

Age and Sequence of Eruption of Permanent Central Incisors, Lateral Incisors and First Molars During Mixed Dentition Phase Among School Children in Prayagraj: A Cross-Sectional Study

Arvind Kumar¹, Rajesh Kumar Rai², Dinesh Kumar Singh³, Archana Kaul⁴

¹Junior Resident III, Department of Forensic Medicine & Toxicology, Motilal Nehru Medical College, Prayagraj.

²Associate Professor, Department of Forensic Medicine & Toxicology, Motilal Nehru Medical College, Prayagraj.

³Assistant Professor, Department of Forensic Medicine & Toxicology, Motilal Nehru Medical College, Prayagraj.

⁴Professor and Head, Department of Forensic Medicine & Toxicology, Motilal Nehru Medical College, Prayagraj.

Corresponding Author: Dr. Archana Kaul

DOI: <https://doi.org/10.52403/ijhsr.20261018>

Received: 12/06/2026; Revised: 02/09/2026; Accepted: 21/10/2026

ABSTRACT

Background: Dental development is useful for age estimation in children, especially when reliable birth records are not available. Clinically, the eruption of permanent teeth is a simple, non-invasive and inexpensive method that can provide supportive information during the mixed dentition period.

Objective: To determine the mean age and sequence of eruption of the permanent first molars, central incisors and lateral incisors among school children in Prayagraj.

Materials and Methods: This cross-sectional descriptive study included 394 children aged 5-15 years. The study was carried out by the Department of Forensic Medicine and Toxicology, Moti Lal Nehru Medical College, Prayagraj, among students of Jwala Devi Saraswati Shishu Mandir, Civil Lines, Prayagraj. The clinical eruption status of the selected permanent teeth was recorded in the maxillary and mandibular arches.

Results: Of the 394 children, 275 (69.8%) were male and 119 (30.2%) were female. The mean age at eruption of the first permanent molar was 6.57 years in both arches. The mandibular and maxillary central incisors erupted at mean ages of 6.77 and 6.84 years, respectively, while the mandibular and maxillary lateral incisors erupted at 7.32 and 7.62 years, respectively. Among the teeth studied, the eruption sequence was first molar, followed by central incisor and then lateral incisor. The original dataset also placed the presence of CI + M1 and CI + M1 + LI within an estimated age range of 5–9 years.

Conclusion: The first permanent molar erupted earliest among the teeth studied. Mandibular incisors erupted slightly earlier than their maxillary counterparts. These findings may provide supportive local reference information for age assessment during the early mixed dentition period.

Keywords: Dental age estimation; Tooth eruption; Permanent first molar; Central incisor; Lateral incisor; Mixed dentition; Forensic odontology.

INTRODUCTION

Age estimation is an important part of forensic medicine and forensic odontology. It may be required for personal identification and in medico-legal situations involving juvenile justice, legal responsibility, child labour, marriage, employment and unidentified individuals. [1,2] In children, dental development provides useful information because tooth formation and eruption follow a broadly predictable pattern, although the exact timing varies between populations. Clinical examination of tooth eruption is simple, non-invasive and inexpensive. It does not require radiographic exposure and can therefore be useful in school-based and community studies. The mixed dentition period, usually extending from about 6 to 12 years of age, is particularly important because several permanent teeth emerge during this period. [3-5] The timing of permanent tooth eruption is influenced by several biological and environmental factors, including sex, ethnicity, nutritional status, socioeconomic conditions and geographic background. For this reason, eruption standards obtained from one population may not always be directly applicable to another. [6-9] Population-specific information is therefore helpful both for clinical dental practice and for forensic age assessment. Studies from India and other countries have shown variation in the timing and sequence of eruption, while mandibular teeth often tend to emerge earlier than corresponding maxillary teeth in the anterior region. [10-13] Published information from Eastern Uttar Pradesh is limited. The present study was therefore undertaken to describe the mean age and sequence of eruption of the permanent first molars, central incisors and lateral incisors among school children in Prayagraj.

MATERIALS & METHODS

Study design and setting: A cross-sectional descriptive study was conducted over a period of one year by the Department of Forensic Medicine and Toxicology, Moti Lal Nehru Medical College, Prayagraj. The study subjects were students of Jwala Devi Saraswati Shishu Mandir, Civil Lines, Prayagraj. The Institutional Ethical Committee approval was obtained before commencement of the study and a pilot study were done before the actual study.

Study population: Male and female students aged 5-15 years, from UKG to Class VII, were included in the study population. This age range was selected because it covers the mixed dentition period and the expected eruption of the permanent first molars and incisors. The participation in the study was fully voluntary and the written informed consent were obtained from the participants.

Exclusion criteria: Children were excluded when consent for participation was not available; when a congenital anomaly or developmental delay had been diagnosed; when there was a history of preterm birth or low birth weight; when an obvious nutritional deficiency disorder was present; or when there was a history of dental trauma or dental surgery.

Dental examination: The eruption status of the permanent first molars, central incisors and lateral incisors was assessed clinically in the maxillary and mandibular arches. The recorded observations were used to describe the age at eruption and the sequence of eruption of the selected teeth. The manuscript did not provide a separate radiographic assessment, and the present report therefore represents clinical eruption findings only. [5-8]

Other variables: Age, sex, socioeconomic status and oral hygiene status were recorded. Socioeconomic data available in the source manuscript specifically identified 153 children (38.8%) as lower middle class

and 146 (37.1%) as upper lower class. Oral hygiene was recorded as good, fair or poor.

Statistical Analysis

The available study data were summarized using frequencies, percentages and mean eruption ages.

RESULT

A total of 394 children aged 5–15 years were included. Of these, 275 (69.8%) were male and 119 (30.2%) were female. The largest age group was 11–12 years, with 67 children (17.1%). The 6–7-year group included 62 children (15.7%), while 61 children (15.5%) were aged 12–13 years.

Table 1. Sex distribution of the study participants

Sex	n (%)
Male	275 (69.8)
Female	119 (30.2)
Total	394 (100)

Table 2. Age distribution of the study participants

Age group (years)	n (%)
5–6	33 (8.4)
6–7	62 (15.7)
7–8	44 (11.2)
8–9	29 (7.4)
9–10	19 (4.8)
10–11	36 (9.1)
11–12	67 (17.1)
12–13	61 (15.5)
13–14	37 (9.4)
14–15	6 (1.5)

Socioeconomic and oral hygiene findings:

The two most frequently reported socioeconomic categories were lower middle class, comprising 153 children (38.8%), and upper lower class, comprising 146 children (37.1%). The source manuscript did not provide a complete category-wise breakdown for the remaining socioeconomic groups. Regarding oral hygiene, 214 children (54.3%) had fair oral hygiene, 150 (38.1%) had poor oral hygiene, and 30 (7.6%) had good oral hygiene.

Table 3. Oral hygiene status

Oral hygiene status	n (%)
Good	30 (7.6)
Fair	214 (54.3)
Poor	150 (38.1)
Total	394 (100)

Mean age at eruption: The first permanent molar was the earliest erupting tooth among those examined, with a mean eruption age of 6.57 years in both the mandible and maxilla. The mandibular central incisor erupted at a mean age of 6.77 years, compared with 6.84 years for the maxillary central incisor. The mandibular lateral incisor erupted at 7.32 years, whereas the maxillary lateral incisor erupted at 7.62 years.

Table 4. Mean age at eruption of the permanent teeth studied

Tooth	Mandible (years)	Maxilla (years)
First permanent molar	6.57	6.57
Central incisor	6.77	6.84
Lateral incisor	7.32	7.62

Comparison between arches: The mandibular central incisor erupted approximately 0.07 years earlier than the corresponding maxillary tooth. The mandibular lateral incisor erupted approximately 0.30 years earlier than the maxillary lateral incisor. No difference was reported between the arches for the first permanent molar.

Eruption sequence: Among the teeth included in the study, the observed sequence was first permanent molar → central incisor → lateral incisor in both arches.

Estimated age from erupted teeth: In the original dataset, the presence of the central incisor together with the first molar (CI + M1) was placed within an estimated age range of 5–9 years. Addition of the lateral incisor (CI + M1 + LI) did not change this

stated range. Because the source manuscript did not describe a statistical derivation for this interval, it should be interpreted cautiously as a descriptive finding rather than a validated prediction rule.

DISCUSSION

The present study describes the eruption timing of the permanent first molars, central incisors and lateral incisors in 394 school children from Prayagraj. The first permanent molar was the earliest tooth among the selected teeth, with a mean eruption age of 6.57 years in both arches. The central incisors followed, and the lateral incisors erupted later. The mandibular central and lateral incisors appeared slightly earlier than their maxillary counterparts. The finding that first molars and incisors are among the earliest permanent teeth to erupt is in agreement with several previous studies. Moslemi et al. [2] studied children aged 4–15 years in Tehran and described the first molars and incisors among the early emerging permanent teeth. Lakshmappa A et al. [4] examined 5,007 Indian school children aged 5–14 years and reported that mandibular teeth generally erupted earlier than maxillary teeth and that girl tended to show earlier eruption than boys. These observations support the general pattern seen in the present study, especially the slightly earlier eruption of mandibular incisors. Chaitanya P et al. [10] examined 1,654 school children aged 5–15 years in Hyderabad and assessed eruption time, sequence and sex differences. Their study also used a cross-sectional design and defined clinical eruption by visibility of a part of the crown through the oral mucosa. The broad sequence reported in Hyderabad places the first molars and incisors among the earliest permanent teeth, which is comparable with the present Prayagraj findings. Differences of a few months between populations are expected because tooth eruption can be influenced by genetic background, nutrition, general health and environmental conditions. Kutesa et al. [7] studied eruption timing in children aged 4–

15 years in Kampala, Uganda, and also evaluated body size in relation to eruption. Their work showed that eruption timing may vary between populations and highlighted the importance of local reference data. Similarly, Upadhyay S et al. [9] examined 623 Nepalese children aged 5–14 years and found that the mandibular first molar was the first permanent tooth to emerge. They also reported that mandibular teeth generally preceded the corresponding maxillary teeth, with significant inter-arch differences for some anterior teeth. This pattern is close to the present observation that mandibular central and lateral incisors erupted before the maxillary incisors. Nassif et al. [12] studied permanent tooth eruption in Lebanese children and reported that first molars and incisors were among the earlier permanent teeth to erupt. Such findings are useful because they show that, although the exact ages vary, the general early mixed-dentition pattern is similar in many populations. Ghose LJ et al. [1] also described population-specific eruption timing among Iraqi school children, further supporting the need to use regional standards rather than relying on a single universal timetable. Additional international studies show similar trends but also demonstrate meaningful population differences. Oziegbe et al. [8] examined 1,078 Nigerian children aged 4–16 years and found that girls generally had earlier mean emergence ages than boys; socioeconomic differences were also observed for some incisors. Bayrak et al. [6] studied 1,491 Turkish children aged 5–15 years and reported that central incisors and first molars were among the first permanent teeth to erupt, while mandibular incisors erupted earlier than their maxillary counterparts. Wedl et al. [3], in a study from Izmir, Turkey, similarly found a tendency toward earlier eruption in females and earlier eruption in the mandible for many teeth. These studies suggest that the basic sequence may be broadly similar, but the exact timing should be interpreted in a population-specific context. An Indian study

by Khan et al. [11] involving 1,477 school children aged 5–15 years reported changes in eruption sequence and examined the relationship of dental age with chronological age and body mass index. Their findings emphasized that eruption patterns may change over time and may also be affected by growth-related factors. More recently, Vandana et al. [13] studied 12,650 school children and adolescents aged 5–18 years in Chennai using multistage random sampling and probit regression. The mandibular first molar was reported as the first tooth to emerge, at approximately 5.5 years, and the study further examined the influence of sex, BMI and socioeconomic status. The younger eruption estimates in that large Chennai sample compared with the 6.57-year mean in the present study illustrates the degree of regional and methodological variation that can occur. The present sample contained more males than females (69.8% versus 30.2%). Although sex is known to influence eruption timing in many populations, sex-specific mean eruption ages were not available in the source data and therefore were not calculated in this report. Future studies from Prayagraj should include balanced representation of both sexes and should compare eruption timing separately in boys and girls. Most children in this study belonged to lower middle and upper lower socioeconomic groups among the categories explicitly reported. Oral hygiene was most commonly fair, followed by poor and good. These variables were described but were not analysed statistically for their relationship with eruption timing. Therefore, no causal conclusion can be drawn from the present data regarding the effect of socioeconomic status or oral hygiene on tooth eruption. Larger studies that include nutritional assessment, BMI and clearly defined socioeconomic measures may help explain some of the variation in eruption timing. From a forensic point of view, clinically visible eruption can provide supportive age information during the mixed dentition period. However, eruption alone should not

be treated as an exact age-determination method because it is influenced by local and individual factors. The 5–9-year age range reported in the source dataset for CI + M1 and CI + M1 + LI has considerable overlap and was not accompanied by a described prediction model. It is therefore better regarded as a broad descriptive range than as a precise forensic age estimate. The main limitations of the study are its cross-sectional design, recruitment from a single school, unequal sex distribution, and lack of detailed inferential statistical analysis in the available dataset. The clinical criteria used to define eruption and examiner calibration were not described in the source manuscript. In addition, the available socioeconomic table did not provide a complete category-wise distribution. These factors should be considered when applying the findings to children outside the study setting.

CONCLUSION

Among the permanent teeth examined in this study, the first molar erupted earliest, followed by the central incisor and then the lateral incisor. The mean eruption age of the first molar was 6.57 years in both arches. The mandibular central and lateral incisors erupted slightly earlier than their maxillary counterparts. These findings may provide useful local reference information for preliminary dental age assessment during the early mixed dentition period, but they should be interpreted together with other clinical and developmental indicators.

Declaration by Authors

Ethical Approval: Approved

Acknowledgement: None

Source of Funding: None

Conflict of Interest: The authors declare no conflict of interest.

Creative Commons Attribution License 4.0

This is an open-access article published under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0).

<https://creativecommons.org/licenses/by/4.0>

REFERENCES

1. Ghose LJ, Baghdady VS. Eruption time of permanent teeth in Iraqi school children. Arch Oral Biol. 1981;26(1):13-5. doi: 10.1016/0003-9969(81)90065-0.
2. Moslemi M. An epidemiological survey of the time and sequence of eruption of permanent teeth in 4-15-year-olds in Tehran, Iran. Int J Paediatr Dent. 2004;14(6):432-8. doi: 10.1111/j.1365-263X.2004.00586.x.
3. Wedl JS, Schoder V, Blake FA, Schmelzle R, Friedrich RE. Eruption times of permanent teeth in teenage boys and girls in Izmir (Turkey). J Clin Forensic Med. 2004;11(6):299-302. doi: 10.1016/j.jcfm.2004.04.007.
4. Lakshmappa A, Gulegdud MV, Patil K. Eruption times and patterns of permanent teeth in school children of India. Indian J Dent Res. 2011;22(6):755-63. doi: 10.4103/0970-9290.94568.
5. Khan N. Eruption time of permanent teeth in pakistani children. Iran J Public Health. 2011;40(4):63-73.
6. Bayrak S, Sen Tunc E, Tuloglu N, Acikgoz A. Timing of permanent teeth eruption in Turkish children. J Clin Pediatr Dent. 2012 Winter;37(2):207-11. doi: 10.17796/jcpd.37.2.8v072017534j0191.
7. Kutesa A, Nkamba EM, Muwazi L, Buwembo W, Rwenyonyi CM. Weight, height and eruption times of permanent teeth of children aged 4-15 years in Kampala, Uganda. BMC Oral Health. 2013; 13:15. doi: 10.1186/1472-6831-13-15.
8. Oziegbe EO, Esan TA, Oyedele TA. Brief communication: Emergence chronology of permanent teeth in Nigerian children. Am J Phys Anthropol. 2014;153(3):506-11. doi: 10.1002/ajpa.22447.
9. Upadhyay S, Shrestha R, Shrestha D, Poudyal S. Permanent Teeth Emergence Time and Sequence in Children of Kavre District, Nepal. Kathmandu Univ Med J (KUMJ). 2016;14(55):269-273.
10. Chaitanya P, Reddy JS, Suhasini K, Chandrika IH, Praveen D. Time and Eruption Sequence of Permanent Teeth in Hyderabad Children: A Descriptive Cross-sectional Study. Int J Clin Pediatr Dent. 2018;11(4):330-337. doi: 10.5005/jp-journals-10005-1534.
11. Khan AS, Nagar P, Singh P, Bharti M. Changes in the Sequence of Eruption of Permanent Teeth; Correlation between Chronological and Dental Age and Effects of Body Mass Index of 5-15-year-old Schoolchildren. Int J Clin Pediatr Dent. 2020;13(4):368-380. doi: 10.5005/jp-journals-10005-1797.
12. Nassif N, Sfeir E. Age and Sequence of Permanent Teeth Eruption in Lebanese Children. Scientific World Journal. 2020; 2020:9238679. doi: 10.1155/2020/9238679.
13. Vandana S, Kandaswamy D, Muthu MS, Aswath Narayanan MB. Sequence and Chronology of Permanent Teeth Eruption in 5-18-Year-Old School Children of Chennai and the Influence of Sex, BMI, and Socio-Economic Status. Am J Hum Biol. 2025;37(1): e24211. doi: 10.1002/ajhb.24211.

How to cite this article: Kumar A, Rai RK, Singh DK, Kaul A. Age and sequence of eruption of permanent central incisors, lateral incisors and first molars during mixed dentition phase among school children in Prayagraj: A cross-sectional study. *Int J Health Sci Res.* 2026; 16(10):170-175. doi: <https://doi.org/10.52403/ijhsr.20261018>
