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Dental Caries and Molar Incisor Hypomineralisation Prevalence Among School Children's in Kavrepalanchowk District, Nepal

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ABSTRACT

Background

Dental caries and molar incisor hypomineralization (MIH) are common oral conditions in children, affecting quality of life, school performance, and self-esteem. These conditions remain prevalent in low- and middle-income countries even though some efforts are being done. The objective of this study is to determine the prevalence of dental caries and molar incisor hypomineralization (MIH) among school children in Kavrepalanchowk District, Nepal.

Methods

A cross-sectional study was conducted involving 622 students from two purposively selected schools. Oral examinations were performed by calibrated dentists using WHO 2013 criteria for dental caries and European Academy of Pediatric Dentistry criteria for MIH. Data were analyzed using descriptive statistics, chi square test and Spearman's rank correlation coefficien

Results

Overall, 61.3% of children have dental caries in primary dentition (dmft) and 50.5 % in Permanent dentition (DMFT). Mean dmft score was 3.16±3.40 and mean DMFT was 1.34±1.80. MIH affected 11.7% of molars and 15.3% of incisors, most commonly the maxillary central incisors. Children with molar MIH were 4.9 times more likely to have incisor MIH (p-value<0.001). Fluorosis prevalence was low (4.3%). Intervention urgency indicated that 82.2% required prompt treatment, and 5.1% required immediate care.

Conclusions

Dental caries remains highly prevalent in this population, with the majority requiring urgent treatment. MIH serves as a significant risk indicator for caries susceptibility. These findings highlight the necessity for targeted, school-based preventive and curative oral health programs.

Keywords: dental caries; dental enamel defects; molar incisor hypomineralization; oral disease; oral health.

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INTRODUCTION

Oral diseases are a significant public health concern in the South-East Asia region, representing common non-communicable diseases with pronounced inequalities affecting disadvantaged populations.[1] In 2019, over 900 million cases of untreated dental caries, severe periodontal diseases, and edentulism were estimated in this region. [2] Globally, over a third of the population suffers from untreated caries, with permanent teeth caries affecting two billion people and deciduous teeth caries affecting 514 million, predominantly in middle-income countries with limited resources. [3] Dental caries, an irreversible microbial disease, involves acid-induced demineralization and destruction of tooth structure, leading to cavitation.[4] MIH, a developmental defect characterized by demarcated opacities, enamel discoloration, post-eruptive breakdown, and increased caries susceptibility. [5] Its global prevalence is 14.2%,[6] with a range of 2.4% to 40.2%.[7] Dental fluorosis results from excessive fluoride ingestion during enamel formation, causing mottling.[8] While fluoride prevents caries in controlled doses. Evaluating oral health status and categorizing children by treatment need through intervention urgency is crucial for effective resource allocation in school based oral health programs. This study aimed to determine the prevalence of dental caries and molar incisor hypomineralization and emergency urgency among school children in Kavrepalanchowk district of Nepal.

METHODS

This school-based, cross-sectional analytical study was conducted from December 2023 to January 2024. The study population comprised school children attending Kavre English Secondary School and National Rising English Secondary School, both purposively selected within Panauti Municipality, Kavrepalanchowk district, Bagmati Province. Students aged 6-15 years who were willing to participate were included. Exclusion criteria involved students with known systemic conditions, those with orthodontic appliances, and children presenting with generalized developmental defects such as Amylogenesis imperfecta, Dentinogenesis imperfecta, hypoplasia, diffuse opacities, white spot lesions, tetracycline stains, erosion, fluorosis, and Turner's hypoplasia. The sample size was calculated using the formula: $n=z^2 p(1-p)/ d^2$, based on a 95% confidence interval (Z=1.96), 5% margin of error (d=0.05), and a baseline prevalence rate (p) of 53.7% derived from a study by Hyo-Jin Lee et al.[9], the initial sample size was determined to be 381. Adjusting for a 95% response rate, the final target sample size was 402. Ethical approval (Approval Number: IRC No.152/23) was obtained from the Kathmandu University School of Medical Sciences, Institutional Review Committee (KUSMS-IRC). Written informed consent was secured from parents or guardians, and assent was obtained from the participating children. School authorities were informed and permission was obtained prior to data collection. Oral health screenings were conducted by three dentists, registered with the Nepal Medical Council (NMC), under the direct supervision of the principal investigator. A Type 3 dental examination, as per American Dental Association (ADA)[10] guidelines was performed using sterile mouth mirrors and explorers under good illumination, adhering to universal safety precautions. Standardized examination conditions included consistent lighting and appropriate positioning. Prior to the study, all examiners received comprehensive training on data collection forms and examination techniques. To ensure inter-examiner reliability and minimize bias, calibration exercises were completed, and Cohen's kappa statistic was employed to assess inter-rater agreement. The screening took place in the presence of teachers, according to individual class schedules, following prior communication with school principals and teachers. The World Health Organization's (WHO) Oral Health survey form was utilized to collect data regarding dental caries

(based on Klein, Palmer, and Knutson criteria) and Intervention Urgency (scores 0-4 indicating treatment need from no treatment preventive to immediate or referral). [11] The diagnostic criteria for Molar Incisor Hypomineralization (MIH) were based on the 2003 guidelines from the European Academy of Pediatric Dentistry (EAPD).[12] A systematic evaluation assessed permanent first molars (buccal, lingual/palatal, occlusal surfaces) and permanent incisors (labial surfaces) for demarcated opacities and enamel breakdown. Data were entered and analyzed using IBM SPSS Statistics for Windows, Version 25.0. Descriptive statistics, including frequencies, percentages, and means, were calculated for all relevant variables. Inferential analyses, such as correlation, independent samples t-tests, and Analysis of Variance (ANOVA), were conducted to assess relationships and differences between various study variables. A p-value of <0.05 was considered to indicate statistical significance.

RESULTS

This study included 622 school students aged 6 to 15 years (Mean: 10.44 years), 342 (55%) boy and 280 (45%) girls from two schools, 300 students in Kavre English Secondary School and 322 students in National Rising English Secondary School. Table 1 measure caries experience among deciduous and permanent teeth and prevalence of MIH and fluorosis. 61.3% of the children have dental caries in primary dentition with the range 0-14 and 50.5% have dental caries in their permanent teeth with the range 0-8.

For children aged 7 to 12 years, the mean decayed score for primary teeth (dmft) was 4.35 ± 3.29 and 0.87 ± 1.26 for permanent teeth. For children aged 13 to 15 years, the mean decayed score for Permanent teeth (DMFT) was 2.52 ± 2.34. Whereas overall mean dmft was 3.16 ± 3.40 and mean DMFT 1.34 ± 1.80 (Table 1).

The prevalence of MIH among the students was 20.6 %. Where MIH is limited to presence of yellow or brown demarcated opacities with no Post eruptive enamel breakdown, according to the European Academy of pediatric Dentistry criteria. Upper central Incisor is most commonly affected followed by lower permanent first molar. 4.35 of the students had fluorosis which is limited to mild form of fluorosis.

Table 1. Prevalence of Dental caries, MIH and Fluorosis.

dmft	Present, n(%)	Absent, n(%)	Range	Mean±SD
	318 (61.3 %)	241 (38.7)	0-14	3.16±3.40
DMFT	314 (50.5)	308 (49.5)	0-8	1.34±1.80
MIH	129 (20.6)	493 (79.4)	0-8	0.66±1.56
Fluorosis	27 (4.3 %)	595 (95.7)	0-2 grade	0.07±0.34

dmft: decayed primary tooth, DMFT: Decayed permanent tooth, MIH: Molar incisor Hypomineralization.

Table 2. Distribution of MIH according to the type of tooth.

Type of teeth affected	No. of teeth affected in an individual	Frequency	Percentage among total population	Percentage among MIH	Mean ± SD among MIH
Molars	1	22	3.5	30.1	2.40 ± 2.00
	2	20	3.2	27.4	
	3	11	1.8	15.1	
	4	20	3.2	27.4	
Incisors	1	21	3.4	22.1	2.43 ± 2.00
	2	39	6.3	41.1	
	3	8	1.3	8.4	
	4	27	4.3	28.4	

Table 3. MIH relationship between Permanent Molars and Central Incisors.

Permanent Molar Incisor	Deciduous Molar		Total
	0	1	
0	290	9	299
1	46	7	53
Total	336	16	352

Table 4. Intervention Urgency (IU) among the school children.

Score	Intervention Urgency	Frequency (%)
0	No treatment needed	3(0.5)
1	Preventive or routine treatment	75(12.1)
2	Prompt treatment required	511(82.2)
3	Immediate (urgent) care	32(5.1)
4	Referral for specialized or advanced care	1(0.2)

Table 2 explains how MIH affects children's teeth. MIH is found more in their incisors (15.3%) than molars (11.7%). Most children had exactly 2 incisors affected (41.1%), and their molar involvement typically ranged from 1, 2 or 4 molars. On average, children have about 2.4 affected teeth, showing that the level of severity is similar. (Table 2)

Overall, 40 children have MIH in both their molars and incisors. The teeth most often affected are left maxillary central incisors (71 children; 11.4%), right maxillary central incisors (63 children; 10.1%) and left mandibular molars (55 children; 8.9%). An Odds Ratio (OR) was computed to assess the association between the occurrence of MIH in both the deciduous molars and permanent molars among the children. (OR= (290*7)/ (46*9) = 4.9) Children with MIH in their molars were around four times more likely to also have MIH in their incisors (OR = 4.9, 95% CI (1.74, 13.81). p-value< 0.001). This shows a strong and statistically significant link between molar and incisor hypomineralization (Table 3).

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Correlation between variables were tested using Spearman's rank correlation coefficients (r). Significant positive correlation between age and decayed permanent teeth (r = 0.49), indicating permanent tooth decay increases with age. Intervention Urgency (IU) was positively correlated with both decayed primary teeth and decayed permanent teeth, indicating intervention urgency was associated with higher caries score (Table 5).

Table 5. Correlation and factors associated with Dental caries.

Variable	Age	Decayed (primary teeth)	Decayed (permanent teeth)
Age	-	r =-0.64, p-value<0.001*	r = 0.49, p-value <0.001*
Gender	r = -0.008, p-value=0.85	r = 0.02, p-value=0.57	r = 0.08, p-value =0.06
Dental visit	r = 0.12, p-value=0.004	r = 0.05, p-value =0.18	r = 0.059, p-value =0.14
Decayed primary teeth	r=-0.64,p-value<0.001*	-	r = -0.24, p-value <0.001*
Decayed permanent teeth	r = 0.43, p-value <0.001*	r = -0.24, p-value<0.001*	-
Fluorosis	r = -0.025, p-value =0.53	r = 0.04, p-value =0.33	r = 0.039, p-value =0.91
IU	r = -0.10, p-value =0.013*	r = 0.37, p-value <0.001*	r = 0.20, p-value<0.001*

** Statistically significant, Spearman's rank correlation coefficient.*

DISCUSSION

This study evaluated the oral health status of children by using key indicators such as frequency of decayed deciduous teeth, decayed permanent teeth, enamel defects (Molar Incisor Hypomineralization), dental fluorosis, and how urgently treatment was needed. Our results showed that 38.7% of children were free of cavities in their baby teeth, while 49.5% had no cavities in their adult teeth. While this suggests that adult teeth are currently healthier in this group, this may also be due to the age distribution among the participants, as this study only involves school-going children aged 6 to 15 years. Similar cavity rates have been found in other studies of this age group. [13,14] According to the World Health Organization (WHO), a population has a low prevalence of cavities if more than 50% of children are caries free. [11] Unfortunately, our data consistent with most data from Nepal shows that we have not met this goal. Despite public health efforts, tooth decay remains a heavy burden in low and middle income countries (LMICs). In these settings, a major set-back is also seen in lack of national level data. We observed a significant gender difference, girls had more cavities in their adult teeth than boys. This aligns with previous research [15] suggesting that females often have higher caries rates due to a combination of factors, including earlier tooth eruption, hormonal influences, genetic factors, and dietary habits. Regarding enamel defects, most teeth were healthy. Only a small number of children had MIH, and most cases were mild (opacities) rather than severe. Previous studies in specific regions of Nepal have reported MIH prevalence between 8.6% and 13.7%.[16, 17] Early detection of MIH was critical because these defects make teeth more sensitive and prone to decay. We found that the upper front teeth (maxillary central incisors) were the most affected, which supports findings from studies in Saudi Arabia. [18] Furthermore, our study shows a link between MIH and cavities where children with these enamel defects had higher rates of decay, highlighting the need for early preventive care for these patients. Dental fluorosis was rare in this population, with 95.7% of children showing no signs of the condition. This suggests that current fluoride exposure is within safe limits. When used correctly, such as brushing twice daily with the right amount of toothpaste and fluoride prevents cavities without causing enamel defects. [19] The assessment of Intervention Urgency (IU) revealed a concerning alarm with 82.2% of children required prompt dental treatment and 5.1% needed immediate care. This high demand for treatment reflects the burden of untreated tooth decay seen in many low-resource settings.[20] As expected, the urgency score was directly linked to the number of decayed teeth, children with more cavities required more urgent attention. Correlational analysis showed important age-related patterns. We found that number of cavities in adult teeth increased with age. This indicates that as children grow, the burden of disease shifts to the permanent dentition. Early identification of problems, such as MIH, along with timely treatment, is essential to stop the progression of decay and improve the quality of life for these children.

Limitations

Selection of school might not represent whole district as the participants were not randomized. The study site school might be difference in socio economic status of the students which might alter the level of oral health knowledge and practice.

CONCLUSIONS

This study demonstrates a substantial burden of dental caries among children, affecting both primary and permanent dentitions. More than half presented with caries in primary teeth and nearly half in permanent teeth, with 82.2% requiring prompt treatment. Caries experience was strongly associated with intervention urgency, underscoring the need for community-level oral health initiatives and school-based programs. Molar incisor hypomineralization (MIH) was present but less in number, and dental fluorosis

was minimal, suggesting low fluoride-related risk. Age trends revealed declining caries in primary teeth and increasing caries in permanent teeth, highlighting the importance of targeted preventive measures to improve oral health–related quality of life. The progressive shift in caries patterns with age underlines the need for continuous monitoring and age-appropriate interventions, especially during the transition from primary to permanent dentition. Although MIH and fluorosis prevalence was low, early detection and management remain important to prevent future complications. Strengthening community-based oral health programs with a focus on prevention, early diagnosis, and timely treatment is very crucial.

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