Occlusal Morphology of Primary Molars in Anganwadi Children, Faridabad

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Abstract

Introduction - Forensic odontology helps in identifying any suspect involved in crime, in accidental cases, in disaster victim identifications. Teeth shows variation in its anatomy as it has a very strong hereditary component. Variations in occlusal morphology of teeth include differences in the number of cusps and the fissure pattern. So, it is important to know the occlusal morphology of teeth in Forensic odontology.

Materials and Method - A descriptive study was conducted to evaluate the cusp and groove pattern in primary second molar of 3-6 year old children from Anganwadis of Faridabad. Hellman and Gregory's criteria for groove pattern were used to know the buccal groove pattern and cusps of primary molar. Data were analyzed with SPSS statistics software 23.0 version.

Result - The predominant groove pattern was "Y" (73.34%). Majority of the participants has 5 cusps in primary second molar. 67.45% of the study participants had 5Y occlusal morphology of primary mandibular second molar and it is mostly seen in male children.

Conclusion - This occlusal configuration will further help in various genetic, anthropological and forensic investigations. Furthermore, knowing common variations in dental anatomy and morphology about each individual tooth can help in providing dental treatments such as restorative, endodontic and orthodontic treatments

Keywords – Cusps, grooves, primay molar, forensics

Introduction

Forensic odontology mainly includes use of teeth and oral structures. It helps in identifying any suspect involved in crime or in accidental cases. Sometimes forensic dentistry is involved in disaster victim identifications such as flood, tsunamis and earthquake. As oral structures are hard structures of body and can remain safe even in adverse conditions so they can be easily used for forensics. These structures can withstand high temperature as well as they are not easily decomposed by bacteria. So they can be recovered in case of mass fatality when where the other means of identification such as fingerprints and facial features are destroyed[1].

Anatomical characteristics of teeth and jaws helps in providing important information related to different species. Teeth shows variation in its anatomy as it has a very strong hereditary component which helps in recording and assessing various evolutionary changes in a population[2]. Within a population, some people have specific structure, while others do not. Further, there is variation observed in anatomy of different oral structure like teeth according to gender and age[3, 4, 5, 6].

So, data regarding variation and diversities within population can also be obtained using Forensic dentistry[7]. Dental characteristics such as tooth morphology, number, position, size, colour, rotation, malalignment,

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fillings, oral pathologies, tooth wear, and other dental anomalies provide a special identity to an individual which helps in identification of an individual. Further, various genetic and environmental factors as well as some oral habits influence the tooth structure formation[8, 9]. Tooth structure formation is a slow progressive process and involves a lot of molecular and cellular interactions.

The cusps, ridges, and grooves that are present on crown surface vary in number and form of tooth roots within different species of primates[10, 11]. Variations in occlusal morphology of teeth also include differences in the number of cusps and the fissure pattern[12, 13, 14]. These morphological differences play a major role in clinical practice also. Dental practitioners and specialists should know these differences, as it can affect various dental treatments. Gregory allocated a cusp number according to its position to make it easy for description of mandibular molars (cusp 1, mesiobuccal; cusp 2, mesiolingual; cusp 3, distobuccal; cusp 4, distolingual; cusp 5, distal; and cusp 6, distomedial)[15]. Mandibular first molars are usually five-cusped.

Groove pattern are the fundamental arrangement of grooves and cusps on occlusal surface of primary and permanent molars. It is observed that this trait (fissure pattern) is polygenic, and its expression of this trait is determined by combinations of alleles at two or more loci[16, 17]. A total of six occlusal groove patterns are observed in permanent mandibular molars: 4+, 4Y, 5+, 5Y, 6+, and 6Y, where 4, 5, and 6 represent the number of cusps present and "+" and "Y" represents the groove patterns. The basic pattern is the "5Y" type[18, 19, 20].

The primary second mandibular molar is smaller in size as compared to permanent first mandibular molar21. They both resembles in shape. The objective of the present study was to assess the occlusal morphology of the primary mandibular second molar in North Indian population.

Information regarding variations in the dental anatomy and morphology of each tooth can help in some dental treatments, like restorative, endodontic, and orthodontic treatments[22]. Till today, there are very few studies on the frequency and expression of different types of occlusal grooves and patterns of the primary mandibular molars in North Indian population. Hence, the present study was undertaken to assess the number of cusps and occlusal groove patterns in the primary mandibular second molar of Faridabad district, North India.

Material and Method

A descriptive study was conducted to evaluate the cusp and groove pattern in primary second molar of 3-6 year old children from eight Anganwadis of Faridabad, North India. Four Anganwadis were selected from East and four from West Faridabad through cluster random sampling. A total of 484 chidren were examined for checking grooves and cusps pattern. Ethical approval to conduct the study was taken from institutional ethical committee. Permission from concerned authorities of Anganwadis and consents from parents was obtained to conduct the study after explaining the purpose of the study. Demographic details like age, gender were recorded. Intra Oral examination was done for number of cusps and grooves using moth mirror under natural light. Hellman and Gregory's criteria for groove pattern were used[15]. Inter examiner reliability was found to be 0.82. Y pattern was considered if the contact of metaconid with the hypoconid occurs. If there was no contact of the metaconid with the hypoconid then + pattern was considered.

Data were analyzed with IBM. SPSS statistics software 23.0 version(SPSS 23.0, IBM, Armonk, NY, United States of America). Children with fully erupted primary second molar, cooperative patients and molars showing clear occlusal outline with all cups and groove pattern were included in the present study. Broken teeth, filled teeth, decayed teeth, teeth with developmental defects of the structure and shape

Result

The present study was conducted among 484 Anganwadi chidren. Among these study participants, 320 were males and 164 are females. In this population, five cusp pattern was most frequently observed.

The predominant groove pattern was "Y" (73.34%). Table 1 shows distribution of cusp and groove pattern. 67.45% of the study participants had 5Y occlusal morphology of primary mandibular second molar and it is mostly seen in male children. The occlusal morphology of primary molars and distribution of cusp and groove pattern according to gender are depicted in Table 2 and 3 respectively.

Table 1. Distribution of cusps and groove pattern of primary mandibular second molar

Tooth	Left Molar	Right molar	Total
4 cusps	30 (6.19)	30 (6.19%)	60 (6.19%)
5 cusps	424 (87.6%)	424 (87.6%)	848 (87.6%)
6 cusps	30 (6.19)	30 (6.19%)	60 (6.19%)
+ pattern groove	132 (27.2%)	126 (26.03%)	258 (26.65%)
Y pattern groove	352 (72.72%)	358 (73.9%)	710 (73.34%)

Table 2. Occlusal morphology of primary mandibular second molar

Tooth	Left Molar	Right molar	Total
4+	8 (1.65%)	12 (2.47%)	20 (2.06%)
4Y	10 (2.06%)	14 (2.89%)	24 9(2.47%)
5+	130 (26.85%)	117 (24.17%)	247 (25.51%)
5Y	327 (67.56%)	326 (67.35%)	653 (67.45%)
6+	5 (1.03%)	9 (1.85)	14 (1.44%)
6Y	4 (0.82%)	6 (1.23%)	10 (1.03%)

Table 3. Cusp numbers and groove pattern in primary mandibular second molar with gender

	4		5		6		+		Y	
	M	F	M	F	M	F	M	F	M	F
L	18 (60%)	12 (40%)	301 (70.9%)	123 (29.10%)	13 (44.3%)	17 (56.66%)	73 (55.30%)	59 (44.69%)	192 (54.54%)	160 (45.45)
R	18 (60%)	12 (40%)	301 (70.9%)	123 (29.10%)	13 (44.3%)	17 (56.66%)	82 (65.07%)	44 (34.92)	199 (55.58)	159 (44.41)

*M – Male, F- Female, L- Left side molar, R – Right side molar

Discussion

It is very important to study oral anatomical characteristics like teeth as they are very valuable in forensic odontology and other anthropolgical studies. Forensic odontology provides information related to hereditary relationship and differences in characteristics within a population[23]. There is inherent variability observed in human dentition, so it is very easy for a forensic odontologist to make dental identification.

Further, if good evidence is there then identification can be done with high level of accuracy. Generally antemortem dental records include radiographs; dental charts, both intra- and/or extra-oral photographs, dental casts, and notes[24].

Occlusal anatomy of primary molars has been recognized as important feature in dental anatomy and clinical dentistry. There is basic arrangement of cusps and grooves on occlusal surface of primary second molar.

Expression of groove trait is determined by combinations of alleles at two or more loci. So, a dental trait in humans can be a valuable diagnostic tool in anthropological studies for differentiating and characterizing various ethnic groups. In past, various studies have been done to relate the prevalence of dental anatomy with different factors. Variations in the size, number of cusps, and groove pattern, have been observed in the mandibular molars of different populations[25].

The morphological features of the occlusal surfaces of the mandibular molars have been described by Gregory and Hellman. The present study aimed to determine the prevalence of different occlusal morphologies (number of cusps and occlusal groove patterns) of the permanent mandibular second molar in Faridabad district, North India.

In the present study, 5 cusps (87.6%) was the most commonly observed cusp type in primary second molar. 4 and 6 cusps types (6.19%) were seen equally among the study population. In contrast to the present study, study done by Phullari et al had seen that the 4 cusp form (88.4%) was the most frequent in second permanent molars[18]. Similarly, in study done by Shetty el al and Dholia et al also, it has been observed that the 4 cusp form was the most frequent occlusal configuration in 86% and 93.5% of the study population respectively[26, 22]. The reason for this could be that majority of the study participants in the present study were males (66.1%) and it has been seen that variation in anatomical structure occur according to gender[3].

The most commonly observed groove pattern in the present study population was Y (73.34%). In contrast to the present study, in the study done by Shetty et al, the predominant occlusal groove pattern seen in mandibular second molar was a "+" shape (85%) followed by "y" pattern (11%)[26]. Similarly, in the study done by Phullari et al and Dholia et al, it was observed that the predominant groove pattern was "+" in 90.1% and 93.5% of study participants respectively[18, 22]. Again, the reason for this could be gender variation in these studies.

The most prevalent occlusal configuration of primary second molars in the present study participants was 5Y pattern. This configuration is important in forensic odontology and only 15% dental practitioners have formal training in collecting, evaluating, and presenting dental evidence[27, 28, 29]. So, there is an increased need for dental surgeons to have a good knowledge about forensic odontology as it is useful in identification of an individual and also discover abuse among all ages.

Conclusion

The present study has been done in children of Anganwadi, Faridabad; it was observed that the most common occlusal configuration was 5Y. This occlusal configuration will further help in various genetic, anthropological and forensic investigations. Furthermore, knowing common variations in dental anatomy and morphology about each individual tooth can help in providing dental treatments such as restorative, endodontic and orthodontic treatments. Hence, studying the occlusal morphology of second molar will be helpful in forensic as well as clinical practice.

References

1. Krishan K, Kanchan T, Garg AK. Dental evidence in forensic identification–An overview, methodology and present status. The open dentistry journal. 2015; 9:250.

2. Ansari AS, Shaikh AT, Zaidi SJ, Ansari ZM, Kazmi S. Permanent mandibular second molars. The Professional Medical Journal. 2018 Nov 10;25(11):1747-53

3. Hillson S. Dental Anthropology. Cambridge: Cambridge University Press; 1996.

4. Marques MR, Pereira MD, Caldas IM. Forensic age estimation using the eruption of the second permanent mandibular molar: determining age over 14 years-old. Australian Journal of Forensic Sciences. 2015 Jul 3;47(3):306-12.

5. Macaluso Jr PJ. Sex discrimination potential of permanent maxillary molar cusp diameters. J Forensic Odontostomatol. 2010 Dec 1;28(1):22-31.

6. Yadav NR, Prasad S, Rajashekharappa CB, Tandon S. Gender influence on occlusal characteristics in primary dentition. APOS Trends orthod 2014;4:87-92

7. Ahsana A, Jeevanandan G, Subramanian EM. Evaluation of occlusal groove morphology of primary mandibular second molar in an Indian population. J Forensic Dent Sci.2018; 10; 92-5

8. Loh HS. Mongoloid features of the permanent mandibular second molar in Singaporean Chinese. Australian dental journal. 1991 Dec;36(6):442-4.

9. Santos Neto ET, Oliveira AE, Barbosa RW, Zandonade E, Oliveira ZF. The influence of sucking

habits on occlusion development in the first 36 months. Dental Press J Orthod 2012;17:96-104.

10. Axelsson G, Kirveskari P. Cusp number and groove pattern of lower molars in Icelanders. Acta Odontologica Scandinavica. 1981 Jan 1;39(6):361-4.

11. Garn SM, Dahlberg AA, Lewis AB, Kerewsky RS. Cusp number, occlusal groove pattern and human taxonomy. Nature. 1966 Apr 9;210(5032):224-5.

12. Peretz B, Smith P. Morphometric variables of developing primary mandibular second molars. Archives of oral biology. 1993 Sep 1;38(9):745-9.

13. Nirmala SV, Challa R, Velpula L, Nuvvula S. Unusual occurrence of accessory central cusp in the maxillary second primary molar. Contemporary clinical dentistry. 2011 Apr;2(2):127.

14. Sockalingam S, Nagarajan MP, Mahyuddin A. Bilateral accessory central cusp of 2nd deciduous molar: an unusual occurrence. Archives of Orofacial Sciences. 2009;4(1):22-4.

15. Gregory WK, Hellman M. The crown patterns of fossils and recent human molar teeth and their meaning. Nat Hist 1926; 26:300-9.

16. Jordan RE, Abrams L, Kraus BS. Kraus' dental anatomy and occlusion. Pmph Bc Decker; 1992.

17. Rodríguez-Flórez CD, Fonseca GM, de Villalba MT. Brief communication: Occurrence of an eighth cusp on primary second mandibular molars of a contemporary Argentinean child. Dental Anthropology Journal. 2006;19(3):83-5.

18. Phulari RG, Rathore R, Takvani MD, Jain S. Evaluation of occlusal groove patterns of mandibular first and second molars in an Indian population: A forensic anthropological study. Indian J Dent Res 2017; 28:252-5.

19. Gregory WK. The evolution of dental occlusion from fish to man. Am J Orthod Oral Surg 1942; 28: 59-61.

20. Mosharraf R, Ebadian B, Ali Z, Najme A, Niloofar S, Leila K. Occlusal morphology of mandibular second molars in Iranian adolescents. Indian Journal of Dental Research. 2010 Jan 1;21(1):16.

21. Butler PM. Comparison of the development of the second deciduous molar and first permanent molar in man. Archives of oral biology. 1967 Nov 1;12(11):1245-60.

22. Dholia B, Manjunatha BS. Occlusal morphology of permanent mandibular first and second molars in Gujarati population. J Forensic Dent Sci. 2015; 7:137e141.

23. Pretty IA. Forensic dentistry: 1. Identification of human remains. Dental update. 2007 Dec 2;34(10):621-34

24. Adams BJ. The diversity of adult dental patterns in the United States and the implications for personal identification. J Forensic Sci 2003;48:497-503.

25. Felemban NH, Manjunatha BS. Prevalence of the number of cusps and occlusal groove patterns of the mandibular molars in a Saudi Arabian population. Journal of forensic and legal medicine. 2017 Jul 1;49:54-8.

26. Shetty UA, Shetty P, D'Cruz AM. Determination of cusp number and occlusal groove pattern in mandibular molars: A preliminary epidemiological study in an indian population. Journal of Forensic Science and Medicine. 2016 Apr 1;2(2):98.

27. Rathod V, Desai V, Pundir S, Dixit S, Chandraker R. Role of forensic dentistry for dental practitioners: A comprehensive study. J Forensic Dent Sci. 2017;9(2):108–109.

28. Gupta SK, Saxena P. Prevalence of cusp 7 in permanent mandibular first molars in an Indian population: A comparative study of variations in occlusal morphology. Journal of investigative and clinical dentistry. 2013 Nov;4(4):240-6.

29. Dahlberg AA. Rationale of identification based on biological factors of the dentition. The American journal of forensic medicine and pathology. 1985 Jun;6(2):125-31.