

Original Article



Assessment of oral health status among school students in Tiruvannamalai District, Tamil Nadu, India: A cross-sectional survey

Muthu Durga Lakshmi Irulappan¹, Vishnu Prasad Subramanian¹, Mahesh Jagadeson¹, Indrapriyadharshini Karthikeyan¹, Karthikayan Ravi¹, Revanth MP¹

¹Department of Public Health Dentistry, Karpaga Vinayaga Institute of Dental Sciences, GST Road, Chinnakolambakam, Chengalpattu District, India

*Corresponding Author: Muthu Durga Lakshmi Irulappan, Email: mailmedrmdl@gmail.com

Abstract

Background: Oral health is becoming increasingly essential for improving one's quality of life in India as the population's life expectancy increases. Many oral and orofacial diseases affect students, notably dental caries, gingivitis, malocclusion, and dental fluorosis. This study aimed to examine the oral health condition of school students in Tiruvannamalai District, Tamil Nadu, India.

Methods: A cross-sectional survey was conducted among school students aged 5–17. Two government and two private schools within the Tiruvannamalai district were chosen using the cluster random sampling method, and 5282 students participated in the study. The World Health Organization (WHO) oral health assessment was used to determine the oral health status of school students. The Kruskal-Wallis ANOVA and median tests were used to analyze the data. Post-hoc analysis using the Mann-Whitney U test was also performed for the dmft/DMFT index. The chi-square test was used to compare the proportions of gingivitis, malocclusion, and dental fluorosis. The P value < 0.05 was considered statistically significant.

Results: There was a 3:2 male-to-female ratio among the study participants. Dental caries, gingivitis, malocclusion, and dental fluorosis were found to be 63%, 37.1%, 8.4%, and 3.7%, respectively. The results showed that there was a significant difference in dental caries ($P=0.001$), gingivitis ($P=0.001$), and malocclusion ($P=0.001$). However, they showed no significant difference in dental fluorosis ($P=0.732$) of primary, middle, and high school populations attending government and private schools in the Tiruvannamalai district.

Conclusion: By assessing the oral health examination of school students in the Tiruvannamalai district, the risk for dental caries was found to be higher in primary than middle and high school populations, while high school students had a higher prevalence of gingivitis, malocclusion, and dental fluorosis than middle and primary school students.

Keywords: Dental caries, Dental fluorosis, Gingivitis, Malocclusion, Oral health

Citation: Irulappan MDL, Subramanian VP, Jagadeson M, Karthikeyan I, Ravi K, et al. Assessment of oral health status among school students in Tiruvannamalai District, Tamil Nadu, India: A cross-sectional survey. *J Oral Health Oral Epidemiol.* 2025;14:2404.1644. doi: [10.34172/johoe.2404.1644](https://doi.org/10.34172/johoe.2404.1644)

Received: April 25, 2024, Revised: March 15, 2025, Accepted: March 16, 2025, ePublished: April 20, 2025

Introduction

As the population's life expectancy increases in India, oral health is becoming increasingly essential to improve an individual's physical, mental, social, and economic well-being.¹ Oral diseases remain widespread in human populations despite the recent improvements in oral health. Moreover, dental caries has proven to be one of the most common oral diseases worldwide.² According to the World Health Organization (WHO), up to 90% of school-age students in some countries have dental caries.³ In addition, early childhood caries continues to remain a serious problem in many nations, including developed and developing countries, and it is still a widespread illness.⁴

Although oral diseases tend to be preventable, their risk factors primarily include unhealthy diets high in

simple carbohydrates that lead to acid-producing bacteria demineralizing the tooth enamel.⁵ Fluoride can prevent dental caries, but consuming large quantities of fluoride during early development can have the consequence of fluorosis. Better appearance of children's teeth can enhance their self-esteem and confidence.⁶

In addition, oral health problems have been linked to a substantial decrease in students' attendance at school, as well as a lack of social interaction with their peers. Students' dental problems may additionally cause parents to miss workdays.⁷

Research on the oral wellness of school students in various age groups is predominantly based on students enrolled in schools. Despite the significance and availability of studies from different countries, a lack of research has



been found on the oral health condition of all age groups of school students in the Tiruvannamalai district, India. The study examined oral health conditions among 5- to 17-year-old school students in Tiruvannamalai district, Tamil Nadu, India.

Methods

This cross-sectional survey was approved by the Institutional Ethics Committee of Karpaga Vinayaga Institute of Dental Sciences (KIDS/IEC/2024/I/010). It was conducted among 5- to 17-year-old school students in various taluks of the Tiruvannamalai district, Tamil Nadu, India. Two government and two private schools from the Tiruvannamalai district were selected based on the cluster random sampling method, and consent from school authorities and parents was obtained. A study subject of 5282 students was screened using mirror tactile dental inspection (MTDI). Data collected included demographic factors such as age, sex, and location, and the oral health status of students was evaluated by the WHO oral health assessment. This investigation was carried out from April 2023 to September 2023.

This research included students enrolled in the schools at the time of the oral health examination, ranging in age from 5 to 17 years. Students who were physically challenged and mentally disabled and were unable to attend school on that day were excluded from this study. Students from primary, middle, and high school who met the inclusion and exclusion criteria were divided into groups and prepared for the detection of caries, gingivitis, malocclusion, and dental fluorosis. We can assess and collect data by screening every individual's oral health status. The collected data were entered into a Microsoft Excel spreadsheet and analyzed using SPSS (version 27, SPSS Inc., Chicago, IL, USA). The P value < 0.05 was considered statistically significant.

Results

In total, 5282 students, 2975 from two government

schools and 2307 from two private schools, from the Tiruvannamalai district were selected based on the cluster random sampling method (Figure 1). Dental procedures such as scaling, restoration, and extraction were performed.

Of the participants, 58.2% were male, 41.8% were female, and 35.4%, 23.1%, and 41.5% were in primary school, middle school, and high school, respectively. The increased risk of dental caries was 63%, higher in primary school students than in middle and high school students. The mean dmft/DMFT between primary, middle, and high school students was 1.39, 1.15, and 1.22, respectively (Figures 2a and 2b), which was statistically significant ($*P < 0.001$) according to the Kruskal-Wallis ANOVA and median tests (Table 1).

The post-hoc comparison between primary, middle, and high school students based on the dmft/DMFT index using the Mann-Whitney U test was statistically significant between primary and middle school students ($*P < 0.003$) and primary and high school students ($P < 0.001$) (Table 2). The prevalence of gingivitis was found to be 37.1%, which was statistically significant ($*P < 0.001$) (Figure 3a and 3b); the prevalence of malocclusion was found to be 8.4%, which was statistically significant ($*P < 0.001$), and the prevalence of dental fluorosis was estimated to be 3.7%. All were higher in high school than middle and primary school students (Table 3).

Discussion

Numerous studies have been conducted to assess the prevalence of dental caries in different parts of India.⁸ Since there is a lack of literature about the prevalence of dental caries among school students in the Tiruvannamalai district of Tamil Nadu, the current research was conducted among 5- to 17-year-old school students.

In contrast to Abedassar and colleagues' study, which observed that the mean DMFT value for children over 12 years was 4.98 ± 3.60 , this study revealed that the mean DMFT value for middle school students was

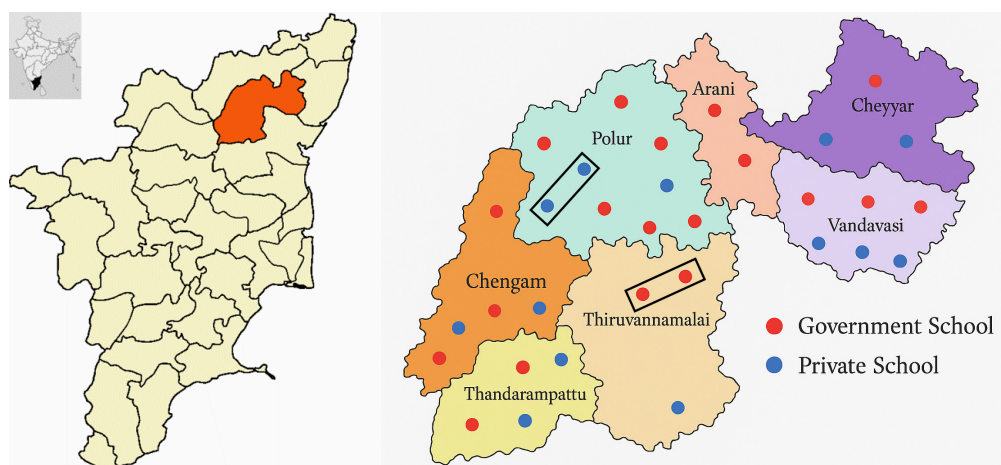


Figure 1. Two government and two private schools from the Tiruvannamalai district

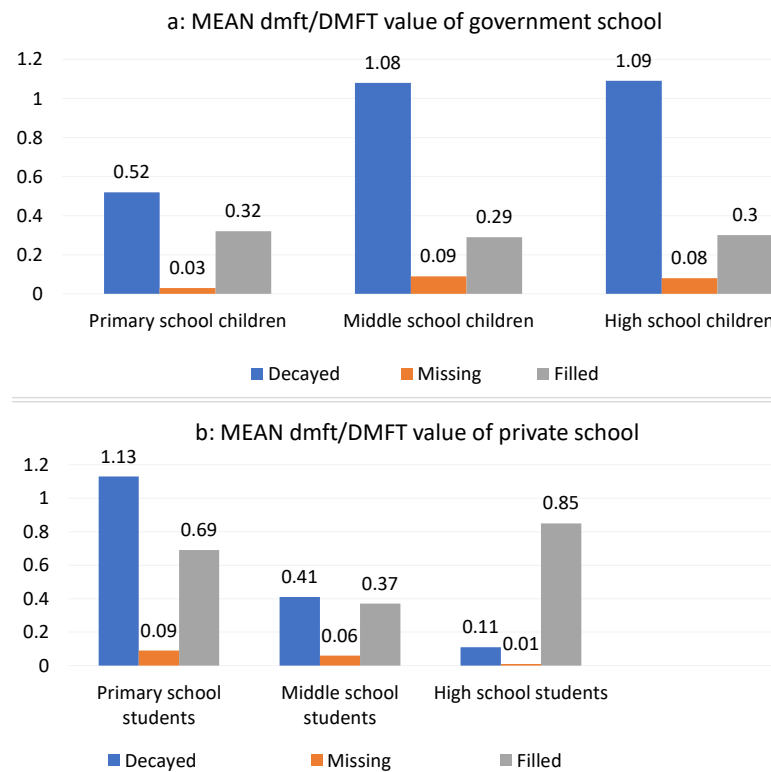


Figure 2. (a) Mean values of the dmft/DMFT index in primary, middle, and high school levels of government school students. (b) Mean values of the dmft/DMFT index in primary, middle, and high school levels of private school students

Table 1. Mean comparison between primary, middle, and high school students based on the dmft/DMFT index

Level of School students	n	Mean	SD	Mean rank	Chi-square	P value
Primary school students ^a	1871	1.39	2.00	2743.63	16.062	0.001**
Middle school students ^a	1221	1.15	1.73	2594.72		
High school students ^a	2190	1.22	1.89	2580.33		
	Primary school students	Middle school students	High school students	Median	Chi-square	P value
>Median	883	517	882	0	20.171	0.001**
≤Median	988	704	1308			

^a Kruskal-Wallis ANOVA test and median test were used

* P value < 0.05 - statistically significant; ** P value < 0.001 - highly significant; P value > 0.05 non-significant (NS).

Table 2. Post hoc comparison between primary, middle, and high school students based on the dmft/DMFT index using the Mann-Whitney U test

Level of school students	n	Mean rank	Sum of ranks	Z-value	P value
Primary school students vs middle school students	1871	1581.41	2958826.00	-2.951	0.003*
	1221	1493.00	1822952.00		
Primary school students vs high school students	1871	2098.22	3925762.00	-3.738	0.001**
	2190	1973.57	4322129.00		
Middle school students vs high school students	1221	1712.72	2091231.00	-0.334	0.738 (NS)
	2190	1702.25	3727935.00		

* P value < 0.05 - statistically significant; ** P value < 0.001 - highly significant; P value > 0.05 non-significant (NS).

1.15 ± 1.73.⁹ The mean dmft score was significantly lower for institutionalized orphan children in Yemen, which Al-Maweri et al¹⁰ reported to be 2.28. According to a study by Anusha et al, this increased risk of caries could be due to a variety of factors, including poor oral hygiene practices,

irregular dietary habits, lack of fluoridated water, easy availability of cheap snacks that are high in sugar, parental neglect, and a lack of effort for preventive care.¹¹ Similar to this research, a study by Shailee et al found that there is a significant difference in mean DMFT between

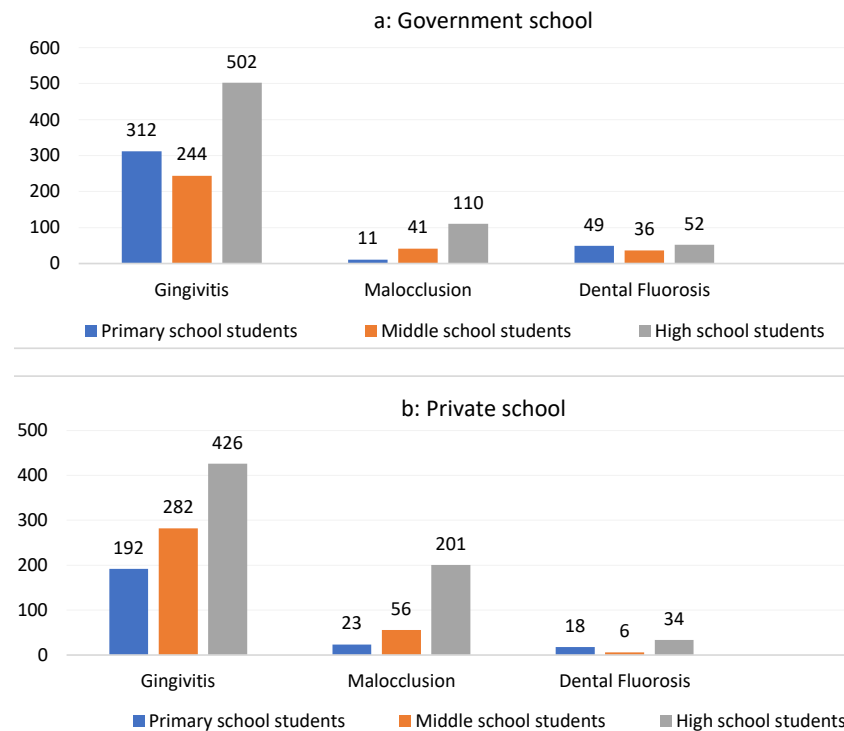


Figure 3. (a) The frequency of gingivitis, malocclusion, and dental fluorosis between primary, middle, and high school levels of government school students. (b) The frequency of gingivitis, malocclusion, and dental fluorosis between primary, middle, and high school levels of private school students

Table 3. Comparison between primary, middle, and high school students based on gingivitis, dental fluorosis, and malocclusion using the chi-square test

Findings	Level of school students	Absent	Present	Chi-square test	P value
Gingivitis	Primary school students	1367	504	127.661	0.001*
	Middle school students	695	526		
	High school students	1262	928		
Fluorosis	Primary school students	1804	67	0.623	0.732
	Middle school students	1179	42		
	High school students	2104	86		
Malocclusion	Primary school students	1837	34	202.169	0.001**
	Middle school students	1124	97		
	High school students	1879	311		

* P value < 0.05 - statistically significant; ** P value < 0.001 - highly significant; P value > 0.05 non-significant (NS).

government and private school children.¹²

Singh and colleagues' study on 8–10-year-old school children in Barabanki district, Uttar Pradesh, reported a 74.36% higher prevalence of gingivitis.¹³ However, the percentage of gingivitis among students was 37.1%, which aligns with this study. The study conducted by AlGhamdi et al on a randomized sample of high school children between the ages 15 to 19 in Saudi Arabia showed a significant prevalence (8.6%) of periodontitis.¹⁴

In the study by Lombardo et al estimating the overall prevalence of malocclusion among different stages of dentition, it was found that the average prevalence of malocclusion for students was estimated to be 56% (CI: 11.0–99.0), whereas this study found that the prevalence of malocclusion was 8.4%.¹⁵ In a systematic review that employed Angle's classification of malocclusion

(25 studies, 28,693 participants), the prevalence of malocclusion among Iranian children under the age of 18 years was found to be 83.1%.¹⁶ Over the past decade, numerous studies have tried to employ cross-sectional observations for individuals, presumably to investigate the malocclusion concern on a population level for the Indian population. The total prevalence of malocclusion was 83.3%, according to Narayanan et al, which was significantly higher than what we observed.¹⁷

On the other hand, a study by Aggarwal et al found that the prevalence of fluorosis was 93.7%, which is significantly higher than the current findings, where the overall rate of fluorosis was 3.7%.¹⁸ Another study was carried out in northern India in Kaiwara village,¹⁹ and a study was conducted in Barabanki district of Uttar Pradesh,¹³ which found that the prevalence was 24.0%

and 33.37%, respectively. A similar study by Verma et al found that 64.3% of adolescents had dental fluorosis, and most government school students were affected, similar to this study. The current fluorosis problem is illustrated by the increasing number of dental fluorosis cases among adolescents as they age.²⁰

In order to preserve a child's oral health and cleanliness, the study highlights the importance of patient education, parental counselling, routine dental examinations, and prophylaxis.²¹

Strength and limitation

The strength of the study is that it includes existing oral health status and treatment needs for a large population of school students at all levels, including both government and private schools. It can also assist in implementing programs to achieve the best possible student health outcomes. The limitation of the research is that, as a cross-sectional survey, it highlights the prevalence of dental caries, gingivitis, malocclusion, and dental fluorosis. Additionally, longitudinal studies are required to monitor school students at all levels.

Conclusion

General health is greatly influenced by oral health. The entire systemic health is significantly impacted by poor oral health. The present research contributes to monitoring school students' oral health in the Tiruvannamalai district, Tamil Nadu, India. Compared to middle and high school students, primary school students had an increased risk of dental caries. Gingivitis, malocclusion, and dental fluorosis were more common in high school students than in primary and middle school students. Creating awareness programs, initiating oral hygiene measures, and performing preventive procedures will improve school students' oral health and well-being.

Authors' Contribution

Conceptualization: Vishnu Prasad Subramanian, Mahesh Jagadeson, Muthu Durga Lakshmi Irulappan.

Data curation: Muthu Durga Lakshmi Irulappan.

Formal analysis: Indrapriyadharshini Karthikeyan, Karthikayan Ravi, Revanth MP.

Investigation: Muthu Durga Lakshmi Irulappan.

Methodology: Muthu Durga Lakshmi Irulappan, Mahesh Jagadeson.

Project administration: Muthu Durga Lakshmi Irulappan, Vishnu Prasad Subramanian, Mahesh Jagadeson.

Resources: Vishnu Prasad Subramanian, Mahesh Jagadeson.

Software: Mahesh Jagadeson, Muthu Durga Lakshmi Irulappan.

Supervision: Mahesh Jagadeson.

Validation: Vishnu Prasad Subramanian, Mahesh Jagadeson, Indrapriyadharshini Karthikeyan, Karthikayan Ravi, Revanth MP.

Visualization: Muthu Durga Lakshmi Irulappan, Vishnu Prasad Subramanian, Mahesh Jagadeson.

Writing—original draft: Muthu Durga Lakshmi Irulappan, Mahesh Jagadeson.

Writing—review & editing: Muthu Durga Lakshmi Irulappan.

Competing Interests

The authors declare no conflict of interest.

Data Availability Statement

The datasets used and analyzed during the current study are available from the corresponding author upon reasonable request.

Ethical Approval

The Institutional Ethics Committee of Karpaga Vinayaga Institute of Dental Sciences approved the study protocol (code: KIDS/IEC/2024/I/010).

Funding

No funding was received for conducting this study.

References

1. Peres MA, Macpherson LMD, Weyant RJ, Daly B, Venturelli R, Mathur MR, et al. Oral diseases: a global public health challenge. *Lancet*. 2019;394(10194):249-60. doi: [10.1016/S0140-6736\(19\)31146-8](https://doi.org/10.1016/S0140-6736(19)31146-8).
2. Pouradeli S, Rad M, Shahravan A, Hashemipour MA, Rezaeian M. Effect of different methods of education on oral health in children with hearing impairment: a systematic review. *J Oral Health Oral Epidemiol*. 2019;8(2):55-60. doi: [10.22122/johoe.v8i2.329](https://doi.org/10.22122/johoe.v8i2.329).
3. Torabi-Parizi M, Eskandarizadeh A, Razifar M, Karimi-Afshar M, Mosharafian S. Assessment of significant caries index and oral hygiene status in a 15-year-old student in Kerman, 2012. *J Oral Health Oral Epidemiol*. 2014;3(1):16-20.
4. Soltani R, Barzegar M, Ghaffarifar S. Determinants of oral health-related quality of life and its affecting factors in preschool children: cross-sectional study. *J Oral Health Oral Epidemiol*. 2023;12(1):32-7. doi: [10.34172/johoe.2023.06](https://doi.org/10.34172/johoe.2023.06).
5. Tinanoff N, Baez RJ, Diaz Guillory C, Donly KJ, Feldens CA, McGrath C, et al. Early childhood caries epidemiology, aetiology, risk assessment, societal burden, management, education, and policy: global perspective. *Int J Paediatr Dent*. 2019;29(3):238-48. doi: [10.1111/ipd.12484](https://doi.org/10.1111/ipd.12484).
6. Unde MP, Patil RU, Dastoor PP. The untold story of fluoridation: revisiting the changing perspectives. *Indian J Occup Environ Med*. 2018;22(3):121-7. doi: [10.4103/ijoem.IJOEM_124_18](https://doi.org/10.4103/ijoem.IJOEM_124_18).
7. Pourhashemi SJ, Paryab M, Kheirandish K, Kharazi-Fard MJ. Oral health and school performance in elementary students: a cross-sectional study in a group of Iranian students, Tehran, Iran. *J Oral Health Oral Epidemiol*. 2015;4(2):64-70.
8. Reddy KS, Reddy S, Ravindhar P, Balaji K, Reddy H, Reddy A. Prevalence of dental caries among 6-12 years school children of Mahbubnagar district, Telangana state, India: a cross-sectional study. *Indian J Dent Sci*. 2017;9(1):1-7. doi: [10.4103/0976-4003.201641](https://doi.org/10.4103/0976-4003.201641).
9. Abedassar S, Malek-Mohammadi T, Dehesh T, Dahesh S. Oral health status and oral hygiene behaviour of orphan children: a survey in support centers in Kerman city, Iran, in 2019. *J Oral Health Oral Epidemiol*. 2022;11(1):32-9. doi: [10.22122/johoe.2021.195295.1221](https://doi.org/10.22122/johoe.2021.195295.1221).
10. Al-Maweri SA, Al-Soneidar WA, Halboub ES. Oral lesions and dental status among institutionalized orphans in Yemen: a matched case-control study. *Contemp Clin Dent*. 2014;5(1):81-4. doi: [10.4103/0976-237x.128673](https://doi.org/10.4103/0976-237x.128673).
11. Anusha D, Kengadaran S, Prabhakar J, MuthuKrishnan K, Katuri LS, Vigneshwari SK, et al. Prevalence of dental caries and gingivitis among children with intellectual disability in India. *J Family Med Prim Care*. 2022;11(6):2351-5. doi: [10.4103/jfmpc.jfmpc_655_21](https://doi.org/10.4103/jfmpc.jfmpc_655_21).
12. Shailee F, Girish MS, Kapil RS, Nidhi P. Oral health status

- and treatment needs among 12- and 15-year-old government and private school children in Shimla city, Himachal Pradesh, India. *J Int Soc Prev Community Dent.* 2013;3(1):44-50. doi: [10.4103/2231-0762.115715](https://doi.org/10.4103/2231-0762.115715).
13. Singh M, Saini A, Saimbi CS, Bajpai AK. Prevalence of dental diseases in 5- to 14-year-old school children in rural areas of the Barabanki district, Uttar Pradesh, India. *Indian J Dent Res.* 2011;22(3):396-9. doi: [10.4103/0970-9290.87060](https://doi.org/10.4103/0970-9290.87060).
 14. AlGhamdi A, Almarghlani A, Alyafi R, Ibraheem W, Assaggaf M, Howait M, et al. Prevalence of periodontitis in high school children in Saudi Arabia: a national study. *Ann Saudi Med.* 2020;40(1):7-14. doi: [10.5144/0256-4947.2020.7](https://doi.org/10.5144/0256-4947.2020.7).
 15. Lombardo G, Vena F, Negri P, Pagano S, Barilotti C, Paglia L, et al. Worldwide prevalence of malocclusion in the different stages of dentition: a systematic review and meta-analysis. *Eur J Paediatr Dent.* 2020;21(2):115-22. doi: [10.23804/ejpd.2020.21.02.05](https://doi.org/10.23804/ejpd.2020.21.02.05).
 16. Akbari M, Bagheri Lankarani K, Honarvar B, Tabrizi R, Mirhadi H, Moosazadeh M. Prevalence of malocclusion among Iranian children: a systematic review and meta-analysis. *Dent Res J (Isfahan).* 2016;13(5):387-95. doi: [10.4103/1735-3327.192269](https://doi.org/10.4103/1735-3327.192269).
 17. Narayanan RK, Jeseem MT, Kumar TA. Prevalence of malocclusion among 10-12-year-old schoolchildren in Kozhikode district, Kerala: an epidemiological study. *Int J Clin Pediatr Dent.* 2016;9(1):50-5. doi: [10.5005/jp-journals-10005-1333](https://doi.org/10.5005/jp-journals-10005-1333).
 18. Aggarwal C, Sandhu M, Sachdev V, Dayal G, Prabhu N, Issrani R. Prevalence of dental caries and dental fluorosis among 7-12-year-old school children in an Indian subpopulation: a cross-sectional study. *Pesqui Bras Odontopediatria Clin Integr.* 2021;21(6):e0141. doi: [10.1590/pboci.2021.031](https://doi.org/10.1590/pboci.2021.031).
 19. Isaac A, Wilma Delphine Silvia CR, Somanna SN, Mysorekar V, Narayana K, Srikantaiah P. Prevalence and manifestations of water-born fluorosis among schoolchildren in Kaiwara village of India: a preliminary study. *Asian Biomed.* 2009;3(5):563-6. doi: [10.5372/abm.v3i5.257](https://doi.org/10.5372/abm.v3i5.257).
 20. Verma A, Shetty BK, Guddattu V, Chourasia MK, Pundir P. High prevalence of dental fluorosis among adolescents is a growing concern: a school based cross-sectional study from Southern India. *Environ Health Prev Med.* 2017;22(1):17. doi: [10.1186/s12199-017-0624-9](https://doi.org/10.1186/s12199-017-0624-9).
 21. Saccomanno S, De Luca M, Saran S, Petricca MT, Caramaschi E, Mastrapasqua RF, et al. The importance of promoting oral health in schools: a pilot study. *Eur J Transl Myol.* 2023;33(1):11158. doi: [10.4081/ejtm.2023.11158](https://doi.org/10.4081/ejtm.2023.11158).