*Original Research Article*

# ESTIMATION OF THE MEAN ERUPTION TIME OF FIRST PERMANENT MOLARS IN THIRUVANANTHAPURAM POPULATION- A DESCRIPTIVE CROSS-SECTIONAL STUDY

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**ABSTRACT**

**Background:** The current study aimed to ascertain the eruption timing of first permanent molars (FPMs) in children visiting a tertiary healthcare facility in Thiruvananthapuram.

**Materials & Methods:** A hospital-based, cross-sectional investigation was conducted on children aged 4 to 8 years who presented to the outpatient department of the tertiary health centre. A tooth was recorded as erupted if any part of crown penetrated the oral mucosa and became clinically visible. Scores 0 and 1 were considered as unerupted, and partially erupted occlusal surface, respectively. Scores 2 and 3 were deemed as fully erupted occlusal surfaces with less than half of the crown exposed and more than half of the crown exposed, respectively. Score 4 was considered as having full occlusion. Data was evaluated using SPSS Statistics. Comparison of mean age of patients with erupting molars across gender, birth type and birth weight were done using independent t- test, whereas the comparison according to body mass index, socioeconomic status, religion, and parents' age, were done using one-way ANOVA test. A p- value <0.05 was considered the threshold for statistical significance.

**Results:** A total of 420 children were examined, 64 (15.3%) had unerupted, 239 (56.9%) had erupting and 117 (27.8%) had erupted permanent first molars. Mean age for eruption of the analytical sample for FPMs was 68.31months/5.7 years with a standard deviation of 6.3months/0.52 years. There was a significant difference between girls and boys with regard to the time of eruption ($p<0.05$), and eruption was earlier among females. However, the comparisons of mean erupting age against BMI, socioeconomic status, birth type, birth weight, religion, father's and mother's age were found to be statistically insignificant.

**Conclusion:** This study disclosed that the rapid development of the FPMs in the study population may necessitate an earlier assessment for orthodontic and preventive dental treatment requirements. Hence reconsidering the timeline for growth modification, space maintenance, and preventive dental protocols, as required.

**Key words:** Eruption time, First permanent molars, Parental age, Sexual dimorphism, Socioeconomic status.



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## INTRODUCTION

The emergence or eruption of first permanent molars (FPMs) is a pivotal developmental milestone with implications for the development of functional occlusion, dental caries risk, and the timing of preventive dental procedures.[1] Various factors influence the FPM tooth eruption. Genetic and hormonal factors, climatic, racial, gender and ethnic differences, socioeconomic status, height, weight, nutrition, fluoride exposure, and temporal variations, together with infrequent general pathological conditions, such as endocrine pathology, irradiation, and developmental syndromes, exert an influence on eruption pattern of FPMs.[2]

Nature has underscored the significance of the first permanent molar by positioning it as the foremost in the eruption sequence of the permanent dentition. They are frequently referred to as the "six-year molars".[3] Issues with the eruption of permanent teeth are classified as temporal anomalies (either early or late eruption) or as deviations in location or orientation. The occurrence of eruption abnormalities in 6-year

molars during the initial phase of mixed dentition poses hazards for subsequent dental arch development and certain combinations of orthodontic malocclusions.[4] The FPM is recognised as the most susceptible to decay in the permanent dentition due to its deep pits and fissures; hence, early eruption necessitates a preventive sealant and fluoride regimen at a younger age.[5] Consequently, the developmental benchmarks for the eruption of FPMs must be assessed for diagnostic purposes, orthodontic intervention planning, and preventive dental interventions.

Many population-based studies on the timing of permanent molar emergence have been connected to the evaluation of pediatric preventive dental treatment.[1] In these therapies, there is reported variance in the timing of the first permanent emergence based on race/ethnicity and sex. The current study aimed to ascertain the eruption timing of FPMs in children visiting a tertiary healthcare facility in Thiruvananthapuram.

## MATERIALS AND METHODS

A hospital-based, cross-sectional investigation was conducted on children aged 4 to 8 years who presented to the outpatient department of Paediatric and Preventive Dentistry at Government Dental College, Thiruvananthapuram. The study was approved by the Institutional Ethics Committee of Government Dental College, Thiruvananthapuram, Kerala with IEC No IEC/E/32/2020/GDCT (06-01-2021). The exclusion criteria were children with systemic diseases, congenital anomalies, dental abnormalities; such as aplasia, hypodontia, supernumerary teeth, impacted teeth, missing teeth, transposed teeth, any permanent tooth extractions, a history of facial trauma or injury that influences the presence, formation, and development of permanent first molars, severe malocclusion and a history of orthodontic treatment. The study also excluded migratory population and children lacking documentation to verify their date of birth. Before initiating the study, ethical approval was secured from the institutional ethics committee, and both verbal and written consent were acquired from the parents. All children presenting at Government Dental College, Thiruvananthapuram, satisfying the research criteria, were enrolled in the study until a sample size of 420 was achieved. The objective was to determine sexual dimorphism, BMI index, socioeconomic status, Birth type and Birth weight, Parental age (maternal and paternal age) and religious lineage, in relation to the mean eruption age of FPM.

Initially, sociodemographic factors like age and gender of the child, weight and height, occupation/income of the parent, and address were noted. The chronological age was assessed by evaluating authentic documents to prove the date of birth (like Aadhar card) and recorded in months. To calculate a child's BMI, the standardised gender-specific BMI-for-age growth charts were used, and socioeconomic status was determined by Modified Kuppuswamy scale.

Dental examination was carried out with the subject seated on an dental chair using a mouth mirror and a blunt probe. Status of eruption of each FPMs were recorded. A tooth was recorded as erupted if any part of crown penetrated the oral mucosa and became clinically visible. Scores 0 and 1 were considered as unerupted, and partially erupted occlusal surface, respectively. Scores 2 and 3 were deemed as fully erupted occlusal surfaces with less than half of the crown exposed and more than half of the crown exposed, respectively. Score 4 was considered as having full occlusion.[6]

Data was evaluated using IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp. IBM Corp. Comparison of mean age of patients with erupting molars across gender, birth type and birth weight were done using independent t- test, whereas the comparison according to, BMI, SES, religion, and parental age were done using one-way ANOVA test. A p- values $<0.05$ was considered the threshold for statistical significance.

## RESULTS

The descriptive information of the patient and parental factors are presented in Table 1a and Table 1b, respectively.

**Table 1a: Description of patient characteristics**

| Variable | Status | N | Percent |
|---|---|---|---|
| Gender | Males | 214 | 51.0 |
| | Females | 206 | 49.0 |
| Birth type | Normal | 303 | 72.1 |
| | C-Section | 117 | 27.9 |
| Birth weight chart | Under weight | 29 | 6.9 |
| | Normal weight | 389 | 93.1 |
| BMI Chart | Under weight | 33 | 8.0 |
| | Healthy weight | 320 | 77.1 |
| | Over weight | 42 | 10.1 |
| | Obese | 20 | 4.8 |
| Term\Preterm | Term | 397 | 94.5 |
| | Preterm | 23 | 5.5 |

**Table 1b: Description of parental factors**

| Variable | Status | N | Percent |
|---|---|---|---|
| Age of Father | Less than 20 | 0 | 0.0 |
| | 20 - 24 | 0 | 0.0 |
| | 25 - 29 | 17 | 4.0 |
| | 30 - 34 | 156 | 37.1 |
| | 35 - 39 | 138 | 32.9 |
| | 40 - 44 | 75 | 17.9 |
| | More than 45 | 34 | 8.1 |
| Age of Mother | Less than 20 | 0 | 0.0 |
| | 20 - 24 | 2 | 0.5 |
| | 25 - 29 | 151 | 36.0 |
| | 30 - 34 | 152 | 36.2 |
| | 35 - 39 | 101 | 24.0 |
| | 40 - 44 | 14 | 3.3 |
| | More than 45 | 0 | 0.0 |
| Socioeconomic status | Upper class | 0 | 0.0 |
| | Upper middle | 31 | 7.4 |
| | Lower middle | 86 | 20.5 |
| | Upper lower | 303 | 72.1 |
| | Lower | 0 | 0.0 |

A total of 420 children were examined, 64 (15.3%) had unerupted, 239 (56.9%) had erupting and 117 (27.8%) had erupted permanent first molars. Mean age for eruption of the analytical sample for FPMs was 68.31months/5.7 years with a standard deviation of 6.3months/0.52 years [Table 2].

**Table 2: Mean age according to eruption status**

| Eruption status | Mean | N | Std. Deviation |
|---|---|---|---|
| Un erupted | 58.09 | 64 | 9.05 |
| Erupting | 68.31 | 239 | 6.27 |
| Erupted | 80.28 | 117 | 8.58 |

An independent t-test confirmed that there was a significant difference between girls and boys with regard to the time of eruption (P value <0.05), and eruption was earlier among females [Table 3]. However, the comparisons of mean erupting age against BMI [Table 4], socioeconomic status [Table 5], birth type [Table 6], birth weight [Table 7], religion [Table 8], father's [Table 9], and mother's [Table 10] age were found to be statistically insignificant.

**Table 3: Comparison of mean erupting age between males and females.**

| Gender | N | Mean | Std. Deviation | P value |
|---|---|---|---|---|
| Males | 111 | 69.59 | 6.88 | 0.003* |
| Females | 128 | 67.19 | 5.48 | |

Independent t-test, P<0.05 - statistically significant.

**Table 4: Comparison of mean age according to BMI**

| Group | N | Mean | Std. Deviation | P value |
|---|---|---|---|---|
| Under weight | 17 | 68.00 | 6.09 | 0.56 |
| Healthy weight | 185 | 68.20 | 6.42 | |
| Over weight | 23 | 70.09 | 6.08 | |
| Obese | 11 | 67.55 | 5.15 | |

One-Way ANOVA test, P<0.05 - statistically insignificant.

**Table 5: Evaluation of average age across the socioeconomic status**

| Socioeconomic status | N | Mean | Std. Deviation | P value |
|---|---|---|---|---|
| Upper middle | 21 | 69.10 | 5.14 | 0.05 |
| Lower middle | 58 | 69.90 | 6.85 | |
| Upper lower | 160 | 67.63 | 6.11 | |

**Table 6: Evaluation of average age according to birth type**

| Birth type | N | Mean | Std. Deviation | P value |
|---|---|---|---|---|
| Normal | 176 | 68.36 | 5.62 | 0.81 |
| C-Section | 63 | 68.14 | 7.87 | |

Independent t-test, P <0.05 - statistically insignificant

**Table 7: Evaluation of average age according to birth weight**

| Birth weight | N | Mean | Std. Deviation | P value |
|---|---|---|---|---|
| Under weight | 15 | 68.20 | 6.54 | 0.95 |
| Normal weight | 223 | 68.31 | 6.28 | |

Independent t-test, P<0.05 - statistically insignificant

**Table 8: Evaluation of average age according to religion**

| Religion | N | Mean | Std. Deviation | P v{Citation}alue |
|---|---|---|---|---|
| Hindu | 163 | 68.56 | 6.50 | 0.40 |
| Muslim | 56 | 68.20 | 5.66 | |
| Christian | 20 | 66.55 | 6.00 | |

One-Way ANOVA test, P <0.05 - statistically insignificant.

**Table 9: Evaluation of average age according to Father's age**

| Father's age in years | N | Mean | Std. Deviation | P value |
|---|---|---|---|---|
| 25 - 29 | 8 | 67.25 | 6.84 | 0.77 |
| 30 - 34 | 87 | 68.60 | 6.19 | |
| 35 - 39 | 83 | 68.66 | 6.20 | |
| 40 - 44 | 45 | 67.31 | 6.21 | |
| More than 45 | 16 | 68.19 | 7.35 | |

One-Way ANOVA test, P <0.05 - statistically insignificant.

**Table 10: Evaluation of average age according to the Mother's age**

| Mother's age in years | N | Mean | Std. Deviation | P value |
|---|---|---|---|---|
| 25 - 29 | 81 | 68.25 | 6.642 | 0.11 |
| 30 - 34 | 89 | 69.02 | 5.675 | |
| 35 - 39 | 61 | 67.97 | 5.627 | |
| 40 - 44 | 8 | 63.50 | 11.084 | |
| 25 - 29 | 81 | 68.25 | 6.642 | |

One-Way ANOVA test, P <0.05 - statistically insignificant.

## DISCUSSION

Research on children globally, has demonstrated a comparable timing for the eruption of the FPMs.[7-10] The majority of investigations in India have indicated that the eruption of FPMs occur only after six years,[11-14] with comparable findings observed in other research.[15-17] In our investigation the eruption time of the FPMs occurred earlier, at approximately 68.31 months (5.7 years), with a standard deviation of 6.3 months (0.52 years). It is commonly established that girls experience an earlier eruption age than males.[2,18-20] Growth spurts in girls occurred sooner, leading to an earlier development of occlusion. The current study also demonstrated that girls exhibit an earlier age of eruption. The average eruption time for girls was 5.6 years, but for boys it was 5.8 years. There has been no evidence of a gender difference in the timing of eruptions in a Pakistani community.[21]

Factors such as ethnicity, socio-economic status, breastfeeding, gross malnutrition, weight and height, gestational age, preterm birth, cranial morphology, and hormones may vary the eruption sequence of the teeth. The majority of the investigations have documented the differences in age and pattern of primary tooth eruption with respect to these factors,[22-26] while there are not enough number of studies on the association of these variables with the eruption timing of FPM.[27-30] So, it was designed to assess the association between the eruption stage of FPM and BMI, socioeconomic status, birth type, birth weight, and parental age of 4-8 year old children, attending a tertiary health centre.

Viscardi et al,[31] and Khaleefa et al,[22] concluded from their study that delayed primary tooth eruption was related to lower birth weight and premature birth. Meanwhile, Sajjadian et al,[32] found that birth weight and infant age were inversely related to the time of first dental eruption. while there are not enough number of studies on the association of these variables with the eruption timing of FPMs.[29] Our study showed no statistically significant relation between the eruption of first molars and birth weight and gestational age. As the majority of children in our study sample were of

normal birth and normal birth weight category, further studies with a larger sample size may have to be carried out to find those associations in the study population.
The emergence patterns of first molars were not correlated with socioeconomic levels, in the present research. This study had limitations, namely a convenience sample with a comparable socioeconomic status. To our understanding, no investigation in the existing literature has evaluated the correlation between FPM eruptions and parental age, utilising a population-based sample and suitable data modelling techniques. There was no substantial relationship identified between the FPM eruption and parental age.

## CONCLUSION

This study disclosed that the rapid development of the FPMs in the study population may necessitate an earlier assessment for orthodontic and preventive dental treatment requirements, hence considering an earlier timeline for growth modification, space maintenance, and preventive dental protocols. It also substantiates the necessity for early interventions of targeted protection and monitoring for caries prevention, especially as the eruption of FPMs often occur unnoticed by the children as well as the parents.
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## REFERENCES

1. Pahel BT, Vann WF, Divaris K, Rozier RG. A Contemporary Examination of First and Second Permanent Molar Emergence. J Dent Res. 2017 Sep;96(10):1115–21.
2. Lakshmappa A, Guledgud MV, Patil K. Eruption times and patterns of permanent teeth in school children of India. Indian J Dent Res Off Publ Indian Soc Dent Res. 2011 Dec;22(6):755–63.
3. Logan and Kronfeld R,The permanent tooth eruption JADA, Vol. 137 January 2006 page- 127
4. Salbach A, Schremmer B, Grabowski R, Stahl de Castrillon F. Correlation between the frequency of eruption disorders for first permanent molars and the occurrence of malocclusions in early mixed dentition. J Orofac Orthop Fortschritte Kieferorthopädie. 2012 Aug 1;73(4):298–306.
5. Evidence-based Clinical Practice Guideline for the Use of Pit-and-Fissure Sealants. Pediatr Dent. 2016 Oct 15;38(5):120–36.
6. Dashash M, Al-Jazar N. Timing and sequence of emergence of permanent teeth in Syrian schoolchildren. J Investig Clin Dent. 2018 May;9(2):e12311.
7. Logan WHG, Kronfeld R. Development of the Human Jaws and Surrounding Structures from Birth to the Age of Fifteen Years**From the Research Department of the Chicago College of Dental Surgery, Dental Department of Loyola University. Sept. 14, 1932. J Am Dent Assoc 1922. 1933 Mar;20(3):379–428.
8. Wedl JS, Schoder V, Blake F a. S, Schmelzle R, Friedrich RE. Eruption times of permanent teeth in teenage boys and girls in Izmir (Turkey). J Clin Forensic Med. 2004 Dec;11(6):299–302.
9. Almonaitiene R, Balciuniene I, Tutkuviene J. Standards for permanent teeth emergence time and sequence in Lithuanian children, residents of Vilnius city. Stomatologija. 2012;14(3):93–100.
10. Wedl JS, Danias S, Schmelzle R, Friedrich RE. Eruption times of permanent teeth in children and young adolescents in Athens (Greece). Clin Oral Investig. 2005 Jun;9(2):131–4.
11. Kidiyoor V, Monteiro F, Bakkannavar S, Kumar G, Nayak V. Eruption Pattern of Permanent Teeth in the Age Group of 5 to 15 Years of Udupi District of Karnataka. J Indian Acad Forensic Med. 2017 Jan 1;39:349–56.
12. Anusha Raghavan, Nagarajan Srinivasan, Afraa SM Sherif, Natrajan Somasundaram, Muniyappan Govindhan, Madan Kumar Parangimalai Diwakar, Association between Mean Age of Eruption of the Permanent Teeth and Body Mass Index among School-going Children of 7–17 Years of Age in Chennai City. Journal of Oral Health and Community DentistryVolume 13 | Issue 2 | Year 2019
13. Gupta R, Sivapathasundharam B, Einstein A. Eruption age of permanent mandibular first molars and central incisors in the south Indian population. Indian J Dent Res. 2007 Oct 1;18(4):186.
14. Agarwal KN, Gupta R, Faridi MMA, Kalra N. Permanent dentition in Delhi boys of age 5-14 years. Indian Pediatr. 2004 Oct;41(10):1031–5.
15. 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 Aug;11(4):330–7.
16. Limbu DK. Eruption of Permanent Teeth Among the Gallong of Arunachal Pradesh. Journal of Human Ecology. 1996 p. 221–2.
17. Indira MD, Bhojraj N, Narayanappa D. A cross-sectional study on eruption timing of primary teeth in children of Mysore, Karnataka. Indian J Dent Res Off Publ Indian Soc Dent Res. 2018;29(6):726–31.
18. Bagewadi. Comparison of chronology of teeth eruption with body mass index among school children at Mangalore: A cross-sectional study jiaphd.article.2016;volume14,issue3,page 76-80
19. Šindelářová R, Soukup P, Broukal Z. The relationship of obesity to the timing of permanent tooth emergence in Czech children. Acta Odontol Scand. 2018 Apr;76(3):220–5.
20. Frazão P. Emergence of the first permanent molar in 5-6-year-old children: implications from a longitudinal analysis for occlusal caries prevention. Rev Bras Epidemiol Braz J Epidemiol. 2011 Jun;14(2):338–46.
21. Khan MA, Ishfaq M, Akhtar M, Rana SAA, Kashif M. Frequency of paediatric facial trauma in a tertiary care dental hospital. Int Surg J. 2017 Dec 26;5(1):310–4.
22. Khalifa AM, El Gendy RA, El-Mohsen MMA, Hammour AA, El Lateef Aly RSA. Relationship between gestational age, birth weight and deciduous tooth eruption. Egypt Pediatr Assoc Gaz. 2014 Jun 1;62(2):41–5.
23. Oziegbe EO, Adekoya-Sofowora C, Folayan MO, Esan TA, Owotade FJ. Relationship between socio-demographic and anthropometric variables and number of erupted primary teeth in suburban Nigerian children. Matern Child Nutr. 2009 Jan;5(1):86–92.
24. Pavičin IS, Dumančić J, Badel T, Vodanović M. Timing of emergence of the first primary tooth in preterm and full-term infants. Ann Anat - Anat Anz. 2016 Jan 1;203:19–23.
25. Infant growth, development and tooth emergence patterns: A longitudinal study from birth to 6 years of age. Arch Oral Biol. 2007 Jun 1;52(6):598–606.
26. Wu H, Chen T, Ma Q, Xu X, Xie K, Chen Y. Associations of maternal, perinatal and postnatal factors with the eruption timing of the first primary tooth. Sci Rep. 2019 Feb 25;9(1):1–8.
27. Hamsin NHH, Indriyanti R, Musnamirwan IA. Prevalence of delayed first permanent molar eruption among children 7 to 9 years old. Padjadjaran J Dent. 2014;26(1):
28. Paulsson L, Arvini S, Bergström N, Klingberg G, Lindh C. The impact of premature birth on dental maturation in the permanent dentition. Clin Oral Investig. 2019;23(2):855.
29. Sabharwal R, Sengupta S, Sharma B, Singh S, Rastogi V. Correlation of body mass index with eruption time of permanent first molars and incisors and caries occurrence: A cross-sectional study in school children in Uttar Pradesh, India. Eur J Gen Dent 2013;2:114-8.
30. Harila-Kaera V, Heikkinen T, Alvesalo L. The eruption of permanent incisors and first molars in prematurely born children. Eur J Orthod. 2003 Jun;25(3):293–9.
31. Viscardi RM, Romberg Mde, Abrams RG. Delayed primary tooth eruption in premature infants: relationship to neonatal factors. PediatricDentistry: January/February 1994;16(1):23-28.
32. Negar Sajjadian, H Shajari, Ramin Jahadi, Michael G Barkett, Ali Sajjadian Relationship between birth weight and time of first deciduous tooth eruption in 143 consecutively born infants. Pediatr Neonatol 2010 Aug;51(4):235-237.