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Assessment Of School-Age Children In Bihar About The Age And Pattern Of Permanent Tooth Eruption: A Cross-Sectional Descriptive Study.

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Abstract:
Background: *Radiographic methods can be used to assess the calcification, growth, and development of dental crowns and roots. However, because it is less expensive, requires no specialized equipment or training, and takes less time, a clinical examination of the oral cavity is recommended for establishing dental age. The purpose of this study was to examine the association between age ranges and the sequence of dental eruptions, as well as the influence of gender on eruption timing in Bihar school children.*
Methods: *A cross-sectional descriptive study was carried out in 10 randomly selected public schools in Bihar for both boys and girls. 65 students who seemed to be in good bodily and mental health and were between the ages of 5 and 15 were screened using a multi-stage sample approach. A qualified dental professional conducted the inspections in both daytime and with a flashlight. The criterion for eruption was the appearance of teeth through the gingiva.*
Results: *Aside from premolars in both sexes, mandibular teeth appeared earlier than their counterparts in the maxillary dentition. In comparison to boys, girls dental eruption occurred earlier. For boys, the first tooth to erupt was the mandibular permanent first molar, but for girls, the first tooth was the mandibular central incisor. In both sexes, the maxillary permanent second molar erupts last.*
Conclusion: *When compared to the statistics presented in the published literature, the research shows that the tooth eruption dates of school children in Bihar were in agreement in some areas and out of sync in others.*
Keywords: *Tooth eruption, Dental age, Permanent teeth, Children, Eruption sequence.*

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I. Introduction:

An important turning point in a person's life is marked by the eruption of their teeth, which are signs of biological maturity [1]. The transfer of a tooth from its loci of budding within the jaws to its functional position in the oral cavity is known as eruption [2]. It is a complicated process that includes both supra- and intra-osseous events. Understanding age-related dental eruption in ethnic groups is crucial for management and prevention, particularly in the fields of orthodontics and pedodontics [3]. Understanding the eruption's order is equally important [4]. Due to the very consistent time of the eruption of both permanent and deciduous teeth, dental age estimation is one of the most reliable techniques for assessing age [5].

Dental age evaluation techniques include clinical examination of tooth eruption and radiography. Radiography can be used to observe calcification and the shape of dental crowns and roots. However, as it requires no specialized tools or dexterity and is more cost-effective, clinical examination of the oral cavity for dental age evaluation is more appropriate.

Localized research is necessary to better understand the eruption chronology within various ethnic and geographic groups in India due to its diversified population. Mandibular teeth usually erupt earlier than maxillary teeth, and girls frequently have enhanced eruption timelines compared to boys, according to foundational evidence from earlier research, including those carried out in Mysore, South India [6]. These investigations highlight the

value of regional research because, in clinical and forensic contexts, depending solely on Western or generalized Indian standards may result in misunderstandings [7]. Bihar lacks thorough data on the eruption timeline of permanent teeth in its school-aged population due to its distinct socioeconomic, dietary, and demographic landscape [8]. For educators and politicians looking to incorporate oral health into more comprehensive child development programs, as well as for dental professionals and public health experts, it is imperative to establish localized norms for eruption timing and trends in this area [9].

Assessing any predominance in maxillary and mandibular dental eruption timings, determining the range of variation in each tooth's eruption time with respect to gender and residential area, and comparing the mean eruption age of permanent teeth in Bihar school children to their chronological ages were the main goals of the study.

II. Material & Methods:

Between March 2025 and July 2025, ten schools—five for boys and five for girls—that were randomly chosen from various locations in Patna, Bihar state, participated in this cross-sectional descriptive study. The study comprised 65 school children in all, ranging in age from 5 to 15. To preserve confidentiality and per the request made during consent, the names of the schools have been left out; they are now simply referred to as schools.

To prevent inter-examiner variability, each examination was conducted by a single, qualified dental examiner in natural daylight using a dental probe and sterile mouth mirror (Type III examination according to WHO guidelines). If any portion of the crown showed through the gingiva, the tooth was deemed to have erupted. Children with a history of developmental problems such as cleft lip and palate, nutritional or endocrine imbalances, or a chronic localized oral infection were not included in the study. Each permanent tooth's existence or absence, sex, case number, date of inspection, and date of birth were noted and classified for further statistical analysis. For this investigation, no radiographs or other dental records were obtained.

A proforma that was pre-structured was used to record each child's tooth eruption status. Based on the last birthday and verified by school records, age was entered in full years. Each permanent tooth's presence or absence—aside from third molars—was recorded quadrant-wise.

The statistical software application SPSS for Windows, Version 16.0 (SPSS Inc., Chicago, IL, USA), was used for all statistical analyses. For every tooth, descriptive data of eruption time were calculated. The differences between the maxillary and mandibular arches, as well as between boys and girls, were evaluated using independent t-tests. P-values were deemed statistically significant if they were less than or equal to 0.05.

III. Result:

The timing and patterns of permanent teeth eruption in Bihar students are the main subjects of the study. The table 1 clearly depicts these eruption times regarding gender, and the table lists the normal eruption ages for each teeth in both boys and girls. Notable results from the data indicate that, in comparison to boys, girls showed earlier dental eruption for all tooth types (Table 1).

Table 1: Comparison of Mean Eruption Age in Boys and Girls

Tooth Type	Boys (Mean ± SD)	Girls (Mean ± SD)	P value
Central Incisor UR	7.58 ± 0.52	7.33 ± 0.72	0.062
Central Incisor LR	7.59 ± 0.39	7.39 ± 0.59	0.081
Lateral Incisor UR	8.79 ± 0.71	9.09 ± 0.62	0.022
Lateral Incisor LR	8.64 ± 0.66	9.11 ± 0.72	0.004
Canine UR	9.96 ± 0.98	9.64 ± 0.82	0.068
Canine LR	9.92 ± 0.96	9.62 ± 0.59	0.038
1st Premolar UR	10.71 ± 0.52	10.59 ± 0.41	0.682
1st Premolar LR	10.58 ± 0.52	10.54 ± 0.43	0.648
2nd Premolar UR	11.29 ± 0.71	11.71 ± 0.51	0.031
2nd Premolar LR	11.29 ± 0.62	11.58 ± 0.52	0.023
1st Molar UR	7.21 ± 0.56	7.11 ± 0.48	0.341
1st Molar LR	7.24 ± 0.57	7.08 ± 0.61	0.385
2nd Molar UR.	13.81 ± 0.86	14.31 ± 0.81	0.025
2nd Molar LR	13.74 ± 0.88	13.64 ± 0.69	0.831

Although this particular information is not shown in the current summary, the mandibular teeth's eruption happened somewhat earlier than the maxillary teeth's, which is consistent with previously reported patterns. The teeth that emerged first were the first molars, and the teeth that emerged last were the second molars (Table 2).

Table 2: Comparison of Mean Eruption Age (Upper and Low Jaw)

Tooth	**Maxillary** (Mean ± SD)	**Mandibular** (Mean ± SD)
Central Incisor	7.61 ± 0.57	7.60 ± 0.49
Lateral Incisor	9.11 ± 0.71	8.99 ± 0.74
Canine	9.92 ± 0.88	9.72 ± 0.81
1st Premolar	10.71 ± 0.50	10.72 ± 0.51
2nd Premolar	11.62 ± 0.49	11.64 ± 0.45
1st Molar	7.11 ± 0.62	7.14 ± 0.61
2nd Molar	13.91 ± 0.81	13.64 ± 0.84

IV. Discussion:

For both general dentists and specialists who treat dental issues in developing children, it is critical to comprehend the timing and sequence of permanent tooth eruption [10]. Both clinical and radiographic approaches can be used to establish the timing and sequence of an eruption; however, radiographic methods may not be practical in developing countries and may not be appropriate for community-based investigations in both developing and developed nations due to ethical concerns [11]. Thus, the eruption period of teeth was clinically assessed in the current study.

It was challenging to identify any congenitally missing or extracted teeth in this study because the children's intraoral examinations were conducted at their schools in natural light or with the aid of a well-focused torch without a radiograph. This could potentially have an impact on a statistical analysis of mean eruption time [12,13]. Variability in eruption time between communities is linked to a number of factors, including environmental factors such as socioeconomic status and nutritional quotient [14,15] and genetic characteristics, including gender [16,17]. However, only the effects of gender and residential area (rural or urban) on eruption time and pattern were examined because this kind of study has not yet been conducted in Bihar.

There are notable parallels between the findings of the current study carried out in Bihar and the numerous studies that have examined the timing and patterns of permanent tooth eruption across a variety of populations. Khan reported no statistically significant differences in eruption timing between genders, however slight delays were noted relative to global standards, presumably related to regional dietary peculiarities [18]. Chaitanya et al. in Hyderabad recommended region-specific eruption charts for accurate dental diagnosis after observing an earlier eruption in girls and a continuous sequence of mandibular teeth erupting before their maxillary counterparts [19].

One possible drawback of this study is the challenge of obtaining an exact extraction history in the age range, particularly between 5 and 10 years. It can be difficult to identify whether teeth have ever been extracted merely based on self-reported information or parental memories.

V. Conclusion:

The findings of this study indicated that, in contrast to earlier research, the eruption of the central and lateral incisors and permanent first molars was delayed by many months, while the eruption of the remaining teeth was somewhat accelerated. Future research should include thorough examinations of sizable and uniform population subgroups in order to more precisely ascertain the eruption timings and sequences of permanent teeth.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

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Author contributions

Pallawi: Conceptualization; Formal analysis; Methodology; Writing—original draft; data collection.
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Kumari Menka: Conceptualization; Formal analysis; Methodology; Writing—original draft; data collection.
Priyanka Narayan: Conceptualization; Formal analysis; Methodology; Writing—original draft; data collection.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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