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Child Oral Health Management: Prevention, Early Diagnosis, and Intervention Strategies

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Abstract

This paper explores various aspects of childhood oral health management, including prevention, early diagnosis, and intervention strategies. This paper reviews the epidemiological data of pediatric oral diseases, highlighting the high incidence of dental caries and periodontal disease in the pediatric population. This paper details multiple preventive measures, such as the use of fluoride and the importance of oral health education, which can help to reduce the incidence of oral diseases. This paper analyzes early diagnostic techniques and therapeutic approaches, including digital imaging and laser diagnostic techniques, highlighting the key role of these techniques in early detection and intervention in oral diseases. This paper presents a series of intervention strategies to improve the oral health of children through integrated management. The results show that systematic prevention and early intervention measures have significant effects in controlling and reducing oral diseases in children.

Keywords: children's oral health, preventive measures, early diagnosis, intervention strategies

1. Introduction

1.1 Research Background

Childhood oral health is one of the key issues of global public health concern. Oral health not only affects children's chewing, pronunciation and appearance, but also is closely related to systemic health, especially in the growth and development stage, oral diseases may have a profound impact on their physical and mental health. In recent years, epidemiological data on oral diseases in children indicate that dental caries and periodontal disease show a high incidence trend globally, especially in developing countries and low-income households. This situation not only increases the financial burden of the family, but also causes great pressure on the social medical resources. The development of modern medical technology and public health strategies offers new opportunities in the prevention and treatment of childhood oral diseases. Early prevention, timely diagnosis, and effective intervention have become important strategies to improve children's oral health. The use of fluoride and oral health education have been shown to be effective preventive measures. The development of early diagnosis techniques such as digital imaging and laser fluorescence diagnosis has enabled the early detection and treatment of oral diseases.

Although multiple studies have demonstrated the significant impact of early prevention and intervention on children's oral health, there are still many challenges in implementing these measures. These challenges include the lack of oral health knowledge among parents and children, the uneven distribution of medical resources, and the shadow of socioeconomic factors. It is of great significance to fully understand the current situation and development trend of children's oral health management, and to propose feasible prevention and intervention strategies to improve the overall health level of children. This study analyzes the epidemiological data on children's oral health, explores existing prevention and diagnosis methods, and proposes improvement measures

and implementation strategies in order to provide a scientific basis for public health policy makers and clinical practice.

1.2 Study Purpose

The main objective of this study is to systematically explore various aspects of childhood oral health management, including the analysis of epidemiological data, evaluation of preventive measures, application of early diagnosis techniques, and the implementation of effective treatment and intervention strategies. Through this study, we hope to achieve the following specific objectives: a comprehensive understanding of the epidemiological status of oral diseases in children, especially the incidence of dental caries and periodontal disease and their differences in different regional and socioeconomic contexts. This analysis will help us to identify high-risk populations and provide data support for the development of targeted prevention strategies. To assess the effectiveness of various preventive measures, including fluoride use, oral hygiene education, dietary control, and regular dental examinations. Through a systematic evaluation of these measures, we hope to identify the most effective prevention methods and explore how they can be generalized and implemented in different settings. To study the development of early diagnostic techniques and their effect in practical application. We will analyze the comparison of traditional diagnostic methods and modern diagnostic techniques (e. g., digital imaging and laser fluorescence diagnosis) to evaluate their role and effect in the early detection and treatment of oral diseases. To propose a comprehensive set of treatment and intervention strategies to improve the overall level of pediatric oral health through personalized treatment programs and multidisciplinary collaboration. These strategies not only include clinical treatment but will also cover preventive and educational interventions at the community and school level to ensure full coverage and sustained effects of the intervention.

1.3 Study Significance

Studying child oral health management has important theoretical and practical implications. Theoretically, this study will enrich and improve the academic research in the field of children's oral health. Through the systematic analysis and summary of the epidemiological data, preventive measures, diagnostic techniques and intervention strategies of childhood oral diseases, it can provide a new perspective and scientific basis for the research of related disciplines. In a practical sense, this study will provide an empirical basis for the development and implementation of public health policies. Children's oral health is not only related to the health and well-being of individuals, but also directly affects the allocation of medical resources and the economic burden of families and society. By studying the oral health status and their influencing factors in different regions and populations, it can help policy makers to develop more targeted and effective public health policies, optimize resource allocation, and improve the effectiveness of prevention and intervention.

This study will also facilitate the improvement and optimization of clinical practice. By evaluating and comparing the effectiveness of various prevention and diagnostic methods, proposing scientific and rational treatment and intervention strategies can provide practical guidance and reference for clinicians and oral health practitioners, so as to improve the level of prevention and treatment of pediatric oral diseases. Especially in resource-limited areas and among low-income people, promoting effective preventive and treatment measures could significantly improve the oral health status of these groups. This study will enhance public attention and awareness of childhood oral health. Through publicity and education activities, improve the oral health knowledge and self-care awareness of parents and children, can reduce the occurrence of oral diseases at the source, cultivate good oral hygiene habits, so as to achieve long-term health benefits.

2. Epidemiological Data of Oral Diseases in Children

2.1 Type of Oral Diseases

2.1.1 Dental Caries

Dental caries is one of the most common oral diseases in children, with high morbidity and widespread impact. According to the latest epidemiological data, about 60% of children worldwide experience at least one dental caries before the age of 12 years. The incidence of dental caries is particularly noteworthy in China. The data show that about 50% of 5-year-olds and 70% of 12-year-olds have varying degrees of caries. The prevalence of dental caries in preschool children is about 60%, and even up to 70% in school-age children. These data suggest that caries is not only high in preschool children but continues to increase after entering puberty. The high incidence of dental caries is mainly related to poor dietary habits (e.g., high-sugar diet), poor oral hygiene awareness (e.g., irregular brushing) and lack of preventive oral healthcare measures (e.g., fluoride use and regular dental visits). These conditions have profound effects on children's quality of life and long-term health and are therefore critical for the prevention and treatment of dental caries.

2.1.2 Periodontal Disease

Periodontal disease is another common oral disease in children, mainly including gingivitis and periodontitis.

Gingivitis is an inflammation of the gums, often seen as redness, bleeding and pain; if left untreated, it may develop into more severe periodontitis, resulting to loosening or even loss. According to epidemiological data, about 20% of children worldwide have different degrees of periodontal disease at school age. In China, about 15% of 5-year-olds and 25% of 12-year-olds are diagnosed with periodontal disease. The high incidence of periodontal disease is mainly related to poor oral hygiene, dental plaque accumulation, genetic factors, and dietary habits. This problem is further exacerbated by changes in lifestyle and dietary especially in developed and developing countries. Early prevention and intervention such as proper brushing methods, use of dental floss and regular dental examinations can be effective in reducing the incidence and severity of periodontal disease. Strengthening the prevention and treatment of periodontal disease is of great significance for the protection of children's oral health.

2.2 Epidemiological Status Quo

2.2.1 Global Oral Health Status of Children

There are significant differences in childhood oral health status worldwide, with the incidence and severity of oral diseases varying between regions and countries. According to the World Health Organization, dental caries is the most prevalent oral disease among children worldwide, especially in low-and middle-income countries. In these areas, about 60% – 90% of school children have caries, while childhood caries prevalence in high-income countries is relatively low but still significant. For example, the incidence of childhood dental caries has decreased significantly through the implementation of comprehensive oral health care policies. Periodontal disease is also quite prevalent among children worldwide. Studies have shown that about 20% of school-age children are affected by gingivitis to varying degrees, possibly developing periodontitis in severe cases. Malnutrition, poor oral hygiene practices, and lack of professional oral health services are the main causes of these problems. Especially in low-resource areas, the lack of preventive care and early treatment have exacerbated oral health problems. With the global dietary changes, especially the increasing consumption of high-sugar foods and beverages, oral health problems in children are increasingly serious. To improve the oral health status of children worldwide, countries need to strengthen the implementation of public health policies, promote effective prevention and interventions, and raise public awareness of oral health.

2.2.2 Oral Health Status of Chinese Children

The oral health status of Chinese children has attracted much attention in recent years, and relevant data indicate that oral diseases have a high incidence in Chinese children. According to the data of the Third National Oral Health Epidemiological Survey in China, about 50% of 5-year-old children and 70% of 12-year-old children suffer from different degrees of dental caries. The high incidence of dental caries is mainly related to high sugar diet, poor oral hygiene habits and insufficient preventive oral health measures. Periodontal disease is also more prevalent in Chinese children, especially with significant differences between urban and rural areas. Studies have shown that about 15% of 5-year-olds and 25% of 12-year-olds have gingivitis or periodontitis, which is closely associated with poor oral hygiene practices, lack of oral health education, and uneven distribution of medical resources. The incidence of periodontal disease increases in urban children, due to changing dietary structure and inadequate oral care, while rural children are more vulnerable to periodontal disease due to the lack of oral health knowledge and inadequate medical services. In order to improve the oral health of Chinese children, the government and health departments have increased the promotion of oral health education and preventive measures in recent years, such as conducting oral health education in schools, promoting the use of fluoride toothpaste and conducting regular oral examinations. It is still necessary to further strengthen the cooperation of all sectors of society to improve the oral health awareness of parents and children, so as to comprehensively improve the oral health level of children.

2.3 Data Analysis and Discussion

According to the data analysis of the oral health status of children globally and in China, it can be seen that dental caries and periodontal disease are the most important oral health problems. Globally, about 60% – 90% of school children have dental caries and are more prevalent especially in low-and middle-income countries. High-income countries significantly reduce the incidence of childhood dental caries by implementing a comprehensive oral health care policy. Despite the low incidence in these countries, ongoing prevention and interventions are needed to maintain good levels of oral health. The incidence of childhood caries and periodontal disease is equally alarming in China. The data show that about 50% of 5-year-olds and 70% of 12-year-olds have dental caries, and the prevalence of periodontal disease is also 15% and 25%, respectively. These data indicate that oral health problems in Chinese children are more serious and further preventive and treatment measures are needed. The analysis found that the high incidence of dental caries was mainly related to poor diet (e.g., high-sugar diet), inadequate oral hygiene (e.g., irregular brushing) and lack of preventive oral health measures (e.g., fluoride use and regular dental visits). The impact of socioeconomic factors on children's oral health also cannot be ignored. In low-income families and rural areas, children are more vulnerable to oral

diseases due to the lack of medical resources and inadequate oral health education. Conversely, although urban children have better medical conditions, the incidence of dental caries and periodontal disease remains high due to changes in dietary structure and inadequate oral care. Based on the above analysis, in order to effectively improve the oral health status of children, many efforts are needed. Government and health departments should strengthen oral health education and raise the awareness of oral hygiene among parents and children. Promote preventive measures such as the use of fluoride toothpaste and regular oral examinations for early detection and treatment of oral diseases. Attention should be paid to the impact of socio-economic factors on oral health, especially to increase the coverage of oral health services in low-income families and rural areas, so as to achieve an overall improvement in children's oral health.

3. Preventive Measures

3.1 Use of Fluoride

3.1.1 Mechanism of Action of Fluoride

Fluoride is one of the most important means to prevent dental caries, which mainly acts through three mechanisms. Fluoride can promote the remineralization of tooth enamel. When the enamel is exposed to acidic environments, demineralisation occurs, leading to the formation of dental caries. Fluoride promotes remineralization of demining by increasing fluoride concentration in saliva and enamel, thereby enhancing the hardness and acid resistance of enamel. Fluoride is able to inhibit the growth and metabolism of cariogenic bacteria in the oral cavity. Streptococcus mutans and Lactobacillus in the oral cavity are the main cariogenic bacteria, which produce acid substances by metabolizing carbohydrates, leading to the demineralization of tooth enamel. Fluoride can interfere with the metabolic processes of these bacteria, reducing acid production and thus reducing the incidence of dental caries. Fluoride can also enhance the structure of tooth enamel by forming fluorapatite. Fluorapatite is more stable than hydroxyapatite (the main component of natural tooth enamel) and is more resistant to acids. By introducing fluoride ions into the enamel, tooth resistance can be improved to acid erosion and reduce caries formation. Fluoride effectively prevents dental caries by the three main mechanisms, namely, promoting mineralization, inhibiting bacterial metabolism and enhancing tooth enamel structure. Rational use of fluoride, such as fluoride toothpaste and fluoridated water, can significantly reduce the incidence of dental caries and protect the oral health of children.

3.1.2 Study on the Effectiveness of Fluoride Use

Numerous studies have shown that fluoride has significant effects in preventing dental caries. Fluoride has been widely used in public health preventive measures through forms such as fluoride toothpaste, fluoridated water and fluoride mouthwash. The use of fluoride toothpaste has been shown to be effective in reducing the incidence of dental caries in children. Studies showed that regular use of fluoride toothpaste reduced the incidence of dental caries by about 30%. Fluorinated water is a public health measure to improves overall oral health in the community by adding appropriate amounts of fluoride to the drinking water. Long-term studies have shown that fluoridated water can significantly reduce the incidence of dental caries. A study of multiple US states found that water fluoridation measures reduced the caries rate by 40% to 60%. Fluoride mouthwashes and fluoride gels are also widely used in schools and communities, especially in areas with high prevalence of dental caries, with equally significant. Not only in high-income countries, but also in low-and middle-income countries have significantly improved the oral health of children by promoting the use of fluoride. Brazil and Mexico have significantly reduced the prevalence of dental caries in children through the promotion of fluorinated water and fluoridated toothpaste. The results of these studies consistently suggest that fluoride is a cost-effective and effective caries prevention measure. The widespread use of fluoride and its remarkable effectiveness are supported by substantial scientific research, which not only improves the oral health of children, but also provides a solid scientific basis for public health policy.

3.2 Oral Health Education

3.2.1 Content and Methods of Education

Oral health education is a key measure to prevent oral diseases, and the occurrence of dental caries and periodontal disease can be effectively reduced by improving the oral health knowledge and self-care awareness of children and their parents. The education content should cover basic oral hygiene knowledge, correct oral care methods, and healthy eating habits. Education should include basic knowledge of oral anatomy and physiology to enable children to understand the structure and function of teeth and gums and realize the importance of oral health. Details the correct brushing methods and techniques, including at least two minutes a day, and how to clean food debris and plaque between your teeth. Education in healthy eating habits is also indispensable. Should emphasize to reduce the consumption of high-sugar foods and beverages and encourage higher consumption of fiber-rich fruits and vegetables to promote oral health. Teachers and oral health workers can use vivid teaching tools such as models, charts, and animated videos to help children better understand and master this knowledge.

In terms of educational methods, diversified teaching methods should be adopted to enhance the interactivity and interest. Through classroom teaching, live demonstration, interactive games and role-playing, children can learn oral health knowledge in a relaxed and happy atmosphere. Parent participation is also very important to encourage parents to learn and practice oral care with children through parent-teacher meetings, homework, and community activities. Schools can regularly hold oral health publicity week, dental health care competition and other activities to stimulate students' interest in and attention to oral hygiene. Through multi-channel and multi-form education and publicity, to form a good atmosphere for the whole society to pay attention to and participate in oral health education. The combination of comprehensive and systematic oral health education content and diversified education methods can effectively improve the oral health knowledge and self-care ability of children and parents, thus significantly reducing the incidence of oral diseases.

3.2.2 Evaluation of the Educational Intervention Effect

Educational interventions play an important role in the management of childhood oral health, and several studies have evaluated its effect. Educational interventions prevent caries and periodontal disease by mainly improving the oral health knowledge of children and their parents and changing bad habits and behaviors. These interventions often include methods such as oral health education courses, parent training, school education programs, and the use of visual and interactive tools. Research has shown that systematic oral health education interventions can significantly improve the level of oral health knowledge and self-care awareness among children and parents. An oral health education program conducted in primary schools showed that educated students had significant improvements in oral health knowledge, toothbrushing skills, and daily oral care habits. Another study conducted in low-income communities showed that parents had a deeper understanding of the importance of oral health through home visits and community lectures, with a significantly lower incidence of dental caries in children.

The long-term effect of the educational intervention was also validated. Some studies have found through follow-up surveys that children receiving the educational intervention remained significantly better after months or even years than those without the intervention. This suggests that educational interventions not only improve oral health habits in the short term but also have lasting impact. The effect of the educational intervention was also limited by multiple factors, including the quality of educational materials, frequency and duration of implementation, strength of parent and school support, and socioeconomic background. To maximize the effectiveness of educational interventions, it is necessary to ensure that the educational content is scientific, accurate, diverse and attractive, and to strengthen the participation and support of parents and teachers. Educational interventions have had significant results in raising childhood oral health awareness and improving oral health behaviors, but their successful implementation requires multi-party collaboration and long-term adherence. This provides an important basis for the development and promotion of more effective oral health education strategies.

3.3 Other Preventive Measures

3.3.1 Dietary Control

Dietary control is one of the important measures to prevent oral diseases in children. High-sugar foods and beverages are one of the main causes of dental caries, and reducing sugar intake is essential to protect children's dental health. Studies have shown that frequent intake of sugars increases the duration of the acidic environment in the mouth, thereby promoting the demineralization of the enamel and the formation of dental caries. Parents and schools should try to control children's sugar intake, especially limiting the consumption of sugary snacks and drinks. Encouraging children to eat more fiber-rich fruits and vegetables not only helps to clean the surface of their teeth, but also promotes saliva production and helps neutralize the acidic oral environment. Food rich in calcium and phosphorus such as dairy products also have a positive effect on tooth remineralization. Reasonable eating habits, such as regular meals, avoid frequent snacks, can effectively reduce the occurrence of dental caries. Through nutrition education and healthy eating programs, children and parents can be helped to establish good eating habits, thus reducing the risk of oral diseases and improving the overall oral health level of children.

3.3.2 Regular Dental Examination

Regular dental screening is a key measure for the prevention and early detection of oral diseases in children. Through regular check-ups, dentists are able to detect and deal with dental caries, periodontal disease and other problems in time to prevent further deterioration of the disease. It is generally recommended that children have a dental examination every six months, so that they can effectively monitor their oral health status and conduct the necessary intervention in time. In the dental examination, dentists will not only perform a comprehensive oral examination, but also provide professional cleaning and fluoride treatment to enhance the caries resistance of the teeth. Dentists also provide personalized oral hygiene guidance to parents and children to help them establish and maintain good oral hygiene practices. Another important role of regular dental examinations is the early

diagnosis and prevention of potential dental and jaw developmental problems. By early detection of these problems, timely corrective measures can be taken to avoid complex and costly treatment. Studies have shown that regular dental examinations can significantly reduce the incidence of dental caries and other oral diseases and improve the oral health of children. Regular dental examination is an important guarantee to ensure children's oral health. Parents should pay attention to and actively arrange their children's regular oral examination in order to achieve early prevention and timely treatment.

4. Early Diagnosis Techniques

4.1 Traditional Diagnostic Methods

4.1.1 Visual Diagnosis

Visual examination is the most basic method of oral examination, through the direct observation of the teeth and soft tissues in the mouth to identify dental caries, gingivitis and other oral diseases. Dentists use simple tools such as probe lights and oral glasses to visually inspect the color, morphology and texture changes of the tooth surface to determine the presence of caries, cracks and other abnormalities. The advantages of visual diagnosis are simple, rapid and noninvasive, suitable for patients of all ages. The accuracy of visual diagnosis depends on the experience and skill level of dentists, and the risk of missing diagnosis may exist especially in the detection of early caries. Visual examination is unable to assess the lesions inside the tooth and below the gum, and requires a comprehensive evaluation combined with other diagnostic methods. Nevertheless, the consultation is still an important means of preliminary oral examination, and through regular consultation, many common oral problems can be detected and handled early, reducing the risk of further development of the disease. To improve the effectiveness of visual diagnosis, it is recommended to combine probing and use auxiliary tools such as stains to more comprehensively assess dental health status. As a traditional diagnostic method, visual diagnosis still plays an irreplaceable fundamental role in oral health management.

4.1.2 Probe

Probing is a conventional and widely-used oral diagnostic technique where dental professionals employ instruments such as tooth probes to identify oral afflictions like dental caries and periodontal disease. This method is particularly crucial for detecting early signs of decay and fractures. By reaching into the tooth's grooves and fissures, a dental probe can ascertain whether there are areas of softening or demineralization, which often indicate the onset of cavities.

The dental probe offers the benefits of being direct and expeditious, furnishing a wealth of detailed information about oral health within a brief period. However, it is not without its drawbacks. Aggressive probing can potentially harm the tooth's surface and may even worsen the decay process. Additionally, the procedure demands a high level of skill from dentists; improper handling could lead to patient discomfort.

To enhance the precision of probing, it is often advised to complement it with visual inspections and supplementary diagnostic techniques like X-ray imaging. This integrated approach allows for a more thorough assessment of oral health. Despite its limitations, probing stands as a vital instrument in dental diagnostics, especially for recognizing and assessing initial lesions. It plays a pivotal role in the early detection and management of oral health issues, which can significantly hinder the progression to severe conditions if caught promptly. Regular probing as part of dental check-ups can be instrumental in the early identification and treatment of oral health concerns, thereby effectively preventing the escalation to more serious diseases.

4.2 Modern Diagnostic Technology

4.2.1 Digital Imaging Technology

Digital imaging technology plays an important role in modern oral diagnosis, providing high-resolution images of teeth and bone structures through advanced imaging equipment, thus realizing early and accurate diagnosis of oral diseases. The main digital imaging technologies include digital X-ray, oral CT, and three-dimensional imaging systems. Digital X-ray technology is one of the most commonly used oral imaging methods, which uses digital sensors instead of traditional X-ray film, which can generate high-quality images in real time. The advantages of digital X-ray are its fast imaging speed, low radiation dose and high image definition, which can finely display the internal structure of the teeth and the condition of the surrounding bones. This is particularly important for the early detection of dental caries, root inflammation, and periodontal disease. Oral CT (computed tomography) provides a more detailed three-dimensional image, and with a multifaceted scan, oral CT can fully show the details of the teeth, roots, and jaw. This technique has an irreplaceable role in the diagnosis and treatment planning of complex cases, such as dental implants and orthodontic treatment. Oral CT enables accurate assessment of bone mineral density, root morphology and lesion location, providing an important reference for clinical decision making. Three-dimensional imaging systems, such as cone-beam CT (CBCT), are capable of generating high-resolution three-dimensional images and are widely used in dental implants,

orthodontics, and maxillofacial surgery. The stereoscopic images provided by CBCT can help doctors to precisely locate the lesion, plan the surgical path, and evaluate the treatment effect. Digital imaging technology improves the early diagnosis and treatment effect of oral diseases by providing accurate image information. With continuous advances in technology, these modern imaging techniques will continue to play an important role in oral medicine to help physicians better maintain and improve the oral health of patients.

4.2.2 Diagnosis of Laser Fluorescence

Laser fluorescence diagnosis is an advanced early detection technique of oral diseases, using a specific wavelength laser to illuminate teeth to detect the fluorescence reaction in tooth tissue, thus identifying dental caries and other lesions. The technique works by producing different fluorescence reactions between healthy enamel and demineralized or carious tooth tissue, and the lesion area can be accurately identified by analyzing the intensity and distribution of these fluorescence signals. The main advantage of laser fluorescence diagnosis is its high sensitivity and non-invasive nature. Compared with traditional visual observation and probing, laser fluorescence can detect small caries and hidden lesions more early, avoiding the mechanical damage to the tooth by the probe. This technique eliminates X-rays and therefore carries no radiation risk to patients and is particularly suitable for oral examination in children and pregnant women. Currently, the most commonly used laser fluorescence diagnostic equipment include DIAGNOdent and SiroInspect. These devices provide immediate diagnosis, help dentists quickly determine dental health and develop treatment options accordingly. Studies have shown that the accuracy and reliability of laser fluorescence diagnosis in early dental caries detection is better than traditional methods, and it can significantly improve the early detection rate of dental caries and reduce the risk of disease progression and complications. Despite the many advantages of laser fluorescence diagnostic technology, its application also has some limitations. The detection effect of laser fluorescence in teeth with heavily mineralized or prosthetic coverage may be limited. Moreover, the higher cost of the equipment may limit its availability in resource-limited areas. As an advanced technique of oral disease detection, laser fluorescence diagnosis provides dentists with a more precise and safe diagnostic means through its high sensitivity and non-invasive characteristics. In the future, with the further development and promotion of technology, laser fluorescence diagnosis is expected to be used in the broader oral medical practice.

4.3 Comparison and Analysis of Diagnostic Techniques

In the diagnosis of oral diseases, traditional diagnostic methods such as visual diagnosis and probing have different advantages compared with modern diagnostic techniques such as digital imaging and laser fluorescence diagnosis. Visual and probing are simple and inexpensive for routine oral examination, but their accuracy depends on physician experience and have limited ability to identify early and concealed lesions. Digital imaging techniques, such as digital X-ray and oral CT, provide high-resolution images capable of tooth and bone structure and are suitable for diagnostic and treatment planning in complex cases but require a certain radiation exposure. Laser fluorescence diagnosis through the analysis of the fluorescence reaction of tooth tissue, can early detect small caries and hidden lesions, and no radiation risk, but the equipment cost is high, the operation of the technical requirements are high. Modern diagnostic techniques have significant advantages in improving the accuracy and safety of early diagnosis, but traditional methods still have an important role in routine examination. Best practice should be to combine multiple diagnostic methods to leverage their respective advantages and provide a comprehensive and accurate oral health assessment and treatment plan.

5. Treatment Methods

5.1 Treatment of Dental Caries

5.1.1 Filling Therapy

Filling therapy is a common treatment of dental caries by removing the carious tissue and filling the defect with restorative materials. The steps of filling treatment include: the dentist uses a drill or laser to remove carious tissue and clean and disinfect the cavity. Suitable restorative materials were selected to fill the cavity and reconciled and polished to align with the natural tooth structure. Commonly used filling materials include silver amalgam, composite resins, and glass ions. Silver amalgam has the characteristics of strong wear resistance and long service life, which is suitable for the filling of posterior teeth, but its color does not match the teeth, which affects the appearance. The color of composite resin material is close to natural teeth, which is often used in front teeth and beautiful parts, but its wear resistance is worse than silver amalgam, and its service life is short. Glass ions have good biocompatibility and fluorine release function, which help to prevent secondary caries, but they are less intense and are usually used for filling of deciduous teeth and non-load-bearing sites.

In recent years, the application of laser and air grinding technology has made the filling therapy more accurate and comfortable. These techniques improve the safety and effectiveness of treatment by reducing damage to healthy dental tissue and reducing discomfort and pain in treatment. Filling therapy not only restores the masticatory function of the teeth but also prevents further development of caries and protects the pulp and

surrounding tissues. Regular dental examination and timely filling treatment are an important means to maintain oral health, which helps to prolong the service life of teeth and reduce the incidence of oral diseases. As an important method in the treatment of dental caries, filling treatment can effectively restore the function and beauty of teeth and prevent the further deterioration of dental caries. It is the key measure to maintain children's oral health.

5.1.2 Prophylactic Resin Filling

Preventive resin filling is a minimally invasive treatment used to prevent dental caries by applying a thin layer of resin material on the occlusal surface, grooves and cracks to seal these areas that tend to accumulate food debris and bacteria. The method is particularly suitable for permanent and deciduous teeth in children and adolescents, especially those with deep occlusal surfaces. The preventive resin filling steps include: the dentist cleaning the tooth surface, removing plaque and food residue, and then treating the tooth surface with acid erosion to increase the adhesion of the resin material. The dentist coated the mobile resin on the occlusal surface and grooves of the tooth and hardened it using a light curing lamp. The dentist will polish and adjust to make the filling smooth and harmonious with the tooth occlusal surface. The main advantage of this method is that it is painless, fast, and effective. Prophylactic resin filling is not only able to significantly reduce the incidence of dental caries but also to cause little damage to the dental structure due to its non-invasive nature. Studies have shown that the use of preventive resin filling can reduce the incidence of caries in molars by children and adolescents by more than 50%.

Maintenance of a preventive resin filling is also very important. Dental inspection is usually recommended every 6 months to 1 year to ensure the filling is intact and patched if necessary. For some children with high risk of caries, preventive resin filling can be combined with other preventive measures such as fluoride use and regular dental examinations to form a comprehensive oral health protection system. Prophylactic resin filling is a simple, effective and economical method for dental caries prevention, especially suitable for children and adolescents with high prevalence of dental caries. Through regular preventive treatment, it can effectively reduce the occurrence of dental caries, protect dental health, and improve the overall level of oral hygiene.

5.2 The Treatment of Periodontal Disease

5.2.1 Mechanical Cleaning

Mechanical cleaning is one of the basic methods of treating periodontal disease. By removing the plaque and calculus on the tooth surface and below the gums, reducing the inflammation caused by bacteria and restoring the health of periodontal tissue. Mechanical cleaning includes two parts: supragingival cleaning and subgingival curettage. Supragingival cleaning is mainly for dental plaque and calculus on the tooth surface, and is removed using ultrasonic tooth cleaner or manual tooth cleaning tools. The ultrasonic tooth cleaner breaks the calculus through high frequency vibration, and sprays water to remove the dirt and plaque on the tooth surface, fast and efficient. Subgingival curettage is deeper, and the plaque and calculus below the gums are removed through special scraping equipment to prevent the growth of bacteria in the periodontal bag. After curettage, the gingival tissue gradually recovered and the depth of the periodontal pocket was reduced. Regular conduct of mechanical cleaning is crucial to the prevention and control of periodontal disease. Professional mechanical cleaning is usually recommended every 6 months to maintain oral health and prevent the recurrence and progression of periodontal disease. Through mechanical cleaning, it can effectively reduce periodontal inflammation, promote gingival health, and protect the long-term health of teeth and periodontal tissues.

5.2.2 Drug Therapy

Medical therapy is an adjunct to the treatment of periodontal disease and is usually used in combination with mechanical cleaning to enhance the therapeutic efficacy. Commonly used drugs include antibiotics, antimicrobial mouthwashes, and locally applied antimicrobial gels or drugs. Antibiotics are effective in killing bacteria that cause periodontal infections and are often used in the treatment of acute periodontal inflammation or deep infections. Common antibiotics, such as amoxicillin, metronidazole, can be used orally or locally according to the specific situation. Topical application of antimicrobial agents such as mouthwash containing chlorhexidine can effectively reduce the bacterial load in the oral cavity and reduce the recurrence rate of periodontal disease. Antimicrobial mouthwash, such as chlorhexidine mouthwash, can be used in daily oral care to help control the formation of dental plaque and reduce gingival inflammation. Topically applied antimicrobial gels, such as those containing antibiotics or antimicrobial agents, can be applied directly to within the gingival and periodontal pockets, providing a sustained antibacterial effect. The effect of drug treatment is to control infection, reduce inflammation and promote healing, but it cannot replace the basic role of mechanical cleaning. Through the combined application of drug therapy and mechanical cleaning, periodontal disease can be managed and treated more comprehensively and effectively, improve the treatment effect and maintain oral health.

5.3 Comprehensive Treatment Strategy

Comprehensive treatment strategies are crucial in the management of periodontal disease, providing comprehensive oral health maintenance through the combined application of multiple treatments. The combination of mechanical cleaning and drug treatment can effectively remove dental plaque and calculus, while controlling bacterial infection and reducing the inflammatory response. Personalized oral hygiene education and behavioral interventions to help patients establish and maintain good oral hygiene practices such as proper tooth brushing and dental floss to reduce plaque accumulation. Multidisciplinary collaboration is also an important component of integrated treatment. Dentists, periodontists and oral hygienists can jointly develop and implement personalized treatment plans, conduct regular follow-up and evaluation according to the specific conditions of patients, and adjust the treatment measures in time. In patients with severe periodontal disease, a combination of surgical procedures such as periodontal flap surgery and bone regeneration surgery may be required to restore and reconstruct periodontal support tissue. Through comprehensive treatment strategies, the periodontal health status can be significantly improved, the progression and recurrence of periodontal disease can be prevented, and the long-term oral health of patients can be guaranteed. Regular professional care and continuous self-management are key to the maintenance of treatment effectiveness.

6. Intervention Strategies and Implementation

6.1 Design of the Intervention Strategies

6.1.1 Strategies Based on Epidemiological Data

The design of intervention strategies based on epidemiological data is the basis for developing effective oral health management programs. Epidemiological data provide detailed information on the incidence, distribution characteristics of childhood oral diseases and their influencing factors, facilitating the identification of high-risk populations and key intervention points. By analyzing these data, health departments can develop targeted prevention and treatment strategies for specific regions and populations. In areas with a high incidence of dental caries, preventive measures such as fluorinated toothpaste and fluorinated water can be promoted, and oral health education can be strengthened to raise the oral hygiene awareness of children and parents. Based on data analysis, areas lacking oral health services can be identified and resources and support prioritized to ensure that children in these areas have access to the necessary preventive and therapeutic services.

Epidemiological data can also help assess the effects of existing interventions and timely adapt strategies. The regular oral health surveys can monitor trends in caries and periodontal disease, assess the effects of fluoride use and oral health education, and identify aspects that need improvement. Strategy design based on epidemiological data can ensure the scientific and targeted interventions and effectively improve the oral health of children. Epidemiological data is the key to the development and implementation of pediatric oral health intervention strategies, and through accurate data analysis, more effective and targeted intervention programs can be designed to improve the overall benefits of public health intervention.

6.1.2 Personalized Intervention Strategies

The personalized intervention strategy is based on the specific circumstances of each child, providing a tailored oral health management program. The oral health status, lifestyle habits and risk factors vary among different children, so targeted preventive and therapeutic measures are needed to maximize intervention effectiveness. The personalized intervention should include a detailed oral health assessment covering dental caries and periodontal disease risk assessment, examination of oral hygiene habits, and analysis of dietary habits. Through these assessments, major risk factors for each child can be identified and interventions developed accordingly. For children with high risk of dental caries, the frequency of fluoride use can be enhanced, increased preventive resin filling, and a more rigorous oral hygiene care plan can be developed. Education and behavioral interventions are also important components of personalized strategies. Dentists and oral hygienists can provide personalized oral health education for each child and their parents, teach proper brushing methods and floss skills, and provide dietary advice based on the child to reduce sugar intake.

Personalized intervention strategies should include regular follow-up and dynamic adjustment. During regular oral examinations, dentists can adjust the prevention and treatment programs in time according to the results of the examination and the intervention effect to ensure the continuous effectiveness of the intervention. Through personalized intervention strategies, oral diseases can be prevented and treated more effectively, and the oral health level of children can be improved. Personalized measures can not only meet the unique needs of each child, but also enhance family engagement and coordination, and promote long-term oral health management.

6.2 Implementation of the Intervention Strategies

6.2.1 Community-Level Implementation

Implementing oral health intervention strategies at the community level is key to improving children’s oral health level. Community health centers and schools can be the main venues for implementing these strategies,

enhancing the oral health awareness and self-care capacity of community residents by organizing regular oral health examinations, educational activities, and preventive measures. The community can regularly organize oral health screening and screening activities, inviting dentists and dental hygienists to provide free or low cost oral screening services for children. The progression of oral diseases can be effectively prevented through early detection and intervention. Community health workers can provide preventive services such as fluoride coating and preventive resin filling, reducing the incidence of dental caries.

The community can improve the oral health knowledge of parents and children through publicity and education activities. Oral health lectures and workshops using community centers, schools, and public places to teach proper toothbrushing methods, techniques for using dental floss, and the importance of healthy eating. Distribution oral health education materials such as manuals, posters and videos to help residents better understand and master oral care. Community-level collaboration is also key to the successful implementation of the intervention strategies. Through collaboration with schools, community organizations and health agencies, resources can be integrated to form a comprehensive, continuous oral health promotion network. Schools can incorporate oral health education into the curriculum, community organizations can coordinate volunteers and professionals in oral health activities, and health institutions can provide technical support and professional training. By implementing these comprehensive interventions at the community level, children can effectively improve their oral health level and promote the sustainable improvement of oral health. Extensive participation and support from the community is essential to building a healthy, caring and harmonious oral health environment.

6.2.2 School-Level Implementation

Implementing oral health intervention strategies at the school level is important to improve the oral health of children. School is an important place for children's daily life. Through systematic oral health education and preventive measures in school, it can effectively promote children to develop good oral hygiene habits. Schools can incorporate oral health education into routine courses and teach oral health knowledge through science courses or health education courses. Teachers can use interactive teaching, video demonstrations and practice to master proper brushing skills, floss and the importance of healthy eating. Schools can regularly organize oral health examination activities, working with local dental clinics or public health agencies to arrange for dentists to perform oral examination and preventive care for students. Through regular examination, oral problems can be detected early, and timely intervention measures can be taken to prevent the further development of the disease.

Schools can also carry out a variety of oral health promotion activities, such as dental health care competition, oral health publicity week, etc., to stimulate students' interest in and attention to oral health. The school cafeteria can provide healthy, low-sugar diet options, reduce the supply of high-sugar foods and drinks, and help students prevent dental caries from their diet. By implementing these comprehensive interventions at the school level, students' oral health awareness and self-care capacity can be effectively improved. The positive role of schools in oral health intervention can not only improve students 'oral health status, but also affect students' families and communities through education, forming a wide range of oral health promotion effects.

6.3 Assessment of the Intervention Effect

Evaluation of intervention effects is an important link to ensure the success of oral health intervention strategies. Through scientific and systematic evaluation, the actual effect of the intervention can be understood, and optimized and adjusted according to the evaluation results. Regular monitoring and recording of oral health indicators, such as caries incidence, periodontal health status, and changes in oral hygiene behavior, is the basis for assessing the effectiveness of the intervention. School and community health workers can collect these data through regular examinations and questionnaires to assess the short-and long-term effects of the intervention. Comparing the data before and after the intervention to analyze the difference in the effect of the intervention in different groups. It can compare the oral health changes of children of different ages, gender, and socioeconomic background before and after the intervention to identify which groups benefit the most and which groups need more attention and support. Feedback from parents and teachers was also important for assessing the effect of the intervention. Understanding their satisfaction and opinions on the intervention through interviews and questionnaires could help to further improve and refine the oral health intervention strategies. A systematic evaluation of intervention effectiveness can not only verify the effectiveness of current measures, but also provide valuable experience and guidance for future oral health interventions, ensuring continuous improvement and optimization of intervention strategies.

References

Ayub, S. S., Sinor, M. Z., Sanusi, S., & Ahmad, B., (2023, January). A scoping review on the educational strategies used in intervention studies to improve oral health in children.

De La Roche Colorado, V., Franco Cortés, Á. M., Ochoa Acosta, E. M., & Bran Muñoz, V., (2020). Assessment of an educational strategy and application of an oral health preventive protocol in early childhood. *Revista Facultad de Odontología*, *32*(1), 1-15.

George, A., Sousa, M. S., Kong, A. C., Blinkhorn, A., Norrie, T. P., Foster, J., ... & Johnson, M., (2019). A systematic review of the effectiveness of preventive maternal programs delivered by non-dental professionals to control early childhood caries.

Jiang, S., McGrath, C., Lo, E., Ho, S., & Gao, X., (2020). Motivational interviewing to prevent early childhood caries: A randomized controlled trial. *Journal of Dentistry*, 103349.

Nation, A., Pukallus, M., Stormon, N., Foley, M., & Lalloo, R., (2022). Health professionals delivering oral health interventions in early childhood: A scoping review of Australian and New Zealand literature. *Health promotion journal of Australia: official journal of Australian Association of Health Promotion Professionals*, *34*(2), 303-315.

Phantumvanit, P., Makino, Y., Ogawa, H., Rugg-Gunn, A., Moynihan, P., Petersen, P., ... & Nakornchai, S., (2018). WHO global consultation on public health intervention against early childhood caries. *Community Dentistry and Oral Epidemiology*, *46*(3), 280-287.

Rajagopal, V., Sood, S., Sharma, N., & Singh, A., (2020). Infant oral health care-an early preventive approach to dental caries. *International Journal of Applied Dental Sciences*, *6*(1), 426-428.

Sitthisettapong, T., Tasanarong, P., & Phantumvanit, P., (2021). Strategic management of early childhood caries in Thailand: A critical overview. *Frontiers in Public Health*, 9.

Spreuwel, P. C. J. M. van, Jerković-Ćosić, K., van Loveren, C., & van der Heijden, G. J., (2021). Parents' willingness to invest in primary oral health prevention for their preschool children. *International Journal of Environmental Research and Public Health*, *18*(21), 11437.

Verlinden, D. A., Schuller, A. A., Vermaire, J. H., & Reijneveld, S., (2023). Long-term effects of a community-based oral health intervention for young children in the Netherlands: A 5-year follow-up. *Community Dentistry and Oral Epidemiology*.

Xiao, J., Alkhers, N., Kopycka-Kedzierawski, D. T., Billings, R. J., Wu, T. T., Castillo, D. A., ... & Eliav, E., (2019). Prenatal oral health care and early childhood caries prevention: A systematic review and meta-analysis. *Caries Research*, *53*(4), 411-421.

Zou, J., (2018). Oral health management for children. *West China journal of stomatology*, *36*(5), 465-468.