Intra-oral Halitosis [J]. *Progress in Modern Biomedicine*, 2011, 11 (04): 791-794.
- [2] Memon Maaz Anwer, Memon Hifza Anwer, FaizanEMuhammad, Fahad Shehzad, Siddiqui Amna, Lee Ka Yiu, Tahir Muhammad Junaid, Yousaf Zohaib. The aetiology and associations of halitosis: a systematic review [J]. *Oral diseases*, 2022, 00: 1-7.
- [3] Yuan-Yuan LI, Wang X W. Research Advances in Treatment of Recurrent Oral Ulcer [J]. *Chinese Journal of Experimental Traditional Medical Formulae*, 2011, 17 (11): 270-273.
- [4] Hai-tao S U N, Xiao-dong F. Correlation analysis on single nucleotide polymorphism of IL-23 receptor gene to susceptibility and clinical efficacy of recurrent oral ulcer [J]. *Shanghai Journal of Stomatology*, 2020, 29 (4): 418-422.
- [5] ZHANG Yue, SUN Ke, JIANG Xiubo. Association of interleukin-1 β /interleukin-6 gene polymorphisms with susceptibility to recurrent oral ulcer: a Meta-analysis [J]. *Journal of Precision Medicine*, 2019, 34 (3): 215-219.
- [6] REN X, ZHANG K, ZHOU L, et al. Changes of oral microecological flora and cellular immune function in patients with recurrent oral ulcer at different disease stages. *Chin J Microecol*, 2021, 33 (05): 537-576.
- [7] Robins-Sadler G, Stoudt A, Fullerton J T, et al. Managing the oral sequelae of cancer therapy [J]. *Medsurg nursing*, 2003, 12 (1): 28.
- [8] Khan, Hasham. Changing concepts in cariology: forty years on (dent update 2013; 40: 277–286) [J]. *Dental Update*, 2013, 40 (10): 853-853.
- [9] CHEN Z, CHEN R. Dental Caries Revisited [J]. *Journal of Oral Science Research*, 2020, 36 (1): 1.
- [10] Butera A, Maiorani C, Morandini A, et al. Evaluation of Children Caries Risk Factors: A Narrative Review of Nutritional Aspects, Oral Hygiene Habits, and Bacterial Alterations [J]. *Children*, 2022, 9 (2): 262.
- [11] Zhan J Y. Epidemiological features and associated factors of halitosis [J]. *Chin J Dent Mater Dev*, 2013, 22 (4): 4.
- [12] Wang J, He L. Effect of mechanical self cleaning of tongue coating on malodor in halitosis patients originating from tongue coating [J]. *Beijing Da Xue Xue Bao*, 2017, 49 (2): 344-348.
- [13] Chen X L, Wei Y E, Tang C. Analysis of oral malodor-related factors [J]. *Journal of Clinical Stomatology*, 2013, 29 (05): 259-262.
- [14] Xiao-Xiao LI, Zhi-Xiang LI, Dong N, et al. Correlation between salivary oxidative stress and immune indexes and the severity of dental caries in children [J]. *Chin J Diffic and Complete Cas*, 2022, 21 (01): 69-73.
- [15] Hong-Ying W U, Wang Y Y, Wang H M, et al. The effects of different intervention methods on oral hygiene knowledge and dental caries in children [J]. *Chinese Journal of Health Education*, 2016, 32 (08): 707-710.
- [16] Zhou Z. Analysis of oral health and dental caries of college students [J]. *Journal of Hangzhou Teachers College (Medical Edition)*, 2008, (01): 32-34.
- [17] Shen K, Feng Q. Analysis on the prevalence of permanent teeth caries and influencing factors among some middle school students in Shaoxing city [J]. *Oral Biomedicine*, 2022, 13 (01): 45-49.
- [18] Badruddin I A, Kiptiyah N M, Prihartono N, et al. The Association between Sweet Food Consumption, Time of Tooth Brushing and Dental Caries Experience in 12- to 15-Year-old Children in Indonesia (Analysis of Indonesian Health Basic Research Data, 2013) [J]. *Journal of International Dental and Medical Research*, 2017, 10 (S): 583-589.
- [19] Shan C, Ye W. Microorganisms related to intra-oral halitosis and generation mechanism of volatile sulfur compounds [J]. *Stomatology*, 2020, 40 (09): 864-868.
- [20] Jing X U, Ming-Feng W U, Wei-Zi W U. Logistic regression analysis of pathogenic factors for oral ulcer in adolescents [J]. *Journal of Clinical and Experimental Medicine*, 2007 (05): 27-28.
- [21] Feng W, Qiu Y, Stomatology D O. Logistics Regression Analysis of Causes of Recurrence of Intractable Oral Ulcer [J]. *Journal of Preventive Medicine of Chinese People's Liberation Army*, 2018, 36 (05): 654-656+660.
- [22] Rumgay H, Murphy N, Ferrari P, et al. Alcohol and cancer: epidemiology and biological mechanisms [J]. *Nutrients*, 2021, 13 (9): 3173.
- [23] Jin-ye F U, Jing G A O, Jia-wei Z, et al. Epidemiologic study of risk factors of oral cancer [J]. *China Journal of Oral & Maxillofacial Surgery*, 2011, 9 (4): 316-322.
- [24] Wang X, Stomatology D O, Hospital J P, et al. Clinical Study on the Treatment of Recurrent Oral Ulcer With Diet Control [J]. *China Health Standard Management*, 2015, 6 (19): 69-71.
- [25] Tong S, Wang X, Zhang B. Study on the relationship between the trace elements, folic acid, vitamin B₁₂ and recurrent oral ulcer [J]. *Laboratory Medicine and Clinic*, 2018, 15 (12): 1704-1706.
- [26] Zhang Huafang. Clinical research of children's oral health education and brushing effect [J]. *China medicine and pharmacy*, 2012, 2 (24): 135-136.
- [27] Zhang Jing-hua, Sha Yue-qin, Cao Cai-fang. Comparative study of the effects of removing plaque by two toothbrushing methods [J]. *Beijing da xue xue bao. Yi xue ban = Journal of Peking University. Health sciences*, 2005, 37 (5): 542-4.

- [28] George J, John J. The Significance of Brushing Time In Removing Dental Plaque [J]. International Journal of Dentistry and Oral Science, 2016, 3 (804): 315-317.
- [29] Kim SeonJip, Lee JaeYoung, Kim SeHee, Cho HyunJae. Effect of interdental cleaning devices on proximal caries [J]. Community dentistry and oral epidemiology, 2021, 50 (5): 414-420.
- [30] Stavrakis Adrian K., Kojić Sanja, Petrović Bojan, Nešković Isidora, Stojanović Goran M.. Performance Evaluation of Dental Flosses Pre- and Post-Utilization [J]. Materials, 2022, 15 (4): 1522.
- [31] B. W. Chaffee, D. Persai, M. V. Vora. Interdental Cleaning and Oral Health Status in an Adult Cohort, 2015 to 2018 [J]. Journal of Dental Research, 2020, 99 (10): 1150-1156.
- [32] Khady Ka. Periodontal Treatment Combined With Tongue Cleaning Reduces Oral Malodor Among Patients With Periodontitis, Whereas for Patients With Gingivitis, Tongue Cleaning Alone is Sufficient [J]. The Journal of Evidence-Based Dental Practice, 2012, 12 (3): 159-161.
- [33] Setia Saniya, Pannu Parampreet, Gambhir Ramandeep Singh, Galhotra Virat, Ahluwalia Pooja, Sofat Anjali. Correlation of oral hygiene practices, smoking and oral health conditions with self perceived halitosis amongst undergraduate dental students [J]. Journal of natural science, biology, and medicine, 2014, 5 (1): 67-72.
- [34] Almas Khalid, Al-Hawish Abdullah, Al-Khamis Waheed. Oral hygiene practices, smoking habit, and self-perceived oral malodor among dental students [J]. The journal of contemporary dental practice, 2003, 4 (4): 77-90.
- [35] Suzuki Nao, Yoneda Masahiro, Naito Toru, Iwamoto Tomoyuki, Hirofujii Takao. Relationship between halitosis and psychologic status [J]. Oral surgery, oral medicine, oral pathology, oral radiology, and endodontics, 2008, 106 (4): 542-547.
- [36] T Oho, Y Yoshida, Y Shimazaki, Y Yamashita, T Koga. Psychological condition of patients complaining of halitosis [J]. Journal of Dentistry, 2001, 29 (1): 31-33.
- [37] Rio A C Dal, Franchi-Teixeira A R, Nicola E M D. Relationship between the presence of tonsilloliths and halitosis in patients with chronic caseous tonsillitis [J]. British dental journal, 2008, 204 (2): E4.
- [38] Scully Crispian, Greenman John. Halitosis (breath odor) [J]. Periodontology 2000, 2008, 48 (1): 66-75.
- [39] Moshkowitz M, Horowitz N, Leshno M, Halpern Z. Halitosis and gastroesophageal reflux disease: a possible association [J]. Oral diseases, 2007, 13 (6): 581-5.
- [40] Nao Suzuki, Richiko Beppu, Masahiro Yoneda, Toru Takeshita, Mikari Asakawa, Yoshihisa Yamashita, Takashi Hanioka, Takao Hirofujii, Tetsuo Shinohara. Effects of eradication of *Helicobacter pylori* on oral malodor and the oral environment: a single-center observational study [J]. BMC research notes, 2020, 13 (1): 406.
- [41] Lee Jeong Sang, Kwon Kwang An, Jung Hyeon Sik, Kim Joo Hyeon, Hahm Ki-Baik. Korea red ginseng on *Helicobacter pylori*-induced halitosis: newer therapeutic strategy and a plausible mechanism [J]. Digestion, 2009, 80 (3): 192-9.
- [42] Wang Kai, Ding Lin, Yang Can, Hao Xingjie, Wang Chaolong. Exploring the Relationship Between Psychiatric Traits and the Risk of Mouth Ulcers Using Bi-Directional Mendelian Randomization [J]. Frontiers in Genetics, 2020, 11: 608630-608630.
- [43] Tong Shuqing, Wang Xiaoyang, Zhang Bingchang. Study on the relationship between the trace elements, folic acid, vitamin B₁₂ and recurrent oral ulcer [J]. Laboratory medicine and clinic, 2018, 15 (12): 1704-1706.
- [44] Xing Yongjun, Liu Luchuan, Han Xu, Lv Xiaoning. The relationship between the mineral content of dental plaque formed in the frequent sucrose exposure and enamel demineralization in 7 days [J]. Journal of oral science research, 2005 (01): 23-26.
- [45] Dental Plaque and Etiology of Dental Caries [J]. Journal of Oral Hygiene & Health, 2022, 10 (1): 296.
- [46] You Didi. Exploration on the clinical effect of pit and fissure sealing technique in preventing dental caries in school-age children [J]. Journal of Liaoning Normal Colleges (Natural science edition), 2021, 23 (04): 82-84.
- [47] Creeth Jonathan, Zero Domenick, Mau Melissa, Bosma Mary Lynn, Butler Andrew. The effect of dentifrice quantity and toothbrushing behaviour on oral delivery and retention of fluoride in vivo [J]. International dental journal, 2013, 63 Suppl 2 (Suppl. 2): 14-24.
- [48] Walsh Tanya, Worthington Helen V, Glenney Anne-Marie, Appelbe Priscilla, Marinho Valeria Cc, Shi Xin. Fluoride toothpastes of different concentrations for preventing dental caries in children and adolescents [J]. The Cochrane database of systematic reviews, 2010 (1): CD007868.