Received 1August 2007; Accepted 1 September 2007

Prevalence and Bilateral Occurrence of First Permanent Molar Caries in 12-Year-Old Students

Mostafa Sadeghi [1*]

1. Assistant Professor, Department of Operative Dentistry, Dental School, Rafsanjan University of Medical Sciences, Iran
**Corresponding Author: E-mail: mostafasadeghi@yahoo.com*

Abstract

Background and aims. Dental caries is one of the most prevalent chronic diseases in children and DMFT index is the most important quantitative factor for measuring tooth health. The purpose of the present study was to determine prevalence and bilateral occurrence of first permanent molar caries in 12-year-old Iranian students.

Materials and methods. This cross-sectional study was carried out on 563 twelve-year-old students (307 boys and 256 girls), randomly selected from private and public schools of Rafsanjan, Iran, in 2006. All students were examined clinically for dental caries using the World Health Organization (WHO) criteria by a specialist on a dental chair in Rafsanjan Dental School. Data was analyzed using chi-square and t-test.

Results. The mean DMFT score of first permanent molars was 1.9 ± 1.6 (1.83 boys, 1.98 girls) and 31.4% (32.9% boys, 29.7% girls) of the students were caries free. There were no significant differences between boys and girls. Decayed (D) component yielded to be 40.9%, missing (M) 0.35% and filled (F) 6.22%. Maxillary and mandibular first permanent molars had 80.8% and 84% bilateral caries occurrence, respectively. There were no significant differences between the caries prevalence of right and left sides.

Conclusion. Caries prevalence among 12-year-old students in Rafsanjan, Iran is less than the global standards of WHO and FDI for 2000, but close to the gold standard for 2010. Bilateral caries occurrence in the first permanent molars was concluded to be high in the study population.

Key words: **Bilateral occurrence, dental caries, DMFT, first molar, Iran.**

Introduction

Dental caries is one of the most prevalent chronic diseases in children. Hence, the prevention and treatment of dental caries remains an important responsibility of the dental profession. DMFT is considered to be an important index to determine the oral health status.[1,2] WHO goals include an average DMFT of not more than 3 in 2000 and not more than 1.0 in 2010 at the age of 12.[3]

Several studies have investigated the prevalence of dental caries in Iranian school children. A WHO report indicates that the DMFT index in Iran increased from 2.4 in 1974 to 2.6 in 1976, and then to 4.2 in 1977.[4] Seyedein et al[5] in a study involving 43772 students of fifth grade from all provinces and districts of the country, classified by gender and place of residence, found that the DMFT index in 12-year-old students

was 1.67 in 1994. The highest prevalence of caries was seen in the first permanent molars.

In one study involving 12-year-old students from two cities of Yazd and Hadi-Shahr, Iran, DMFT score was reported to be 1.8 ± 1.75, and 74.73% of the students were found to have caries.[6] Momeni et al assessed the prevalence of dental caries and treatment needs of 12-year-old children living in Tehran and a suburb of Isfahan and reported the mean DMFT score as 0.77 among study population.[7] In the latter study, 63.8% of children presented a sound permanent dentition and the prevalence of caries among 12-year-old children in Iran was concluded to be as low as in the developed countries of central Europe. The author reported the prevalence of caries in 12-year-old students to be 38.2% in a previous study in the city of Rafsanjan (41.3% and 35.1% among boys and girls, respectively).[8]

Knowledge of caries patterns in a population assists in the prevention and diagnosis of dental caries. A bilaterally symmetrical pattern in the occurrence of dental caries has been reported previously by several researchers around the world; however, the observations have been confined to equal or similar level of caries experience on both sides of the mouth.[1,9] Brekhus[10] first noted the bilateral pattern of tooth mortality due to caries in 1928. Knutson and Klein[11] in 1938 recognized that tooth eruption and occurrence of caries in teeth are symmetrical and bilaterally equal. Halikis[12] also reported the bilaterality of dental caries in both permanent and deciduous dentition of Australian children in 1965. Wei[13] et al (1993) reported a bilateral prevalence of dental caries in Hong Kong preschool children. Nainar and Wyne[9] (1998) and Wyne[14] (2000) have reported the phenomenon of caries bilaterality in preschool children. Wyne[1] (2004) also reported that caries bilaterality and the conditional probability for bilateral caries occurrence was high in the study population.

In 2000, both WHO and FDI announced the age of 12 to be of special importance with regard to caries; twelve is the most crucial age regarding prevention policies.[15] Most of the 12-year-olds have all the permanent teeth, except for the third molar, hence the permanent dentition starts at this age.[16,17] Although several studies have reported prevalence of dental caries in 12-year-old students in Iran (Table 1), there has been no report on the bilateral occurrence of dental caries in Iranian students. The purpose of the present study was to determine prevalence and bilateral occurrence of dental caries in first permanent molars of 12-year-old students in Rafsanjan, Iran

Materials and Methods

This cross-sectional study was carried out on 12-year-old school children in Rafsanjan. The total number of 12-year-old students was obtained from the local education administration. Sampling was carried out using a random cluster method from all private and public elementary and junior high schools. The sample size was estimated allowing for caries prevalence of 60%[8] and precision of 0.05. All of the selected students, who were Iranian citizens and permanent residents of the city, participated in the clinical examination conducted from September to December 2006.

A questionnaire was designed to record personal profile of the students and their DMFT index for first permanent molars. All selected students were examined for dental caries by a specialist utilizing the WHO criteria for diagnosis of dental caries. The examination was carried out using a cycle and cow-horn two headed dental explorer (Aesculap AG, Tuttlingen, Germany), a plane mouth mirror (Aesculap AG), and cotton rolls to remove any plaque or debris, where necessary. All examinations were performed on a dental chair in Rafsanjan Dental School.

A tooth is considered as decayed when in addition to showing clinical signs such as a color change, wedging and catching of an explorer tip during the examination encounters some degree of resistance. Marthateler method was used for proximal surfaces. According to this method, a surface is diagnosed as decayed if the explorer is retained. Dressed and restored teeth that had recurrent caries were recorded as caries. Teeth filled with temporary materials were considered as filled, not as decayed, and no radiographs were taken. Teeth with white spots were not considered as decayed in this study.[2,6,18]

The association between prevalence of caries and gender was assessed using chi-

Table 1. DMFT index and percentage of caries free in 12-year-old students according to location in Iran

Year	DMFT Index	Caries Free	Location
1990-1992	2.4	31.3%	Iran[22]
1990	3.52	7.6%	Tehran[36]
1991	3.17	N/A*	Tehran[31]
1992	1.45	45.5%	Kashan (Girls)[16]
1992	4.08	15%	Mashhad[35]
1993-1994	1.67	N/A	Iran[5]
1995	2.02	17%	Iran[23]
1996	3.08	19.1%	Tehran[31]
1997	1.76	N/A	Birjand[32]
1998	N/A	38.2	Rafsanjan[8]
1998	2.83	25%	Tehran[36]
1998-1999	1.5	47.7%	Iran[24]
2000	6.12	N/A	Shahreza[33]
2001	1.8	28.6%	Yazd & Hadi-Shahr[6]
2000-2001	3.3¥	N/A	Blind Children, Tehran[2]
2002	1.8	N/A	Dayer [29]
2004	0.77	63.8%	Tehran & Esfahan[7]
2004	2.28	10.7	Qom[34]
2005	1.62	N/A	Andimeshk[30]
2006	1.9	31.4	Rafsanjan†

*: N/A = Not available

¥: DMFT of First Permanent Molars

†: Present Study

square test. To evaluate the mean difference of DMFT between girls and boys, t-test was used. Coefficient analysis was performed to examine the relationship between bilateral occurrence of dental caries. Statistical analysis of data was performed by SPSS computer software. A p-value of less than 0.05 was considered statistically significant.

Results

A total of 563 students (307 boys and 256 girls) aged 12 were examined for DMFT index of first permanent molars. The mean DMFT score of first permanent molars was 1.9 ± 1.6 (1.83 boys, 1.98 girls); 31.4% of students (32.9% boys, 29.7% girls) were caries free (Table 2). There were no statistically significant differences in DMFT of first permanent molars and caries-free population between boys and girls. The above index was also determined separately for each molar and each component of this index, namely decayed, missing and filled. Decayed component yielded to be 40.9%, missing 0.35%, and filled 6.22% (Table 3).

The prevalence of caries was similar in both sides of the mouth in maxillary and mandibular first permanent molar teeth. Maxillary and mandibular first permanent molars yielded 80.8% and 84% bilateral caries occurrence, respectively. There was no significant difference in the bilateral occurrence of dental caries between the right and left first molars.

Table 2. DMFT index and its components in first molars according to gender in 12-year-olds

DMFT Rate / Gender	DT Mean ± SD	MT Mean ± SD	FT Mean ± SD	DMFT Mean ± SD
Boys n = 307	1.65 ± 1.53	0.023 ± 0.20	0.17 ± 0.62	1.83 ± 1.57
Girls n = 256	1.63 ± 1.55	0.004 ± 0.063	0.35 ± 0.94	1.98 ± 1.63
Total n = 563	1.64 ± 1.54	0.014 ± 0.16	0.25 ± 0.78	1.90 ± 1.60
Difference in DMFT and gender	P = 0.902 (NS)[1]	P = 0.126 (NS)	P = 0.008	P = 0.281 (NS)

1: NS = Not Significant

Table 3. D, M and F components in first molars at 12-year-old students in Rafsanjan, Iran (2006)

Index / Molar	DT n[1] (%)	MT n (%)	FT n (%)
Upper Right	207 (36.8)	1 (0.2)	24 (4.3)
Upper Left	208 (36.9)	00 (00)	28 (5.0)
Lower Right	258 (45.8)	4 (0.7)	44 (7.8)
Lower Left	250 (44.4)	3 (0.5)	44 (7.8)
Total	922 (41)	8 (0.4)	140 (6.2)

1: n = number

Discussion

In this study, only the first permanent molars were evaluated since they are a key to the permanent dentition and have almost erupted for about 6 years in the mouth in 12-year-old children. The difference in the type of obtained results should be taken into consideration when comparing to that of the other studies. The present study investigated DMFT of first permanent molars due to the following reasons: Initially, the first permanent molars are the earliest erupting teeth of the permanent dentition in most cases; they have mighty control over the teeth erupting later behind and in front of them, as they are forced to position to the already erupted and in occlusion functioning first molars.[17] Secondly, they are the biggest teeth, their local position in the occlusal arch supports the main masticatory duty and operation; they influence the vertical distance of upper and lower jaws, the occlusal height, and esthetic proportions.[17] In addition, the first permanent molars are at greater risk of damage and loss, because of their special morphology.[2] Thirdly, the health of these teeth can be considered as a good basis to study the oral health status of these children.[2] Finally, such a study can be used as a powerful aid for planning a proper health care system at early ages. Such plans may include improving parents' knowledge about the importance of these teeth, especially because most parents are unaware that these teeth are the first permanent teeth.

In this study 31.4% of the students were caries free and DMFT of first permanent molars was 1.9 ± 1.6. There was no significant difference between caries prevalence and DMFT of first permanent molars in relation to gender. The obtained results are less than the global standards of WHO and FDI for the year 2000[3]; however, since these pertain only to caries in first permanent molars, they are considered close to the gold standard for year 2010.[15,19]

WHO has drafted new goals for 2020, entitled "Goals for Oral Health 2020". The

updated objectives are intended to act as a framework for the formulation of regional and national oral health goals as the slogan "Think globally, act locally" implies. The new goals are allowing for the fact that not all recommendations are applicable equally to all countries and populations. Appropriate differentiation is therefore important.[19]

Previous studies in this age group showed that the DMFT index of first permanent molars in Islamic Republic of Iran has decreased from 3.52 to 1.9 between 1990 and 2006 (Table 1). In an assignment report on oral health care in Iran, Leous reviewed the results of 12 surveys conducted to assess dental caries and the mean DMFT of first permanent molars during a period of 30 years (1959-1989). The researcher reported that the mean caries experience in 12-year-old children in Iran had increased from 1.8 to 4 concerning DMFT of first permanent molars.[20] The first nationwide survey was conducted in 1990-1992 and revealed that mean DMFT of first permanent molars in 1426 children aged 12 was 2.4 and 31.3% were caries free.[21] In the second survey in 1995, the mean DMFT of first permanent molars was 2.02 and 17% of children were caries free[22]. The third national investigation was carried out in 1998-1999 by the Oral Health Department, Ministry of Health and Medical Education, and showed that the dental caries experience had declined to 47.7% and DMFT of first permanent molars to 1.5.[23]

The D component was the major contributor to DMFT index of first permanent molars (40.9%), which indicates a high percentage of untreated caries. It is as an important criterion for treatment needs assessment of these students. Previous studies in Iran have also reported similar results.[2,5,7,16,24] Data from surveys in the past two decades shows a marked decline in dental caries from 4 to 1.5 considering DMFT of first permanent molars in 12-year-old children and that more than 50% have caries experience, with the decayed component being the greatest component.[24] In this study only first permanent molars were examined and almost all other permanent erupted teeth were intact (only 7 teeth were decayed); also the significant decrease in the missing index and marked increase in filled index indicates a developing dental caries prevention strategies (education, diet, systemic and topical fluoride, tooth brushing) and improving dental care in the last few years in Islamic Republic of Iran.

In the present study caries prevalence was similar in both right and left sides of the mouth for maxillary (80.8%) and mandibular (84%) first permanent molar teeth, which is in agreement with several previous studies.[1,9,14] Similar caries prevalence on both sides of the mouth indicates a high bilateral occurrence of caries. This effect is due to the heterogeneous nature of caries distribution that both sides of the mouth are in fact not true mirror images of each other,[25] thus suggesting careful examination of the contra-lateral molar if the molar on one side is carious.

Al-Malik and Rehbini[26] reported that the prevalence of caries in permanent molars were mostly bilateral. The bilaterality of primary molar caries was also reported in previous studies.[27,28] Wyne[1] reported that maxillary first molars and mandibular first molars in 12-13 year old children showed very high caries bilaterality (86.5% and 86.0%, respectively). Caries were significantly bilateral in all teeth except for canines and premolars ($p<0.05$). The latter author reported the caries occurrence bilaterality to be 83.6% in maxillary first permanent molars and 70.3% in mandibular first permanent molars in another study.[14]

In the present study, caries bilaterality demonstrated to be the highest in first permanent molars, which are considered to be the most important teeth in the permanent dentition. Therefore, first permanent molars require special attention during routine dental examination. A high bilateral occurrence demands careful prevention strategies including fissure sealants, topical fluoride applications, and meticulous home care.[1]

Conclusions

1. The caries prevalence among 12-year-old students in the Islamic Republic of Iran is less than global standards according to WHO references for 2000, but close to the gold standard for 2010.
2. Bilateral caries occurrence was similar in both sides of the mouth in maxillary and mandibular first permanent molars in the study population.

3. The probability that a first permanent molar on the left side would be carious given that the molar tooth on the right side is carious was very high.

Acknowledgements

The author would like to thank Dr. S. Amirahmadi for her assistance in data collection, Mr. A.R. Sayadi for his help in data analysis, and the students of Rafsanjan Dental School for their cooperation in this study. This study was supported by a grant from Vice Chancellor of Research in Rafsanjan University of Medical Sciences.

References

1. Wyne AH. The bilateral occurrence of dental caries among 12-13 and 15-19 year-old school children. *J Contemp Dent Pract* 2004; 1:42-52.
2. Ghandehari Motlagh M, Kohestani A. An investigation on DMFT an first permanent molars in 12-year-old blind children in residential institutes for blinds in Tehran (2000-2001). *Journal of Dentistry, Tehran University of Medical Sciences* 2004; 1:56- 61.
3. WHO, FDI. Global goals for oral health 2000. *Int Dent J* 1982; 32:74-7.
4. WHO. Oral health global indicators for 2000, May 1991 (unpublished document No. WHO/ORH/DMFTT/12.91). Available from: The Oral Health Unit, WHO Headquarters, Geneva.
5. Seyedein SM, Zali MR, Golpaigani MV, Yazdani H, Nourhalouchi S. Oral health survey in 12-year-old children in the Islamic Republic of Iran, 1993-1994. *East Mediterr Health J* 1998; 4:338-342.
6. Daneshkazemi AR, Davari A. Assessment of DMFT and enamel hypoplasia among junior high school children in Iran. *J Contemp Dent Pract* 2005; 4:85-92.
7. Momeni A, Mardi M, Pieper K. Caries prevalence and treatment needs of 12-year-old children in the Islamic Republic of Iran. *Med Princ Pract* 2006; 15:24-28.
8. Sadeghi M. Prevalence of caries free in 12 and 15 years old students of Rafsanjan city in 1998. *Journal of Rafsanjan University of Medical Sciences* 2001; 1:59-63 [In Persian].
9. Nainar SMH, Wyne AH. Caries pattern of high caries pre-school children attending a dental clinic in Riyadh, Saudi Arabia. *Saudi Dent J* 1998; 10:80-83.
10. Brekhus PJ. Investigation of loss of human teeth. *J Am Dent Assoc* 1928; 15:679-690.
11. Knuston JW, Klein H. Studies of dental caries, part IV: tooth mortality in elementary school children. *Pub Health Rep* 1938; 53:1021-1032.
12. Halikis SE. A study of dental caries in a group of Western Australian children. IV. The bilaterality of dental caries. *Aust Dent J* 1965; 10:371-375.
13. Wei SH, Holm AK, Tong LS, Yuen SW. Dental caries prevalence and related factors in 5-year-old children in Hong Kong. *Pediatr Dent* 1993; 15:116-119.
14. Wyne AH. The phenomenon of caries bilaterality in Saudi pre-school children. *Egypt Dent J* 2000; 46:189-191.
15. World Health Organization. WHO Assignment report. Geneva: WHO; 1998.
16. Afshar H, Ershadi A, Ershadi M. An investigation on the correlation between DMFT and OHI-S indices on 12-year-old school girls in Kashan. *Journal of Dentistry, Tehran University of Medical Sciences* 2004; 1:38-42 [In Persian].
17. Risse G. The angulation of upper 1st permanent molars, the key to functional occlusion. *Artikel Fach J* 2005; 1:1-9.
18. World Health Organization. Oral Health Surveys: Basic Methods. 3rd ed. Geneva: WHO; 1997.
19. Ziller S, Micheelis W, Oesterreich D, Reich E. Goals for oral health in Germany 2020. *Int Dent J* 2006; 56:29-32.
20. Leous P. Oral health care in the Islamic Republic of Iran. Assignment report, Jan 1990, available at http://www.who/orh/eis/12yr book, 1993, 4,12.
21. Jaberi Ansari Z. A review of the reported data on DMF scores in Iran during 1990-1992. *Beheshti Univ Dent J* 2000; 17:246-254 [In Persian].
22. Oral Health Situation of Iranian Children. 1st ed. Tehran: Ministry of Health and Medical Education, Under-secretary of Health, Oral Health Bureau, 1998-1999 [In Persian].
23. Samadzadeh H, Hesari H, Nori M. A survey on the DMFT trend in 6-12 year olds

Iranian school children in 1993. *Beheshti Univ Dent J* 2001; 19:262-272 [In Persian].
24. Pakshir HR. Oral health in Iran. *Int Dent J* 2004; 54:367-372.
25. Meyer-Lueckel H, Paris S, Shirkhani B, Hopfenmuller W, Kielbassa AM. Caries and fluorosis in 6- and 9-year-old children residing in three communities in Iran. *Community Dent Oral Epidemiol* 2006; 34: 63–70.
26. Al-Malik MI, Rehbini YA. Prevalence of dental caries, severity, and pattern in age 6 to 7-year-old children in a selected community in Saudi Arabia. *J Contemp Dent Pract* 2006; 7:46-54.
27. Al-Mohammadi SM, Rugg-Gunn AJ, Butler TJ. Caries prevalence in boys aged 2, 4, and 6 years according to socio-economic status in Riyadh, Saudi Arabia. *Community Dent Oral Epidemiol* 1997; 25:184-186.
28. O'Brien M. Children's Dental Health in the United Kingdom 1993. London: Office of Population Censuses and Surveys, 1994.
29. Ramezani GH, Valaei N, Eikani H. Prevalence of DMFT and fluorosis in the students of Dayer city (Iran). *J Indian Soc Pedod Prev Dent* 2004; 22:49-53.
30. Ghandehari-Motlagh M, Jahed-Khaniki GR, Adiban H. Investigation of Dental Caries Prevalence among 6-12 year old Elementary School Children in Andimeshk, Iran. *J Med Sci* 2007; 7:116-120.
31. Porhashmi SJ, Nabai H. Assessing the success rate of current prevention methods in 12 years-old Tehranian children. *Beheshti Univ Dent J* 1998; 32:21-26 [In Persian].
32. Froozanfar F. Evaluation of DMFT on Birjand 12- year-old pupils. *J Birjand Med Sci Univ* 1997; 4:10-11 [In Persian].
33. Arbabzadeh ZF, Bouzari M, Hatamosa D. Study of DMFT index in 12 year old school grils and boys in Shahreza, Iran (2000). *J Dent Edu* 2004; 68:63-70.
34. Toomarian L, Souri S, Farhadi H. Epidemiological evaluation of DMFT index in 12-year-old students of Qom city in 2004. *Beheshti Univ Dent J* 2005; 23:467-474 [In Persian].
35. Pajand H, Aryan-Nejad H. A comparison between DMFT-Indices of junior and high school children in Mashhad Iran. *Journal of Mashhad Dental School* 2000; 24:91-100 [In Persian].
36. Poorhashemi SJ. A longitudinal study on caries reduction rate of 12 year old children in Tehran (1990-98). *Beheshti Univ Dent J* 2001; 18:323-327 [In Persian].