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ORIGINAL RESEARCH

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Analysis of the incidence and influencing factors of dental caries and periodontitis in children aged 5–12 in Jinhua, Zhejiang province

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Abstract

This study aims to examine the prevalence of dental caries and periodontitis among children aged 5–12 years in Jinhua, Zhejiang province, and analyze the influencing factors of dental caries and periodontitis. A total of 280 children meeting the study criteria for a first-time oral examination were retrospectively analyzed and divided into caries (n = 190), no-caries (n = 90), periodontitis (n = 85) and non-periodontitis group (n = 195) groups based on the presence of caries or periodontitis. An analysis of general survey questionnaires and logistic regression of dental caries and periodontitis among children in different groups was conducted. Caries disease was diagnosed in 67.86% with an average decayed missing filled tooth (DMFT) of 2.94, and periodontitis was diagnosed in 30.36% of 280 children. The independent risk factors for dental caries were daily brushing habits, parental supervision (assisted) brushing, place of residence and frequency of eating desserts or beverages ($p < 0.05$). Periodontitis was not related to parental education and knowledge of oral health care ($p > 0.05$). Periodontitis is independent of plaque, tartar, mastery of brushing methods, regular oral examination, and gargling after meals ($p < 0.05$). While daily brushing habits, parental supervision (assisted) brushing, place of residence and frequency of eating desserts or beverages were protective factors for dental caries ($p < 0.05$). According to the prevalence of dental caries and periodontitis among children aged 5–12 in this area as well as the analysis of influencing factors, further effective measures can be taken to reduce the incidence of adverse influencing factors, thereby reducing the risk of dental caries and periodontitis for children.

Keywords

Children; Dental caries; Periodontitis; Influencing factors

1. Introduction

Dental caries and periodontal disease impair chewing abilities and dental aesthetics, as well as cardiovascular, digestive and respiratory ailments [1, 2]. According to the National Oral Health Epidemiology Survey, 71.9% of 5-year-olds and 34.5% of 12-year-olds in China suffered from dental caries in 2017. Dental caries has become significantly more prevalent in deciduous teeth and young permanent teeth as a result of changes in lifestyle, greater economic standing, and improved quality of life for Chinese individuals [3, 4]. Periodontitis is a chronic inflammatory disease that develops from gingivitis further expands to deeper periodontal tissues. Due to its early clinical manifestations, periodontitis may be undetected until it progresses to an advanced stage, resulting in loose teeth and bite weakness, which are major causes of tooth loss [5]. Periodontitis pathogenesis is complex, mainly due to local irritations, with plaque being the main causative factor [6]. Due to low mineralization of deciduous teeth, poor self-care abilities and oral health care awareness, children are more likely to develop caries disease and periodontitis [7]. On 20 September, the 33rd "National Love Teeth Day" took place with the theme "Oral health, whole body health" with the subtitle "Develop brushing habits from childhood, enjoy a healthy life". Understanding and paying attention to the health status of children in Jinhua, Zhejiang province, as well as analyzing the influencing factors of oral diseases, giving early intervention, strengthening popularizing oral health science, and providing oral health education are of great significance to preventing and controlling children's oral hygiene and reducing dental caries and periodontitis.

2. Research information and methods

2.1 General information

Retrospective analysis of clinical data of children aged 5~12 years old from January 2021 to January 2023 from dental hos-

pitals in Jinhua, Zhejiang province. Screening criteria for this study include children between the ages of 5 and 12 receiving their first dental treatment, being logical and clear, having a degree of communication ability, and actively participating in the questionnaire survey completion. We excluded patients with serious uncorrected visual or hearing impairments and those who could not complete the questionnaire survey due to mental illness. Based on statistical variables, the sample size of the influencing factors of the relevant variables was at least 5–10 times the number of variables. With 16 predictive influencing variables considered, the sample size of this study was 80–160 cases. However, since 20% of the questionnaires were invalid, the final sample size was 280.

2.2 Research methods

Caries and periodontitis were diagnosed according to the Basic Methods of Oral Health Survey standards for periodontal examination of all enrolled children. Diagnostic criteria for dental caries [8]: obvious cavities in the fissures or smooth surfaces of the teeth, obvious damage under the enamel or obvious softening of the bottom of the cavity (cavity wall) lesions. Symptoms of early periodontitis [9]: gingival erythema, bleeding, bleeding on probing, periodontal pocket formation, periodontal probing reveals loose texture of gingival tissues that can easily be penetrated by a probe, roughness on compressed root surface and loss of periodontal attachment.

2.3 Content of investigation

2.3.1 Children's oral health questionnaire

A children's oral health questionnaire and professional dentists' opinions were used to investigate children's oral health conditions. In the questionnaire, patients' age, gender, frequency of eating desserts or beverages, time to start brushing, mastery of brushing methods, daily habits, regular oral examination, oral health knowledge, and other aspects were included. Considering the purpose of the study, the survey included relevant parental content, such as the parental educational levels, children's daily caregivers, and whether children receive parental assistance with brushing.

2.3.2 Content and distribution of the questionnaire

The survey is presented entirely as a questionnaire. Nursing professionals deliver and explain questionnaire content and purpose. Parents fill out the questionnaire while the children are supervised on the spot. Questions needing clarification are answered by professionals; the questionnaire is filled out on-site after recovery to avoid omissions; and submitted to specialists for data summary and analysis.

2.4 Statistical analysis

Data were processed using IBM SPSS version 23.0 (SPSS Inc., Chicago, IL, USA). Continuous data variables like age were described by means, and categorical variables like gender, parental education, *etc*. were expressed as the number of cases (percentage). Using one-way Analysis of Variance (ANOVA) and independent *t*-tests for group comparisons, and multiple regression for periodontitis influencing factors analysis. $p < 0.05$ was considered a statistically significant difference.

3. Results

3.1 The incidence of dental caries and periodontitis

According to survey statistics, 190 out of 280 enrolled children suffered from dental caries, representing 67.86%. Overall, there were 588 caries in 190 children, with an average DMFT of 2.94. The enrolled children were divided into two groups based on dental caries status: a caries group (n = 190) and a no-caries group (n = 90). Among 280 children, 85 had periodontitis, which accounted for 30.36%. Children were divided into a periodontitis group (n = 85) and a non-periodontitis group (n = 195). Tables 1 and 2 show general information of the enrolled children in different subgroups.

3.2 Univariate analysis of dental caries

By comparing the general information of patients in different groups, Table 1 revealed that there were no statistically significant differences between the caries group and the no-caries group regarding average age, male-female gender ratio, time to start brushing, daily caregivers, and oral health care knowledge acquisition ($p > 0.05$). It was found that parental education, daily brushing habits, parental supervision (assisted) brushing, plaque, tartar, place of residence, frequency of eating desserts or beverages, mastery of brushing methods, knowledge of oral health care, regular oral checkups, gargling after meals and brushing before bedtime followed by eating were statistically significant differences between the two groups ($p < 0.05$).

3.3 Comparison of general information of patients in different periodontitis groups

Table 2 shows the comparison of general information of patients in different periodontitis groups. There is no statistically significant difference between the periodontitis group and the non-periodontitis group in terms of the average age, gender, time to start brushing, daily caregivers, oral health care knowledge acquisition and brushing before bedtime followed by eating ($p > 0.05$). It was statistically significant that the information differed between both groups regarding parental education, daily brushing habits, parental supervision (assisted) brushing, plaque, tartar, place of residence, frequency of eating desserts or beverages only, mastery of brushing methods, knowledge of oral health care, regular oral checkups and gargling after ($p < 0.05$).

3.4 Logic regression analysis of dental caries disease

In Table 3, the results of the logistic regression analysis indicated that the occurrence of caries disease was not related to time to start brushing ($p > 0.05$) and that parental education, plaque, tartar, mastery of brushing methods, knowledge of oral health care knowledge, regular oral examination, gargling after meals and brushing before bedtime followed by eating were independent risk factors for dental caries. While daily

TABLE 1. Comparison of general information of enrolled children between different subgroups.

General information	Caries group (n = 190)	No-caries group (n = 90)	t/χ^2	p
Average age	7.89 ± 2.09	7.91 ± 1.83	0.056	0.955
Gender				
Male	102	47	0.052	0.819
Female	88	43		
Parental Education				
Middle School and below	82	26	8.522	0.014
High School	75	36		
Bachelor's Degree and above	33	28		
Time to start brushing				
Before 3 years old	112	42	3.721	0.054
3 years old and after	78	48		
Daily brushing habits				
Regular	65	51	12.692	<0.001
Irregular	125	39		
Daily caregiver				
Parents	105	46	0.424	0.515
Non-parent	85	44		
Parental supervision (assisted) brushing				
Yes	75	69	33.820	<0.001
No	115	21		
Plaque				
Yes	143	36	32.932	<0.001
No	47	54		
Tartar				
Yes	131	32	27.994	<0.001
No	59	58		
Place of residence				
Urban	103	60	3.895	0.048
Rural	87	30		
Frequency of eating desserts or beverages				
Occasionally	76	52	6.589	0.010
Often	114	38		
Mastery of brushing methods				
No Knowledge	100	22	19.744	<0.001
Little Knowledge	47	36		
Complete mastery	43	32		
Knowledge of oral health care				
No Knowledge	109	28	16.855	<0.001
Little Knowledge	54	41		
Complete mastery	27	21		

TABLE 1. Continued.

General information	Caries group (n = 190)	No-caries group (n = 90)	t/χ^2	p
Regular oral examination				
Never	88	20	15.653	<0.001
Occasionally	47	28		
Often	55	42		
Oral health care knowledge acquisition				
TV/Short Video	47	19	4.413	0.529
Family	62	28		
Schools	20	5		
Dental Professionals	18	11		
Community Health Activities	17	9		
None of the above	26	18		
Gargling after meals				
Never	75	27	6.259	0.044
Occasionally	63	25		
Often	52	38		
Brushing before bedtime followed by eating				
Yes	134	32	25.605	<0.001
No	65	58		

TABLE 2. Comparison of general information of enrolled children between different subgroups.

General information	Periodontitis group (n = 85)	Non- periodontitis group (n = 195)	t/χ^2	p
Average age	8.12 ± 2.21	7.88 ± 1.93	0.942	0.347
Gender				
Male	39	110	2.635	0.105
Female	46	85		
Parental Education				
Middle School and below	39	69	6.638	0.036
High School	24	87		
Bachelor’s Degree and above	22	39		
Time to start brushing				
Before 3 years old	51	103	1.223	0.267
3 years old and after	34	92		
Daily brushing habits				
Regular	27	89	4.697	0.030
Irregular	58	106		
Daily caregiver				
Parents	41	110	1.592	0.207
Non-parent	44	85		
Parental supervision (assisted) brushing				
Yes	22	122	31.887	<0.001
No	63	73		

TABLE 2. Continued.

General information	Periodontitis group (n = 85)	Non- periodontitis group (n = 195)	t/χ^2	p
Plaque				
Yes	79	100	44.551	<0.001
No	6	95		
Tartar				
Yes	57	106	3.925	0.048
No	28	89		
Place of residence				
Urban	25	138	41.624	<0.001
Rural	60	57		
Frequency of eating desserts or beverages				
Occasionally	30	98	5.340	0.021
Often	55	97		
Mastery of brushing methods				
No Knowledge	44	78		
Little Knowledge	27	56	6.914	0.032
Complete mastery	14	61		
Knowledge of oral health care				
No Knowledge	39	98		
Little Knowledge	36	59	11.126	0.004
Complete mastery	10	38		
Regular oral examination				
Never	41	67		
Occasionally	26	49	10.003	<0.001
Often	18	79		
Oral health care knowledge acquisition				
TV/Short Video	18	48		
Family	29	61		
Schools	9	16	2.822	0.727
Dental Professionals	11	18		
Community Health Activities	8	18		
None of the above	10	34		
Gargle after meals				
Never	49	53		
Occasionally	24	64	27.818	<0.001
Often	12	78		
Brushing before bedtime followed by eating				
Yes	57	109	3.055	0.080
No	28	86		

brushing habits, parental supervision (assisted) brushing, place of residence and frequency of eating desserts or beverages were protective factors for dental caries ($p < 0.05$).

3.5 Logic regression analysis of periodontitis

A logic regression analysis was conducted on factors with significant differences in Table 2. The method was used in the same way as in Result 3.4. In Table 4, the results of logic regression analysis showed that the occurrence of periodontitis was not related to parental education and knowledge of oral health care ($p > 0.05$). Plaque, tartar, mastery of brushing methods, regular oral examination and gargling after meals were independent risk factors. In contrast, daily brushing habits, parental supervision (assisted) brushing, place of residence and frequency of eating desserts or beverages were protective factors for periodontitis ($p < 0.05$).

4. Discussion

70% of 6-year-old children worldwide already suffer from dental caries, and in economically underdeveloped regions, the situation is even more severe due to a lack of oral health awareness, education, and corresponding prevention and treatment channels [10, 11]. Changing diet structures and an unhealthy lifestyle are causing an increase in children's oral diseases. Oral problems can affect children's development and learning, as well as their quality of life to some extent without treatment [12, 13]. There is a high dental caries prevalence in China, based on relative research. Several factors contribute to dental caries, including behavior, culture, social and economic factors such as family background, oral health habits and diet habits. This study confirms that identifying these factors is an important tool for disease control and prevention [14, 15]. In previous studies, high-sugar diets have been identified as the leading cause of oral problems in children nationwide [16]. Aside from dental plaque (bacteria), periodontitis is also

TABLE 3. Logic regression analysis of dental caries.

Factors	β	S.E.	Wald	sig	EXP (B) 95% confidence interval
Parental Education	0.488	0.171	8.151	0.004	1.629 (1.165–2.277)
Time to start brushing	0.495	0.258	3.695	0.055	1.641 (0.990–2.719)
Daily brushing habits	−0.922	0.262	12.391	<0.001	0.398 (0.238–0.665)
Parental supervision (assisted) brushing	−1.617	0.290	31.076	<0.001	0.198 (0.112–0.350)
Plaque	1.518	0.273	30.910	<0.001	4.564 (2.672–7.794)
Tartar	1.392	0.270	26.530	<0.001	4.024 (2.369–6.836)
Place of residence	−0.524	0.267	3.861	0.049	0.592 (0.351–0.999)
Frequency of eating desserts or beverages	−0.719	0.260	7.664	0.006	0.487 (0.293–0.811)
Mastery of brushing methods	0.613	0.160	14.745	<0.001	1.847 (1.350–2.526)
Knowledge of oral health care	0.625	0.172	13.152	<0.001	1.868 (1.333–2.619)
Regular oral examination	0.588	0.156	14.132	<0.001	1.800 (1.325–2.445)
Gargling after meals	0.359	0.157	5.221	0.022	1.431 (1.052–1.947)
Brushing before bedtime followed by eating	1.467	0.272	29.164	<0.001	4.337 (2.546–7.387)

Sig: Significance Level; SE: Std. Error; EXP: The exponential function of the independent variable.

TABLE 4. Logic regression analysis of periodontitis.

Factors	β	S.E.	Wald	sig	EXP (B) 95% confidence interval
Parental Education	0.081	0.172	0.219	0.640	1.084 (0.774–1.519)
Daily brushing habits	−0.590	0.274	4.641	0.031	0.554 (0.324–0.948)
Parental supervision (assisted) brushing	−1.566	0.288	29.454	<0.001	0.209 (0.119–0.368)
Plaque	2.526	0.447	31.937	<0.001	12.508 (5.208–30.042)
Tartar	0.536	0.272	3.887	0.049	1.709 (1.003–2.912)
Place of residence	−1.760	0.285	38.013	<0.001	0.172 (0.098–0.301)
Frequency of eating desserts or beverages	−0.616	0.268	5.275	0.022	0.540 (0.319–0.914)
Mastery of brushing methods	0.408	0.166	6.085	0.014	1.505 (1.088–2.081)
Knowledge of oral health care	0.060	0.175	0.119	0.731	1.062 (0.754–1.496)
Regular oral examination	0.467	0.158	8.740	0.003	1.596 (1.171–2.175)
Gargling after meals	0.775	0.173	20.085	<0.001	2.170 (1.546–3.045)

Sig: Significance Level; SE: Std. Error; EXP: The exponential function of the independent variable.

associated with calculus, food impaction, bad habits (mouth breathing and bruxism), genetic characteristics or hormonal changes [17]. In fact, many parents are unaware that tooth decay begins inside the tooth. When they discover that their child has tooth decay, they actually deduct points for decay inside the tooth [18, 19]. Therefore, parents need to take a keener interest in the prevention and treatment of children's dental caries, ensuring healthy oral health.

According to the World Health Organization, 12-year-old children are the ideal age group for the Oral Health Survey Index and for oral health education in China [20]. The study results indicated that 190 out of 280 children in this region suffered from dental caries, with an average DMFT of 2.94, representing 67.86%, while 85 children had periodontitis accounting for 30.36%. Based on a comparison of different subgroups dental caries disease is not related to a child's age, gender, time to start brushing, daily caregivers and oral health care knowledge acquisition. This part of the study differs significantly from previous findings of a higher prevalence of dental caries among girls than among boys. Studies indicate that girls develop earlier, are exposed to the oral environment for longer periods after tooth eruption, and prefer sweets more [21]. It is possible that individual differences in sample size account for this part of the difference between results.

We found that the level of parental education, dental plaque, tartar, mastery of brushing methods, knowledge of oral health care, regular oral examination, gargling after meals, and brushing before bedtime followed by eating were independent risk factors for the development of caries disease, while daily brushing habits, parental supervision (assisted) brushing, place of residence, and frequency of eating desserts or beverages were protective factors for the development of caries disease. These findings showed that parents with higher education were more concerned with children's oral health when it came to supervised and assisted brushing, greater attention paid to children's brushing skills, a better knowledge of oral health care, regular checkups, and a reduction in sweets and beverages consumption. There was also a correlation between dental caries prevalence and children's residence location, with a higher proportion of children living in rural areas. It is possible that accessibility of care and oral health care significance contributed to this finding, but further investigation requires a larger sample size.

A comparison of the two groups of children with or without periodontitis revealed that periodontitis occurrence was not related to age, gender, time to start brushing, daily caregivers, oral health care knowledge acquisition brushing before bedtime followed by eating. Logic regression analysis showed that periodontitis occurrence was not related to parental education and knowledge of oral health care. Plaque, tartar, mastery of brushing methods, regular oral examination, and gargling after meals were independent risk factors for the development of periodontitis, while daily brushing habits, parental supervision (assisted) brushing, place of residence, and frequency of eating desserts or beverages were protective factors for the development of caries disease. The results suggest that children with plaque or tartar are at greater risk of caries and periodontitis, so proper brushing habits, regular checkups, and postprandial rinsing may help prevent these conditions.

5. Conclusions

Therefore, parents' awareness of oral health care should be strengthened to prevent and treat children's oral health problems in the future. It is critical to encourage children to brush their teeth and develop good oral hygiene habits. Especially for children who enjoy sweets and beverages, don't gargling after meals, and have poor oral hygiene (plaque or tartar is more abundant), oral health awareness campaigns should be further strengthened to emphasize the importance of cleaning tooth surfaces, and regular checkups should be conducted. In this study, although all children brushed their teeth regularly, there was no qualitative analysis of the control of dental biofilms performed, which should be evaluated in future studies.

AVAILABILITY OF DATA AND MATERIALS

The authors declare that all data supporting the findings of this study are available within the paper and any raw data can be obtained from the corresponding author upon request.

AUTHOR CONTRIBUTIONS

SYL, LF and SFZ—designed the study and carried it out; SYL and LF—supervised the data collection, analyzed the data, and interpreted the data; SYL—prepared the manuscript for publication and reviewed the draft of the manuscript. All authors have read and approved the manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical approval was obtained from the Ethics Committee of Dongyang Hospital of Traditional Chinese Medicine (Approval no. 2023-1). Consent form was voluntarily signed by guardians of all enrolled children before participating in the study.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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