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Age At Menarche And Eruption of Permanent Second Molars: An Investigation To Determine A Possible Correlation

Menarşta Yaş ve Daimi İkinci Öğütücü Dişlerin Çıkması: Olası Bir İlişkiyi Belirlemek Üzerine Yapılan Bir İnceleme

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ÖZET

Amaç: Ortalama menarş yaşında azalan değişimler ve daimi ikinci öğütücü dişlerin daha erken çıkması son yıllarda dünya çapında gözlemlenmiştir. İkisi arasında pozitif bir ilişki, daimi ikinci öğütücü dişler için menarş, bir biyogösterge ya da tam tersini yapar ve onu ergenlik dönemindeki kızların oral durumlarını gözlemlemek için basit bir araç haline getirir. Bu çalışma, 10-13 yaşları arasındaki kızlarda daimi ikinci öğütücü dişlerin ortaya çıkma durumu ile menarş kazanımı arasında bir ilişki bulmak amacıyla yapılmıştır.

Materyal Ve Yöntemler: Görüşmeye ve oral incelemeye katılmayı kabul eden rastgele seçilen 6 okuldan toplam 470 kız öğrenci ile tanımlayıcı kesitsel bir çalışma yapılmıştır. Elde edilen veriler, p değeri <0.05 olarak istatiksel anlamlı kabul edilen Chi kare (X2) testi kullanılarak analiz edilmiştir.

Çalışma Sonuçları: Menarş kazanımı (p=0.000) ve ikinci öğütücü dişlerin çıkma durumuna (p=0.000 tüm dört diş için) yönelik yaş grupları arasında anlamlı farklılıklar bulunmuştur. Ancak, menarş kazanımı ve daimi ikinci öğütücü dişlerin çıkma durumu arasında hiçbir ilişki bulunamamıştır.

Sonuç: Bu çalışma iki değişken arasında ilişki bulmakta başarısız olsa da, nüfusa bağlı çok merkezli bir araştırma bu konuda kesin sonuç verebilir.

Anahtar Kelimeler: İlişki, Diş Çıkması, Kızlar, Menarş, Daimi İkinci Öğütücü Dişler**.**

Abstract:

Objective: Downward shifts in the mean menarcheal age and earlier emergence of per- manent second molars have been observed worldwide during the past few decades. A positive cor- relation between the two would make menarche a biomarker for permanent second molar eruption or vice versa, making it a simple tool for monitoring oral status of adolescent girls. This study was conducted to find a correlation between attainment of menarche and eruption status of permanent second molars in girls aged 10-13 years.

Material and Methods: A cross-sectional descriptive study was conducted on 470 female students from six randomly selected schools who consented to participate in the interview and oral examination. Data were analyzed using the Chi square (X^2) test with a p-value of < 0.05 considered statistically significant.

Results: Significant differences existed within the age groups with regard to attainment of menarche (p = 0.000) and eruption status of second molars (p = 0.000 for all four teeth). How- ever, no correlation could be found between attainment of menarche and eruption status of the permanent second molars.

Conclusion: Although this study failed to find a correlation between the two variables, a population based multicentric survey may give a concrete conclusion on this issue.

Key Words: Correlation, eruption, girls, menarche, permanent second molars

Introduction:

Growth, development and maturity in human populations can be studied by understanding different physiological processes which vary with age and gender, and can be measured through various maturity measures – morphological, dental, skeletal, secondary sex characters and mental age.[1] Several biologic indicators have been proposed to assess individual physiologic maturity such as dental development, tooth eruption and menarche in females.[2-4] Menarche, the onset of menstruation, is one of the most significant milestones in a woman's life.[5-7] Unlike other pubertal changes that are gradual and continuous, menarche is a distinct event with a sudden onset.[6] For most females, it occurs between the ages of 10 to 16 years.[3,4,6,8-11] Downward shift in the mean menarcheal age has been observed worldwide during the past few decades.[2-4,6,7,9,10,12] These could be assumed to be the consequences of improved sanitary, nutritional, socioeconomic and general health conditions in many countries including India.[2-4,6,9,10,13]

Eruption of teeth is related to chronological age, gender and ethnic origin.[1] The permanent second molars erupt between the ages of 10 to 13 years. A secular trend has also been noted in the earlier emergence of these teeth.[1,8,12,14]

The eruption period of permanent molar teeth is a risk factor concerning caries development as the partially erupted teeth favor occlusal plaque accumulation and caries initiation with a fast progression rate.[15] Preventive programs for controlling occlusal caries development, therefore, ought to be initiated from the moment of eruption of these teeth, with a close follow-up during the eruption period.[15] In addition, an accurate knowledge of dental emergence patterns is essential for monitoring occlusal development, diagnosing malocclusion and planning dental treatment in adolescents. Mapping a specific time sequence for permanent tooth eruption would aid in effectively intercepting malocclusion in the permanent dentition.[14] With chronological age being an unreliable indicator for skeletal maturation, biological indicators such as onset of menarche have been proposed to assess individual physiologic maturity.[2]

If correlation could be shown between the attainment of menarche and eruption status of permanent second molars among girls, menarche can be taken as a marker for permanent second molar eruption or vice versa. Pinpointing the age of onset of menarche will enable health care professionals to take advantage of this period of accelerated growth for the implementation of therapeutic modalities as in the field of orthodontics and dentofacial orthopedics. There is a lack of scientific literature on this subject. This study, therefore, was conducted to find a correlation between attainment of menarche and the eruption status of permanent second molars in girls in the age group of 10-13 years.

Materials and Methods:

A cross-sectional descriptive study was conducted between August 2011 and February 2012 on 10-13-year-old school girls in Mangalore City, India. This age group (10-13 years) was selected because the permanent second molars erupt between the ages of 10 to 13 years.

A proforma was prepared for data collection. It recorded information on: name of the school, age of the subject (as on last birthday), whether menarche attained, and eruption status of permanent second molars. The age at the onset of the first menstrual period was recorded to the nearest whole year.[2] The permanent second molar was considered as erupted only when at least a portion of the crown of the tooth, however small, had penetrated the gingiva. This was in concurrence with other studies which defined tooth eruption as the time when any part of the crown / tooth has emerged through the gingival surface / oral mucosa.[1,8,15] To ensure confidentiality, the child's name and class register number were not recorded.

Since scientific literature showed a lacuna on this subject, a pilot study was carried out to determine the sample size. A list of schools in Mangalore City was obtained from the office of the Block Educational Officer. In a randomly selected school, thirty randomly selected female students in each of the ages of 10, 11, 12 and 13 years were examined in the presence of a teacher. The interviews and oral examinations (using available illumination) were conducted by a single investigator during school hours with the subjects seated in ordinary chairs. The armamentarium consisted of plane mouth mirrors, instrument trays, disposable gloves and face masks, and copies of the data collection proforma. The examination instruments were autoclaved before use. Data obtained were statistically analyzed and, based on the results of the pilot study, the sample size was determined to be 470 (at a confidence level of 95% and power of the test set at 90%).

The data collected in the pilot study was excluded from the main survey. From the list obtained from the Block Educational Officer, schools to be surveyed were selected by simple random sampling (lottery method) and female students aged 10-13 years who consented to participate in the interview and oral examination were enlisted. To obtain the study sample of 470, subjects from six schools underwent examinations. Data collection procedures were similar to those followed in the pilot survey. The study proforma did not need any modifications for the main survey.

The investigators attempted to obtain consent from the subjects' parents. Most parents, however, did not return the consent form despite reminders. Consent for the study was then sought and obtained from the Block Educational Officer and the school authorities before the start of the survey. Assent was taken from each student before examination. Ethical clearance was obtained from the Yenepoya University Ethics Committee. The examiner underwent training and calibration before the start of the study. The intra-examiner reliability was checked at the beginning and three months into the study, and it averaged 0.94.

Data were tabulated according to the age of the subjects and were analyzed using the Chi square (X^2) test in the SPSS Version 17.0 program for Windows. A p-value of < 0.05 was considered as statistically significant.

Results:

The mean age of the selected female students was 11.28 ± 0.88 years (mean ± standard deviation). Of the 470 participants in this study, only 17.9% (n = 84) had attained menarche. The number of female students in each age group and whether they had attained menarche is given in Table 1. A significant difference existed within the age groups with regard to attainment of menarche ($p = 0.000$).

Eruption status of the maxillary and mandibular second molars was analyzed according to the age of the participants. A significant difference was found within the age groups with regard to the eruption status of these teeth ($p = 0.000$ for all four second molars).

The data were analyzed to check for correlation between attainment of menarche and the eruption status of the permanent second molars. Tables 2, 3, 4 and 5 depict the eruption status of the maxillary and mandibular second molars according to age of the students and attainment of menarche. For all four second molars, the differences in relation to age and eruption status were found to be insignificant in the students who had attained menarche. No correlation could be found between attainment of menarche and eruption status of the permanent second molars.

The data was further analyzed to check for any correlation between attainment of menarche versus eruption of any second molar. It revealed that attainment of menarche was greater among those with erupted second molars ($X^2 = 38.927$, $p < 0.001$).

Table 1: Distribution of subjects based on age and attainment of menarche.

Age (in years)	Menarche attained n (%)	Menarche not attained n (%)	Total n (%)
10	2 (2.0%)	99 (98.0%)	101 (100.0%)
11	13 (7.8%)	154 (92.2%)	167 (100.0%)
12	49 (29.2%)	119 (70.8%)	168 (100.0%)
13	20 (58.8%)	14 (41.2%)	34 (100.0%)
Total	84 (17.9%)	386 (82.1%)	470 (100.0%)

(p = 0.000)

Table 2: Distribution of subjects based on age, eruption status of the maxillary right second molar and attainment of menarche.

Whether menarche attained	Age (in years)	Erupted n (%)	Unerupted n (%)	Total n (%)
YES	10	1 (50.0%)	1 (50.0%)	2 (100.0%)
	11	7 (53.8%)	6 (46.2%)	13 (100.0%)
	12	37 (75.5%)	12 (24.5%)	49 (100.0%)
	13	18 (90.0%)	2 (10.0%)	20 (100.0%)
	Total	**63 (75.0%)**	**21 (25.0%)**	**84 (100.0%)**
NO	10	15 (15.2%)	84 (84.8%)	99 (100.0%)
	11	38 (24.7%)	116 (75.3%)	154 (100.0%)
	12	63 (52.9%)	56 (47.1%)	119 (100.0%)
	13	9 (64.3%)	5 (35.7%)	14 (100.0%)
	Total	125 (32.4%)	261 (67.6%)	386 (100.0%)

(p = 0.103)

Table 3: Distribution of subjects based on age, eruption status of the maxillary left second molar and attainment of menarche.

Whether menarche attained	Age (in years)	Erupted n (%)	Unerupted n (%)	Total n (%)
YES	10	1 (50.0%)	1 (50.0%)	2 (100.0%)
	11	7 (53.8%)	6 (46.2%)	13 (100.0%)
	12	36 (73.5%)	13 (26.5%)	49 (100.0%)
	13	17 (85.0%)	3 (15.0%)	20 (100.0%)
	Total	**61 (72.6%)**	**23 (27.4%)**	**84 (100.0%)**
NO	10	19 (19.2%)	80 (80.8%)	99 (100.0%)
	11	41 (26.6%)	113 (73.4%)	154 (100.0%)
	12	66 (55.5%)	53 (44.5%)	119 (100.0%)
	13	12 (85.7%)	2 (14.3%)	14 (100.0%)
	Total	138 (35.8%)	248 (64.2%)	386 (100.0%)

(p = 0.223)

Table 4: Distribution of subjects based on age, eruption status of the mandibular left second molar and attainment of menarche.

Whether menarche attained	Age (in years)	Erupted n (%)	Unerupted n (%)	Total n (%)
YES	10	1 (50.0%)	1 (50.0%)	2 (100.0%)
	11	10 (76.9%)	3 (23.1%)	13 (100.0%)
	12	41 (83.7%)	8 (16.3%)	49 (100.0%)
	13	19 (95.0%)	1 (5.0%)	20 (100.0%)
	Total	71 (84.5%)	13 (15.5%)	84 (100.0%)
NO	10	27 (27.3%)	72 (72.7%)	99 (100.0%)
	11	62 (40.3%)	92 (59.7%)	154 (100.0%)
	12	83 (69.7%)	36 (30.3%)	119 (100.0%)
	13	12 (85.7%)	2 (14.3%)	14 (100.0%)
	Total	184 (47.7%)	202 (52.3%)	386 (100.0%)

(p = 0.251)

Table 5: Distribution of subjects based on age, eruption status of the mandibular right second molar and attainment of menarche.

Whether menarche attained	Age (in years)	Erupted n (%)	Unerupted n (%)	Total n (%)
YES	10	1 (50.0%)	1 (50.0%)	2 (100.0%)
	11	10 (76.9%)	3 (23.1%)	13 (100.0%)
	12	41 (83.7%)	8 (16.3%)	49 (100.0%)
	13	19 (95.0%)	1 (5.0%)	20 (100.0%)
	Total	**71 (84.5%)**	**13 (15.5%)**	**84 (100.0%)**
NO	10	25 (25.3%)	74 (74.7%)	99 (100.0%)
	11	60 (39.0%)	94 (61.0%)	154 (100.0%)
	12	82 (68.9%)	37 (31.1%)	119 (100.0%)
	13	12 (85.7%)	2 (14.3%)	14 (100.0%)
	Total	179 (46.4%)	207 (53.6%)	386 (100.0%)

(p = 0.251)

Discussion:

This study was an attempt to find a correlation between attainment of menarche and eruption status of permanent second molars in 10-13-year-old school girls.

Studies carried out over the past few decades have revealed a downward shift in the mean menarcheal age.[2-4,6,7,9,10,12] A similar secular trend has also been noted in the earlier emergence of the permanent second molar teeth.[1,8,12,14] Therefore, evidence of a link between these two physiological events, which occur during a period of rapid growth, would be of great scientific interest. Confirmation of a link between these two events would make one a marker for the other, thus enabling oral health care professionals to take advantage of this phase for implementing preventive and therapeutic programs for oral conditions such as dental caries, and orthodontic and orthopedic corrections.

Of the 470 subjects in this study, only 17.9% had attained menarche. Investigations by other researchers[2,3,6,10] showed higher values which could be attributed to the wider age range of their target populations. The percentage of girls attaining menarche increased with increasing age;[2] however, in this survey, a lower percentage of girls in all ages had attained menarche as compared to Lai et al (2008).[2]

Self-reported menarcheal age may be a limitation of this study due to recall bias.[2,13] However, it has been documented that the recall method of age at menarche is reliable and valid enough for epidemiologic research.[2,4] Equal number of students could not be examined in each group as, in the selected schools; only 34 13-year-old students were available and consented to participate. Although the results may have been different if an equal number of subjects were present in each age group, the data obtained shows that the attainment of menarche was higher among the 13-year-olds in comparison to the other age groups. That this finding mirrors other studies[2,3,8,10,13] is important in validating the other data obtained from this study. Thus, it seems logical, as in another investigation,[15] that if our data is representative regarding the age of attainment of menarche and the eruption ages of the second molars, it should also be representative concerning the inferences derived from the study.

To conclude, investigators found that only 17.9% subjects had attained menarche. Significant differences existed within the age groups with regard to attainment of menarche and with regard to eruption status of second molars. Although it was revealed that attainment of menarche was greater among those with erupted second molars, the objective of finding a correlation between attainment of menarche and eruption status of permanent second molars could not be fulfilled. A population based multicentric survey, focusing on a larger sample encompassing a wider age range, may give a concrete conclusion on this issue.

REFERENCES

1. Kaur I, Singal P, Bhatnagar DP. 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.
2. Lai EHH, Chang JZC, Yao CCJ, Tsai SJ, Liu JP, Chen YJ, et al. Relationship between age at menarche and skeletal maturation stages in Taiwanese female orthodontic patients. J Formos Med Assoc 2008;107(7):527-32.
3. Rokade SA, Mane AK. A study of age at menarche, the secular trend and factors associated with it. The Internet Journal of Biological Anthropology 2009;3(2). DOI: 10.5580/115b.
4. Cho GJ, Park HT, Shin JH, Hur JY, Kim YT, Kim SH, et al. Age at menarche in a Korean population: secular trends and influencing factors. Eur J Pediatr 2010;169:89-94.
5. Gajdos ZK, Hirschhorn JN, Palmert MR. What controls the timing of puberty? An update on progress from genetic investigation. Curr Opin Endocrinol Diabetes Obes 2009;16(1):16-24.
6. Prakash C, Srivastava B, Gaur S, Bala R, Rai A, Roham. Age of menarche in girls of Uttarakhand. J Indian Acad Forensic Med 2010;32(1):49-51.
7. Dvornyk V, Haq Wu. Genetics of age at menarche: a systematic review. Hum Reprod Update 2012;18(2):198-210.
8. Guedes-Pinto AC. The relationship between the menarche and dental eruption. Aust Dent J 1977;22(6):468-70.
9. Wyshak G, Frisch RE. Evidence for a secular trend in age of menarche. N Engl J Med 1982;306:1033-35.
10. Bagga A, Kulkarni S. Age at menarche and secular trend in Maharashtrian (Indian)girls. Acta Biol Szeged 2000;44(1-4):53-7.
11. Kaczmarek M. Adolescent growth and its relation to menarche, dental and somatic maturation. Anthropol Rev 2002;65:27-42.
12. Helm S. Secular trend in tooth eruption: a comparative study of Danish school children of 1913 and 1965. Arch Oral Biol 1969;14(10):1177-91.
13. Clavel-Chapelon F, the E3N-EPIC group. Evolution of age at menarche and at onset of regular cycling in a large cohort of French women. Hum Reprod 2002;17(1):228-32.
14. Rousset MM, Boualam N, Delfosse C, Roberts WE. Emergence of permanent teeth: secular trends and variance in a modern sample. J Dent Child 2003;70(3):208-14.
15. Ekstrand KR, Christiansen J, Christiansen MEC. Time and duration of eruption of first and second permanent molars: a longitudinal investigation. Community Dent Oral Epidemiol 2003;31:344-50.