

STATISTICAL DETERMINATION OF THE SEQUENCE AND CHRONOLOGY OF THE ERUPTION OF THE FIRST PERMANENT MOLARS AND INCISORS IN ROMANIAN CHILDREN

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Abstract:

Teeth eruption is a dynamic, genetically dictated process which is a part of the odontogenesis and comprises all of the tooth's movement from the bone crypt where it formed until reaching the occlusal plane and starting its function. Chronologically normal eruption is defined as the situation in which dental eruption takes place at time moments placed around the medium eruption age calculated on large population samples. Determining the medium eruption age of the teeth emerging in the first stage of the permanent teeth eruption (incisors and first molar) in children from Bucharest, Romania. The retrospective transversal study was conducted on a sample of 2139 Caucasian children aged between 5 and 10 years who presented to the Paedodontics Clinic for consultation and treatment in the period 2006-2011. The statistical analysis used specific descriptive and inferential (confidence intervals) methods. The order and timing of eruption in girls was: IClo (5.8-5.10 years), M1lo (5.10-6 years), M1up (6-6.2 years), ICup and ILlo (7-7.2 years) and ICup (8-8.2 years). (p=0.01) The order and timing of eruption in girls was: IClo, M1up and M1lo (6-6.2 years), ICup (7-7.2 years), ILlo (7.2-7.4 years) and ILup (8.4-8.6 years). (p=0.01) The results of the study confirm data from literature in terms of faster eruption in girls. Permanent incisors and first molars erupt between 5.8 and 8.2 years in girls and between 6 and 8.6 years in boys.

Key words: chronology and sequence of eruption; permanent incisors; first permanent molars

Introduction

Tooth eruption is a long and complex physiological process which is responsible for the tooth's movement from its site of development in the jaw's bone where it formed until reaching the occlusal plane and starting its function [1]³.

The process of teeth eruption and occlusion development lasts (excluding M3) for approximately 13-15 years, during which period teeth erupt successively, at time moments placed around the eruption medium age specifically for every dental group, in the primary dentition as well as in the permanent dentition [2, 3].

This process suffers a wide individual variability, especially in the permanent teeth. The timing of tooth eruption is influenced by various factors: physiological factors (i.e. heredity, constitution, geographic factors, sex, race, nutrition, climate, urbanisation a.s.o.), pathological systemic factors (various diseases i.e. endocrine diseases, cerebral palsy, severe intoxications, severe renal diseases, genetic disorders a.s.o.) and pathological local factors (local eruption obstacles, hypodontia, lack of space a.s.o.) [4, 5].

The time and sequence of the eruption of the first permanent molars and incisors has been studied by several researchers in many areas of the world with similar results to other studies. Thus, Moslemi in Iran (2004) showed that, with the exception of the maxillary second premolars, the average age at eruption of permanent teeth in girls is less than in boys [3]; Lee et al. in Hong Kong (1965, cited by Nizam et al., 2003) as well as Jaswal (1983) and Gaur and Singh (1994) in India reported earlier eruption in girls than in males [6, 7, 8]. Nizam et al. in Malaysia (2003) reported for both genders that most of the mandibular teeth erupted earlier than the maxillary teeth, the first tooth which erupted was the lower first permanent molar (mean eruption time of lower first molar is 6.0 years) [6]. The sequence and chronology of tooth eruption for both sexes were: m1 (mean age 6 years), M1 (mean age 6.3 years), i1 (mean age 6.35 years), I1 (mean age 7.15), i2 (mean age 7.4 years), I2 (mean age 8.55 years).

Koch et al. (2001) in Denmark and Pahkala et al. (1991) in Finland, have reported that Caucasians have a delayed time of eruption and Stewart R (1982) suggested that negroes have been shown to have an earlier eruption pattern when compared to other ethnic groups [1, 3].

The order and chronology of the permanent teeth eruption is a major factor in the development of the permanent teeth and in the establishment of a correct occlusion [6].

Adequate knowledge of the timing and pattern of tooth eruption are important for diagnosis and treatment planning in paediatric dentistry [6].

The purpose of this study was to determine the sequence and chronology of the eruption of the permanent incisors and first permanent molars by gender in a Romanian children group from Bucharest and other parts of the country.

Material and method

The cross sectional, retrospective study was carried out on a number of 2139 Caucasian children aged between 5 and 10 years. The children were randomly selected. The study group was selected out of all the patients consulted over a period of 5 years in the Paedodontics clinic of the Faculty of Dental Medicine within "Carol Davila" University of Medicine and Pharmacy, Bucharest, Romania, by one of the authors of the paper.

The inclusion criteria were:

- all healthy patients between 5 and 10 years of age

- all children with complete dental records
- all children who presented at the dental visit for other reasons that those related to the chronology and sequence of teeth eruption

General data and the cross-sectional data on the first permanent molars and permanent incisors eruption were collected from the dental records of the patients.

The recorded data consisted of the patient's name, date of birth, date of the dental visit and records of the present teeth (central upper and lower incisors – ICup, IClo; lateral upper and lower incisors – ILup, ILlo; upper and lower first molar – M1up, M1lo). An erupted tooth was defined as any tooth with any part of its crown penetrating the gingiva and becoming visible in the oral cavity.

The variables taken into account were: age, sex, tooth type and dental arch. In order to facilitate age computation, patients were divided into age groups of 2 months intervals. Taking into account the fact that most of the time symmetrical and homologues teeth erupt at similar moments in time, the study did not take into account the hemi-arch on which a particular tooth was located. Instead, similar teeth on the left and right hemi-arch were observed as pairs [9, 10, 11, 12, 13]. The median time of onset of the eruption of a particular tooth was considered to be situated in the age interval in which the consulted patients presented 50% of the possible number of teeth of the respective pair.

The statistical analysis used specific descriptive and interferential (confidence intervals) methods.

Results

1. From the total of 2139 children, 47.8% were girls (n=1022) and 52.2% were boys (n=1117).
2. The mean age of the children was 7.48 years (SD = 1.45 years), with the mean age of the girls 7.50 years (SD = 1.45 years) and of the boys 7.46 years (SD = 1.44 years). The patients' distribution by age groups is showed in Table 1.

Table 1. The patients' distribution by age groups (in years and months)

Age group	Number of patients	Age group	Number of patients
5 – 5.2	62	7.6 – 7.8	72
5.2 – 5.4	72	7.8 – 7.10	71
5.4 – 5.6	78	7.10 – 8	67
5.6 – 5.8	75	8 – 8.2	83
5.8 – 5.10	69	8.2 – 8.4	74
5.10 – 6	72	8.4 – 8.6	70
6 – 6.2	75	8.6 – 8.8	71
6.2 – 6.4	69	8.8 – 8.10	69
6.4 – 6.6	65	8.10 – 9	69
6.6 – 6.8	73	9 – 9.2	71
6.8 – 6.10	79	9.2 – 9.4	73
6.10 – 7	66	9.4 – 9.6	71
7 – 7.2	72	9.6 – 9.8	71
7.2 – 7.4	61	9.8 – 9.10	72
7.4 – 7.6	70	9.10 - 10	70

3. The sequence of eruption for both sexes are shown in Table 2.

Table 2. The sequence of eruption by gender

Age group (in years and months)	5.8 – 5.10	5.10 – 6	6 – 6.2	7 – 7.2	7.2 – 7.4	8 – 8.2	8.4 – 8.6
Girls	IClo	M1lo	M1up	ICup ILlo		ILup	
Boys			IClo M1lo M1up	ICup	ILlo		ILup

Discussion

Time of emergence of teeth (mean age of eruption) is determined by specific statistical methods based on data collected from population-wide samples. This process suffers a wide physiological individual variability depending on heredity, constitution, geographic factors, sex, race, nutrition, climate, urbanisation a.s.o.

The present study employed specific descriptive and inferential (confidence intervals) methods. The study's results reveal several concordances and inconsistencies with data in other reports.

The sequence and timing of dental eruption in girls was as follows: IClo (5y 8m - 5y 10m), M1lo (5y 10m - 6y), M1up (6y - 6y 2m), ICup and ILlo (7y - 7y 2m) ILup (8y - 8y 2m). The sequence and timing of dental eruption in boys was as follows: IClo (6y - 6y 2m), M1lo and M1up (6y - 6y 2m), ICup (7y - 7y 2m), IClo (7y 2m - 7y 4m), ILup (8y 4m - 8y 6m). These results differ from other studies in what concerns the eruption of the lower central incisors before the first permanent molars [14, 15]. However, this is in agreement with many previous studies carried out in several countries and this has been reported as a global phenomenon with a reversal in the order of eruption between the M1lo and IClo [13, 16].

The present study is in agreement with the vast majority of existing reports with regard to the earlier onset of the permanent teeth's eruption in girls [12, 13, 16, 17].

As generally accepted, in both sexes, the mandibular teeth erupted earlier than the maxillary teeth, with the exception of the upper and lower first permanent molar in boys, that erupted concomitantly [9, 10, 12, 13, 18, 19]. The biggest difference between the ages of eruption of maxillary and mandibular teeth was recorded at the central incisors in girls (approximately 1 year). This significant difference is supported by several studies, although the values obtained by other authors are generally lower [12, 20].

References

1. Aranza, O.T. and Garcia, J.L.M. **Cronología de erupción dentaria en escolares de una población indígena**, Revista de la Asociación Dental Mexicana, 62 (3), 2005, pp. 94-100
2. Carlos, J.P. and Gittelsohn, A.M. **Longitudinal Studies of the Natural History of Caries. I. Eruption Patterns of the permanent teeth**, Journal of Dental Research, 44, 1965, pp. 509-516

3. Carrara, C.F.C, Lima, J.E.O., Carrara, C.E. and Vono B.G. **Chronology and Sequence of Eruption of the Permanent Teeth in Patients With Complete Unilateral Cleft Lip and Palate**, *Cleft Palate–Craniofacial Journal*, 41 (6), 2004, pp. 642-645
4. Demirjian, A. and Levesque, G.Y. **Sexual Differences in Dental Development and Prediction of Emergence**, *Journal of Dental Research*, 59, 1980, pp. 1110-1122
5. Denloye, O. **Eruption sequence of first permanent teeth in some Nigerian children**, *Pediatric Dental Journal*, 18(1), 2008, pp. 1–4
6. Gaur, R. and Sing, N.Y. **Emergence of permanent teeth among the meiteis of Manipur, India**, *American Journal of Human Biology*, 3(6), 1994, pp. 321-328
7. Harila-Kaera, V., Heikkinen, T. and Alvesalo, L. **The eruption of permanent incisors and first molars in prematurely born children**, *European Journal of Orthodontics*, 25, 2003, pp. 293–299
8. Jaswal, S. **Age and sequence of permanent-tooth emergence among Khasis**, *American Journal of Physical Anthropology*, 62(2), 1983, pp. 177–186
9. Kaur, I., Singal, P. and Bhatnagar, D.P. **Timing of Permanent Teeth Emergence and Dental Caries among Jatsikh Children of Public and Government Schools of Patiala District**, *Anthropologist*, 12 (2), 2010, pp. 141-148
10. Khan, N.B., Chohan, A.N., Al-Mograbi, B., Al-Deyab, S., Zahid, T. and Al-Moutairi, M., **Eruption time of permanent first molars and incisors among a sample of Saudi male schoolchildren**, *The Saudi Dental Journal*, 18(1), 2006, pp.18-24
11. Koch, G., Kreiborg, S. and Andreasen, J.O. **Eruption and shedding of teeth**, in Koch, G., Poulsen, S. "Pediatric Dentistry – A Clinical Approach", second edition, Blackwell Publishing, 2009, pp. 197-199
12. Leroy, R., Bogaerts, K., Lesaffre, E. and Declerck, D. **The emergence of permanent teeth in flemish children**, *Community Dentistry and Oral Epidemiology*, 31, 2003, pp. 30–39
13. Moslemi, M. **An epidemiological survey of the time and sequence of eruption of permanent teeth in 4–15-year-olds in Tehran, Iran**, *International Journal of Paediatric Dentistry*, 14(6), 2004, pp. 432-438
14. Muñiz, B. **Chronology of permanent tooth eruption in Argentinian children**, *Revista de la Asociación Odontológica Argentina*, 76(6), 1988, pp. 222-228
15. Nizam, A., Naing, L. and Mokhtar, N. **Age and sequence of eruption of permanent teeth in Kelantan, North-eastern Malaysia**, *Clinical Oral Investigations*, 7, 2003, pp. 222–225
16. Rajic, Z., Rajic-Mestrovic, S. and Verzak, Z., **Chronology, Dynamics and Period of Permanent Tooth Eruption in Zagreb Children (Part II)**, *Collegium Antropologicum*, 24(1), 2000, pp. 137–143
17. Rakhi, G., Sivapathasundharam, B. and Einstein, A. **Eruption age of permanent mandibular first molars and central incisors in the south Indian population**, *Indian Journal of Dental Research*, 18(4), 2007, pp.186-189
18. Suri, L., Gagari, E. and Vastardis, E. **Delayed tooth eruption: Pathogenesis, diagnosis, and treatment. A literature review**, *American Journal of Orthodontics and Dentofacial Orthopedics*, 126, 2004; pp. 432-445
19. Wedl, J.S., Danias, S., Schmelzle, R. and Friedrich, R.E. **Eruption times of permanent teeth in children and young adolescents in Athens (Greece)**, *Clinical Oral Investigations*, 9,2005, pp.131–134
20. Wedl, J.S., Schoder, V., Blake, F.A.S., Schmelzle, R. and Friedrich, R.E. **Eruption times of permanent teeth in teenage boys and girls in Izmir (Turkey)**, *Journal of Clinical Forensic Medicine*, 11, 2004, pp. 299–302

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³ Codification of references:

[1]	Koch, G., Kreiborg, S. and Andreasen, J.O. Eruption and shedding of teeth , in Koch, G., Poulsen, S. "Pediatric Dentistry – A Clinical Approach", second edition, Blackwell Publishing, 2009, pp. 197-199
[2]	Suri, L., Gagari, E. and Vastardis, E. Delayed tooth eruption: Pathogenesis, diagnosis, and treatment. A literature review , American Journal of Orthodontics and Dentofacial Orthopedics, 126, 2004; pp. 432-445
[3]	Moslemi, M. An epidemiological survey of the time and sequence of eruption of permanent teeth in 4–15-year-olds in Tehran, Iran , International Journal of Paediatric Dentistry, 14(6), 2004, pp. 432-438
[4]	Rajic, Z., Rajic-Mestrovic, S. and Verzak, Z., Chronology, Dynamics and Period of Permanent Tooth Eruption in Zagreb Children (Part II) , Collegium Antropologicum, 24(1), 2000, pp. 137–143
[5]	Harila-Kaera, V., Heikkinen, T. and Alvesalo, L. The eruption of permanent incisors and first molars in prematurely born children , European Journal of Orthodontics, 25, 2003, pp. 293–299
[6]	Nizam, A., Naing, L. and Mokhtar, N. Age and sequence of eruption of permanent teeth in Kelantan, North-eastern Malaysia , Clinical Oral Investigations, 7, 2003, pp. 222–225
[7]	Jaswal, S. Age and sequence of permanent-tooth emergence among Khasis , American Journal of Physical Anthropology, 62(2), 1983, pp. 177–186
[8]	Gaur, R. and Sing, N.Y. Emergence of permanent teeth among the meiteis of Manipur, India , American Journal of Human Biology, 3(6), 1994, pp. 321-328
[9]	Wedl, J.S., Danias, S., Schmelzle, R. and Friedrich, R.E. Eruption times of permanent teeth in children and young adolescents in Athens (Greece) , Clinical Oral Investigations, 9, 2005, pp. 131–134
[10]	Wedl, J.S., Schoder, V., Blake, F.A.S., Schmelzle, R. and Friedrich, R.E. Eruption times of permanent teeth in teenage boys and girls in Izmir (Turkey) , Journal of Clinical Forensic Medicine, 11, 2004, pp. 299–302
[11]	Khan, N.B., Chohan, A.N., Al-Mograbi, B., Al-Deyab, S., Zahid, T. and Al-Moutairi, M., Eruption time of permanent first molars and incisors among a sample of Saudi male schoolchildren , The Saudi Dental Journal, 18(1), 2006, pp. 18-24
[12]	Leroy, R., Bogaerts, K., Lesaffre, E. and Declerck, D. The emergence of permanent teeth in Flemish children , Community Dentistry and Oral Epidemiology, 31, 2003, pp. 30–39
[13]	Carlos, J.P. and Gittelsohn, A.M. Longitudinal Studies of the Natural History of Caries. I. Eruption Patterns of the permanent teeth , Journal of Dental Research, 44, 1965, pp. 509-516
[14]	Rakhi, G., Sivapathasundharam, B. and Einstein, A. Eruption age of permanent mandibular first molars and central incisors in the south Indian population , Indian Journal of Dental Research, 18(4), 2007, pp. 186-189
[15]	Kaur, I., Singal, P. and Bhatnagar, D.P. Timing of Permanent Teeth Emergence and Dental Caries among Jatsikh Children of Public and Government Schools of Patiala District , Anthropologist, 12 (2), 2010, pp. 141-148
[16]	Denloye, O. Eruption sequence of first permanent teeth in some Nigerian children , Pediatric Dental Journal, 18(1), 2008, pp. 1–4
[17]	Muñiz, B. Chronology of permanent tooth eruption in Argentinian children , Revista de la Asociación Odontológica Argentina, 76(6), 1988, pp. 222-228
[18]	Demirjian, A. and Levesque, G.Y. Sexual Differences in Dental Development and Prediction of Emergence , Journal of Dental Research, 59, 1980, pp. 1110-1122
[19]	Carrara, C.F.C, Lima, J.E.O., Carrara, C.E. and Vono B.G. Chronology and Sequence of Eruption of the Permanent Teeth in Patients With Complete Unilateral Cleft Lip and Palate , Cleft Palate–Craniofacial Journal, 41 (6), 2004, pp. 642-645
[20]	Aranza, O.T. and Garcia, J.L.M. Cronología de erupción dentaria en escolares de una población indígena , Revista de la Asociación Dental Mexicana, 62 (3), 2005, pp. 94-100