Permanent Teeth Emergence Time and Sequence in Children of Kavre District, Nepal

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ABSTRACT

Background

Population specific standards on the timing and sequence of emergence of permanent teeth are essential in planning dental care for children. There is only a single study on the emergence of permanent teeth in Nepalese children.

Objective

To determine the standards for permanent teeth emergence time and sequence in children of Kavre district, Nepal.

Method

A descriptive cross sectional study was conducted in 623 children of age 5 to 14 years from six different schools of Kavre district. The number of permanent tooth erupted except third molar was recorded along with age and gender. Data were analysed using SPSS 20.0. Descriptive statistics was used to determine the number and percentage of permanent teeth emerged at different ages and the mean age of emergence of each tooth. Student 't' test was used to determine the inter jaw differences in the mean age of emergence of each tooth.

Result

The study population constituted 50.7% boys and 49.3% girls of the total sample. The first tooth to emerge was mandibular first molar, whereas maxillary second molar tended to be the last to emerge in both the genders. Though in general, mandibular teeth tended to precede the corresponding maxillary teeth in emergence but significantly only mandibular central, lateral and second premolar emerged earlier than maxillary.($p \leq 0.05$)

Conclusion

This study can be used as a reference data for clinical and academic purpose especially for the children of Kavre district, Nepal.

KEY WORDS

Emergence sequence, emergence time, permanent teeth

INTRODUCTION

Tooth eruption is defined as the movement of tooth from it's site of development within the alveolar process to it's functional position in oral cavity.[1] The whole process is divided into five stages one of which is the mucosal penetration or emergence of any visible part of a tooth into oral cavity.[2] Tooth emergence is considered as an important event in individual's life. Studies have found differences in emergence of permanent teeth between ethnic groups, gender, socioeconomic and nutritional factors, carious condition, fluorides, congenital abnormalities such as supernumerary teeth, Down's syndrome, cleidocranial dysplasia, and environmental and secular trends.[3-5]

Developmental norms of emergence of permanent teeth need to be established for diagnosis, orthodontic treatment planning, preventive dentistry procedures, archeological, anthropological, paleontological and may have legal as well as forensic application.[6]

There is only a single study done recently on emergence of permanent teeth in Sunsari district of Eastern Nepal.[7] The reference for the tooth emergence age needed for clinical and academic situations is based on American and European standards. But those standards cannot be extrapolated in Nepalese scenario. So, to determine and establish the standards of tooth emergence age is the need of hour.

METHODS

A descriptive cross sectional study was carried out in 623 school children with age ranging from 5 to 14 years. Sample was collected from four different schools of outreach centers of Dhulikhel hospital and two schools from Dhulikhel itself. Ethical approval for the study was obtained from Institutional Review Committee of Kathmandu University School of Medical Sciences. Prior permission was obtained from principal of school and the date of examination was scheduled. The study was conducted between February 2015 to April 2015.

Physically and mentally healthy children with age ranging from 5 to 14 years were included in the study. Children with a history of chronic infectious disease, nutritional, or endocrine disturbances, recognized syndromes and developmental disturbances such as cleft lip and palates were excluded.

Children were examined by two examiners with the help of a trained assistant. Before the initiation of the study a calibration test was carried out to observe inter examiner consistency for which 20 children with age ranging from 5 to 14 years were examined separately by two examiners to record the teeth present. Inter examiner agreement was found 100%. Kappa value for the inter examiner reliability was 1.00. Examination was done using mouth mirror and probe under adequate natural light. A tooth with any of the parts emerged through the gingiva were considered as emerged. The number of permanent teeth emerged in oral cavity were recorded along with age and gender of the child.

Data were analysed using SPSS 20.0. Descriptive statistics was used to determine the number and percentage of permanent teeth emerged at different ages and the mean age of emergence of each tooth. Student 't' test was used to determine the inter jaw differences in the mean age of emergence of each tooth.

RESULTS

The study population consisted of 623 school children among which 316 were boys constituting 50.7% and 307 were girls constituting 49.3%. of the total sample.(table 1)

Table 2 and table 3 shows the number and percentage of permanent maxillary and mandibular teeth erupted at different ages. Since there was no significant difference in the age of emergence of teeth between the right side and left side so right side was selected.

At the age of 5 years, none of the permanent teeth were emerged in both the genders whereas all the permanent teeth except third molars were erupted at the age of 14. First teeth to emerge in oral cavity was mandibular first molar whereas maxillary second molar was the last teeth to emerge.

The sequence of emergence of maxillary teeth were first molar, central incisor, lateral incisor, first premolar, canine, second premolar and second molar where as for mandible it was first molar, central incisor, lateral incisor, canine, first premolar, second premolar and second molar.

Though in general, mandibular teeth tended to precede the corresponding maxillary teeth in emergence but significantly only mandibular central, lateral and second premolar emerged earlier than maxillary. ($p \leq 0.05$) (table 4) In general, teeth emergence was earlier in girls than in boys.

Table 1. Distribution of the study population

Age of the student	Boys	Girls	Total
5	12	10	22
6	26	24	50
7	31	28	59
8	36	26	62
9	38	29	67
10	49	46	95
11	41	53	94
12	42	50	92
13	20	22	42
14	21	19	40
Total	316 (50.7%)	307(49.3%)	623

Table 2. Number and percentage of permanent maxillary teeth emerged at different ages

Age in years	Sex	Central Incisor	Lateral Incisor	Canine	First Premolar	Second Premolar	First Molar	Second Molar
5	Boys	0	0	0	0	0	0	0
	Girls	0	0	0	0	0	0	0
6	Boys	0	0	0	0	0	**11(42.3%)**	0
	Girls	0	0	0	0	0	**13(54.2%)**	0
7	Boys	**1(3.2%)**	0	0	0	0	**28(90.3%)**	0
	Girls	**4(14.3%)**	0	0	0	0	**26(92.9%)**	0
8	Boys	27(75.0%)	8(22.2%)	0	0	0	36(100%)	0
	Girls	16(61.5%)	5(19.2%)	0	0	0	26(100%)	0
9	Boys	**35(92.1%)**	**19(50%)**	0	3(7.9%)	0	38(100%)	0
	Girls	**28(96.6%)**	**16(55.2%)**	0	2(6.9%)	0	29(100%)	0
10	Boys	49(100%)	**41(83.7%)**	3(6.1%)	**4(8.2%)**	**1(2.0%)**	49(100%)	0
	Girls	46(100%)	**44(95.7%)**	3(6.1%)	**14(30.4%)**	**2(4.3%)**	46(100%)	0
11	Boys	41(100%)	41(100%)	**9(22.0%)**	**19(46.3%)**	**7(17.1%)**	41(100%)	**4(9.8%)**
	Girls	53(100%)	53(100%)	**28(52.8%)**	**33(62.3%)**	**18(34.0%)**	53(100%)	**14(26.4%)**
12	Boys	42(100%)	42(100%)	**29(69.0%)**	41(97.6%)	**30(71.4%)**	42(100%)	**15(35.7%)**
	Girls	50(100%)	50(100%)	**43(86.0%)**	47(94.0%)	**36(72.0%)**	50(100%)	**31(62.0%)**
13	Boys	20(100%)	20(100%)	20(100%)	20(100%)	**17(85.0%)**	20(100%)	**17(85.0%)**
	Girls	22(100%)	22(100%)	22(100%)	22(100%)	**22(100%)**	22(100%)	**21(95.5%)**
14	Boys	21(100%)	21(100%)	21(100%)	21(100%)	21(100%)	21(100%)	21(100%)
	Girls	19(100%)	19(100%)	19(100%)	19(100%)	19(100%)	19(100%)	19(100%)

Bold digits shows the age group with emergence time in girls earlier than boys

Table 3. Number and percentage of permanent mandibular teeth emerged at different ages

Age in years	Sex	Central Incisor	Lateral Incisor	Canine	First Premolar	Second Premolar	First Molar	Second Molar
5	Boys	0	0	0	0	0	0	0
	Girls	0	0	0	0	0	0	0
6	Boys	**2(7.7%)**	0	0	0	0	**12(46.2%)**	0
	Girls	**7(29.2%)**	0	0	0	0	**19(79.2%)**	0
7	Boys	**21(67.7%)**	**3(9.7%)**	0	0	0	**28(90.3%)**	0
	Girls	**19(67.9%)**	**3(10.7%)**	0	0	0	**27(96.4%)**	0
8	Boys	36(100%)	**19(52.8%)**	0	0	0	36(100%)	0
	Girls	26(100%)	**16(61.5%)**	0	0	0	26(100%)	0
9	Boys	38(100%)	**34(89.5%)**	**2(5.3%)**	**0**	0	38(100%)	0
	Girls	29(100%)	**26(89.7%)**	**3(10.3%)**	**1(3.4%)**	0	29(100%)	0
10	Boys	49(100%)	49(100%)	**9(18.4%)**	**3(6.1%)**	**0**	49(100%)	0
	Girls	46(100%)	46(100%)	**18(39.1%)**	**14(30.4%)**	**3(6.5%)**	46(100%)	0
11	Boys	41(100%)	41(100%)	**20(48.8%)**	**19(46.3%)**	**9(22.0%)**	41(100%)	**6(14.6%)**
	Girls	53(100%)	53(100%)	**38(71.7%)**	**33(62.3%)**	**22(41.5%)**	53(100%)	**21(39.6%)**
12	Boys	42(100%)	42(100%)	**34(81.0%)**	**35(83.3%)**	**23(54.8%)**	42(100%)	**19(45.2%)**
	Girls	50(100%)	50(100%)	**47(94.0%)**	**48(96.0%)**	**37(74.0%)**	50(100%)	**41(82.0%)**
13	Boys	20(100%)	20(100%)	20(100%)	20(100%)	20(100%)	20(100%)	**17(85.0%)**
	Girls	22(100%)	22(100%)	22(100%)	22(100%)	22(100%)	22(100%)	**21(95.5%)**
14	Boys	21(100%)	21(100%)	21(100%)	21(100%)	21(100%)	21(100%)	21(100%)
	Girls	19(100%)	19(100%)	19(100%)	19(100%)	19(100%)	19(100%)	19(100%)

Bold digits shows the age group with emergence time in girls earlier than boys

Table 4. **Mean age of emergence of permanent teeth**

Teeth	Age±SD	p
Maxillary Central Incisor	8.5±1.29	p<0.0001*
Mandibular Central Incisor	7.0±1.0	
Maxillary Lateral Incisor	9.5±1.29	p<0.0001*
Mandibular Lateral Incisor	8.5±1.29	
Maxillary Canine	11.5±1.29	p=0.28
Mandibular Canine	11±1.58	
Maxillary First Premolar	11±1.58	p>0.999
Mandibular First Premolar	11±1.58	
Maxillary Second Premolar	12 ±1.58	P=0.003*
Mandibular Second Premolar	11.5±1.29	
Maxillary First Molar	7±1.0	p>0.999
Mandibular First Molar	7±1.0	
Maxillary Second Molar	12.5±1.29	p>0.999
Mandibular Second Molar	12.5±1.29	

*p≤0.05 considered as statistically significant

DISCUSSION

This was a cross-sectional study done in 623 school children of age 5 years to 14 years from six schools of Kavre district to determine the mean age and sequence of emergence of permanent teeth. The first teeth to emerge in oral cavity was mandibular first molar and last teeth was maxillary second molar. In general mandibular teeth emerged earlier than its maxillary counterparts. This finding is in agreement with many studies.[8-12]

The sequence of emergence of maxillary teeth was 6-1-2-4-3-5-7. This sequence is similar to the result found in another study.[13] But it doesnot match with the standard findings by Logan and Kronfeld.[14] According to Logan and Kronfeld the eruption sequence in maxillary teeth is 6-1-2-4-5-3-7. In our result, canine erupts earlier than second premolar in maxilla. The sequence of emergence of mandibular teeth was 6-1-2-3-4-5-7. The findings are in agreement with studies done by Logan and Kronfeld.[14] In general girls showed early teeth eruption than boys. This is similar to the studies done by Diamanti J and Townsend GC, Lakshmappa A et al.[13,15] It is assumed that the earlier onset of permanent dentition is part of different sexual maturity of both sexes at a given age.[16]

The results of the present study when compared with other Australian, Asian, African studies it was found that the mean emergence time was delayed for all the teeth.[13,15,17,18] Timing of teeth emergence differs from population to population and can be affected by genetic and environmental factors. Both ethnic origin and gender can be attributed to genetic factors and there is an agreement between studies that emergence of permanent teeth in African black children is earlier compared to Caucasian or Asian counterparts.[19-21] A study done in Sunsari district of Eastern Nepal showed that permanent teeth emerge and mature earlier in Rai and Limbu compared to Brahmin and Chhetri.[7]

According to the literature, numerous environmental conditions are said to influence clinical eruption time of the permanent teeth. They can be further subdivided into two categories: general, such as body composition, nutrition, intake of fluorides, socio-economic level and local, such as primary teeth caries and its sequels, early loss of predecessor, crowding in dental arch or trauma to both primary and developing permanent tooth. While general factors affect not only developing dentition but also the human body as a whole, they are most likely to be associated with the changes of clinical tooth eruption time of all teeth, as dental development and emergence is a physiological process and should go hand in hand with general development.[2]

This statement can be proved by the results of different studies which show although slight but still advancement of dental development in taller and heavier children.[22-24] Teeth emergence has been found to be earlier in children with high socio-economic background and from city comparing to that of the rural area.[11,25] Primary teeth decay and its sequel affects both the order and the time of permanent teeth emergence.[3,26]

Emergence time of permanent premolars and canines are most likely to be modified by the caries in primary teeth, although several studies concluded that early extraction of second primary molar or caries experience in primary molars could accelerate the clinical eruption of permanent second molars.[27] The limitations of this study are that as no radiographs were taken, some of the congenitally missing teeth may have been incorrectly recorded as unerupted. Likewise, teeth recorded as congenitally missing might have been still unerupted or extracted. Nevertheless, these sorts of recording errors are unlikely to have biased the results of the study. The second limitation is that the effect of both the premature loss and caries experience in primary teeth could not be evaluated in this cross- sectional study. In order to investigate such relationship, longitudinal study would be ideal but such study design has number of limitations as it is elaborate, expensive to run, require long period to complete and participants may quit study at any time. In contrast, cross-sectional studies are simple carry out, can cover large sample of subjects with less expenses and efforts, are reliable and can be used at the time of tooth emergence.[28]

CONCLUSION

First teeth to emerge was mandibular first molar whereas maxillary second molar was the last teeth to emerge in oral cavity which has been found as a universal trend. Mandibular teeth tended to precede the corresponding maxillary teeth in both the genders. In general teeth emergence was earlier in girls than boys. The result of this study can be used as a reference data for clinical and academic purpose especially for the children of Kavre district, Nepal.

REFERENCES

1. Massler M, Schour I. Studies in tooth development: theories of eruption. *Am J Orthod Oral Surg* 1941;27:552-76.
2. Almonaitiene R, Balciuniene I, Tutkuviene J. Standards for permanent teeth emergence time and sequence in Lithiuanian children, residents of Vilinus city. *Stomatologija, Baltic Dental and Maxillofacial Journal* 2012;14:93-100.
3. Leroy R, Bogaerts K, Lesaffre E, Declerck D. The effect of fluorides and caries in primary teeth on permanent teeth emergence. *Community Dent Oral Epidemiol* 2003;31:463-70.
4. Baccetti T. Tooth anomalies associated with failure of eruption of first and second permanent molars. *Am J Orthod Dentofacial Orthop* 2000;118:608-10.
5. Rousset MM, Boualam N, Delfosse C, Roberts WE. Emergence of permanent teeth: Secular trends and variance in a modern sample. *J Dent Child (Chic)* 2003;70:208-14.
6. Arya VK. Oral Health Survey Basic Methods. 4th Ed. World Health Organization. Geneva: A.I.T.B.S Publishers and Distributors; 1999.
7. Baral P, Bhattacharya S, Hiremath S.S,Niraula SR, Banstola D. A comparative study on emergence pattern of permanent teeth among four communities of Nepal. *J Pak Dent Assoc* 2016;25(1):9-15.
8. Eskeli R, Laine-Alava MT, Hausen H, Pahkala R. Standards for permanent tooth emergence in Finnish children. *Angle Orthod* 1999;69:529-33.
9. Hernandez M, Espasa E, Boj JR. Eruption chronology of the permanent dentition in Spanish children. *J Clin Pediatr Dent* 2008;32:347-50.
10. Leroy R, Bogaerts K, Lesaffre E, Declerck D. The emergence of permanent teeth in Flemish children. *Community Dent Oral Epidemiol* 2003;31:30-9.
11. Kaur I, Singal P, Bhatnagar D.P. Timing of permanent teeth emergence and dental caries among Jatsikh children of public and government schools of Patiala district. *Anthropologist* 2010;12(2):141-8.
12. Friedrich RE, Katerji H, Wedl JS, Scheuer HA. Eruption times of permanent teeth in children and adolescents of Paderborn, Westphalia, Germany. *Arch Kriminol* 2006;217:20-35.
13. Diamanti J, Townsend GC. New standards for permanent tooth emergence in Australian Children. *Australian Dental Journal* 2003;48:(1):39-42.
14. Logan WHG, Kronfeld R. Development of the human jaws and surrounding structures from birth to age fifteen. *J Am Dent Assoc* 1933;20:379.
15. Lakshmappa A, Guledgud MV, Patil K. Eruption times and patterns of permanent teeth in school children of India. *Indian J Dent Res.* 2011 Nov-Dec;22(6):755-63.
16. Ritz-Timme S, Cattaneo C, Collins MJ, Waite ER, Schütz HW, Kaatsch HJ, Borrman HIM: Age estimation: the state of the art in relation to the specific demands of forensic practice. *Int J Legal Med* 2000; 113:129–136.
17. Dahiya BR, Singh V, Shahida P, Singh HP, Singh D. Age estimation from eruption of permanent teeth as a tool for growth monitoring. *J Indian Acad Forensic Med* 2013;35(2): 148-150.
18. Kutesa A, NKamba EM, Muwazi L, Buwembo W, Rwenyonvi CM. Weight, Height and eruption times of permanent teeth in children aged 4-15 years in Kampala, Uganda. *BMC Oral Health* 2013;13:15.
19. Garn SM, Sandusky ST, Nagy JM, Trowbridge FL. Negro- Caucasoid differences in permanent tooth emergence at a constant income level. *Arch Oral Biol* 1973;18:609-15.
20. Hassanali J, Odhiambo JW. Ages of eruption of the permanent teeth in Kenyan African and Asian children. *Ann Hum Biol* 1981;8:425-34.
21. Mugonzibwa EA, Kuijpers-Jagtman AM, Laine-Alava MT, van't Hof MA. Emergence of permanent teeth in Tanzanian children. *Community Dent Oral Epidemiol* 2002;30:455-62.
22. Garn SM, Lewis AB, Kerewsky RS. Genetic, Nutritional, and maturational correlates of dental development. *J Dent Res* 1965;44(suppl):228-42.
23. Kaur B, Singh R. Physical growth and age at eruption of deciduous and permanent teeth in well-nourished Indian girls from birth to 20 years. *Am J Hum Biol* 1992;4:757-66.
24. Agarwal KN, Gupta R, Faridi MM, Kalra N. Permanent dentition in Delhi boys of age 5-14 years. *Indian Pediatr* 2004;41:1031-5.
25. Shaweesh AI, Al-Omiri MK, Alsoleihat FD. Variation in time of emergence of permanent teeth among urban and rural Jordanian school children. *Saudi Med J* 2011;32:1066-72.
26. Kochhar R, Richardson A. The chronology and sequence of eruption of human permanent teeth in Northern Ireland. *Int J Paediatr Dent* 1998;8:243-52.
27. Kim C, Hong Y, Han DH, Hong HK, Kim YN, Bae KH. A prospective cohort study on emergence of permanent teeth and caries experience in Korean children. *Int J Paediatr Dent* 2011;21:254-60.
28. Parner ET, Heidmann JM, Vaeth M, Poulsen S. A longitudinal study of time trends in the eruption of permanent teeth in Danish children. *Arch Oral Biol* 2001;46:425-31.