

Volume 7, No. 3, Summer 2018  
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Original Articles

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Scientific Research Journal

Journal of Oral Health & Oral Epidemiology

# Journal of Oral Health & Oral Epidemiology

Official Journal of Kerman Oral and Dental Diseases  
Research Center

Online ISSN 2322-1372

Volume 7, No. 3, Summer 2018

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Haapasalo M, Qian W: Irrigants and Intracanal Medicaments. In: Ingle JI, Bakland LK: Endodontics 6. 6<sup>th</sup> ed. BC Decker Inc, Hamilton; Ontario, Canada. 2008; Chapter 28: 997-9.

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Maryam Allameh DDS, MSc<sup>3</sup>, Najmeh Mohseni DDS<sup>4</sup>

### Original Article

#### Abstract

**BACKGROUND AND AIM:** Information gathered from patients about dental implants is often incomplete and scattered. The aim of the present study was to measure the level of this information and the attitudes of patients seeking dental implants.

**METHODS:** In the present cross-sectional descriptive-analytic study, 248 people were employed. To discover the level of knowledge and attitudes in dental implants a questionnaire was distributed amongst the participants. Data were collected from people seeking implants in dental colleges and implant dental clinics in Isfahan, Iran. Analyses of the patients' answers in the questionnaire was carried out using SPSS software with t-test, Spearman's rho correlation coefficient, and one-way analysis of variance (ANOVA) test ( $\alpha = 0.05$ ).

**RESULTS:** The mean score of knowledge was  $5.3 \pm 2.1$  (from maximum 12). The average of attitude questions in Likert scale reached to  $25.84 \pm 3.38$  (from maximum 35), and in questions with numerical linear scale it was  $21.44 \pm 5.38$  (from maximum 25). The source of information on dental implants for most of the patients was their dentists. The level of knowledge increased with higher level of education and also with better economic status. The attitude of patients about this method of tooth replacement was also more positive amongst ones with better economic situation.

**CONCLUSION:** The results of the present study demonstrated that the knowledge of patients about dental implants is moderate, and there is a positive attitude toward this treatment method.

**KEYWORDS:** Attitude; Dental Implants; Knowledge

**Citation:** Yaghini J, Naghsh N, Allameh M, Mohseni N. **A cross sectional study on knowledge and attitude level of patients demanding implants in Isfahan, Iran, 2016.** J Oral Health Oral Epidemiol 2018; 7(3): 99-106.

Common oral conditions have a paramount impact on the quality of life of an individual. Missing one or more natural tooth often leads to discomfort and disability, as many of diary functions such as speaking, mastication, and sensation take place through mouth and teeth. Dental prosthesis is used when these functions and the individual's beauty are compromised due to tooth missing. However, many of patients adapt to these

devices difficultly, and some other never get used to it. This problem can be related to different factors such as anatomical, psychological, and denture related issues.<sup>1-3</sup>

The aim of modern dentistry is to restore function as well as aesthetic and normal health to partially or totally edentulous patients. Implant dentistry is a promising tooth replacement method which covers all these objectives.<sup>4-7</sup> Moreover, it is proved that implant-supported prosthesis has excess

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advantages of bone maintenance and satisfying aesthetic needs compared to conventional denture treatments.<sup>8,9</sup> On the other hand, although the implant has some disadvantages such as high cost, an additional surgery in treatment stages, probability of failure, and the time consuming duration of treatment,<sup>10</sup> such facts have not negatively affected the patients' tendency toward implant; to the extent that many reports have shown that patients accept implant therapy as an approved treatment strategy. In a study by Grogono et al., it was reported that 88% of cases declared an improved self-confidence after implant placement, 98% announced a better feeling of health in their mouth, 89% agreed to undergo another more implant treatment, and 90%-94% of patients with previous implant therapy showed a positive attitude toward this method.<sup>11</sup>

In Al-Hamdan and Meshrif investigation, conducted on Saudi people in 2007, the level of patients' satisfaction of beauty needs was reported up to 71%, and 78% satisfaction was recorded about the function of dental implants.<sup>12</sup> The rate of knowledge and attitude of 120 American patients demanding dental implants was investigated by Zimmer et al.<sup>13</sup> The results of this study showed a high level of patients' knowledge and a positive attitude toward this treatment method. They also demonstrated that people believe prosthesis supported by implants satisfy more beauty needs than removable conventional dentures. The mass media was the principle source of individual information. In contrast to these results, in a study conducted in India in 2013, only 33% of 440 participants had knowledge of dental implants, whilst 70% of the implant applicants reported a positive attitude toward this treatment.<sup>16</sup>

In 1992, Kent reported that treatment costs, phobia of surgery, and the long term course of implant therapy are the major factors which prevent attendance for this treatment.<sup>14</sup> Satpathy et al. showed that high

cost is reported as the major implant disadvantage in 58% of patients, while in 43% the stressful process of implant surgery was declared as the main disadvantage.<sup>15</sup>

In an investigation which was undertaken in Tabriz, Iran, in 2012, knowledge and attitude of patients toward implant was evaluated as moderate, and dentists were the principle source of patients' information.<sup>17</sup> Although tooth replacement with implant is considered as a pleasant experience for most patients, the available data about treatment stages and its success rate is often incomplete and scattered; and at the same time the information reflected by media are often not based on scientific evidence.<sup>11</sup> This problem is more prominent in developing countries which have compromised trainings from education custodians about patients' awareness and knowledge.<sup>18</sup>

It is important for dentists to know the level of their patients' knowledge about dental implants. Awareness of patients' perceptions toward dental implants can help dentists for evaluating patients' expectations.<sup>19</sup> In addition, awareness of people about dental implants would limit negative attitude caused by inadequate or false information. The studies of this model on dental implants are scarce in our country, Iran; therefore, we decided to investigate the level of patients' knowledge and their attitude in regard to dental implants as a choice of tooth replacement therapy.

## Methods

This cross-sectional descriptive-analytic study was conducted in Isfahan, Iran, from November 2015 to February 2016. All the procedures were conducted in accordance with ethics committee (393718) of Isfahan University of Medical Sciences.

A number of 248 patients who referred to dental clinics across the Isfahan City for implant purposes and also to the dental departments of Isfahan universities of medical sciences were employed to fill the questionnaires. The criteria for entrance of

patients to the project were cases seeking implant that previously had not undergone this treatment. Patients who had not been consistent with the process of the investigation were excluded from the study. The questionnaires were randomly distributed amongst patients of the study who were referred to implant section of dentistry school and implant offices in the city. Adequate explanation was told to each case before filling the questionnaire. In addition, a close supervision was taken while patients were answering the questions. This process of data gathering took 5 months from October to March 2016.

The questionnaire constituted of three sections divided upon previous studies;<sup>8,10,12,13,15,16,18</sup> first beginning with demographic questions including age, sex, economic status (by asking the amount of income rating questions as low, average, good, and excellent), and level of education; followed by the second part with the knowledge evaluating questions. In this section content related validity and face validity became approved. To achieve this goal, a group comprising of three specialists of periodontics was assigned to approve the content validity of questions related to knowledge. Furthermore, a weight was assigned to each question (1 = high coordination, 2 = moderate coordination, 3 = low or unspecified coordination) in order to detect accordance of each question to the goal of asking that part. Moreover, specialists were asked to propose any suggestion or concept to each question or the whole process of the project. After this step, all questions scored 2 or 3 were omitted or modified upon periodontics' opinion. Then questions were approved once again by specialists. In this way, the validity of the knowledge questionnaire was approved. Finally, 12 questions were assigned in this section. The third and last section was related to attitude questions with two subcategories: questions with Likert scale (7 questions), and questions with linear numerical scale

(5 questions). Questionnaires of other studies were used in designing the questions of this section. Otherwise, a group of specialists were asked to present their comments on objectives such as what the patients' reasons for implant treatment are, the level of their consent of this treatment, and factors which play a significant role on this satisfaction. Upon specialists' opinions, the sentences of attitude section of the questionnaire were written, and at last these questions were again reviewed by specialist to approve its validity. It is noteworthy to state that in making the attitude questions all principles of writing attitude questionnaires were observed; for example, the time of questions was present and there was not any induction in questions.

*The mode of rating and scoring of knowledge questions:* in the knowledge evaluating section, each question scored 1 if the patient's response was right. Thus, the range of the total score of this section was between 0 and 12. At the end, the mean score of knowledge for each patient was calculated, and then the classification of these results was done in a way that mean scores from 0 to 4 were classified as poor, from 4.1 to 8 as moderate, and the means amongst 8.1 to 12 were categorized as high.

Guttman coefficient was calculated as 0.7, which showed the validity of our questionnaire.

The third section of questionnaire was related to attitude evaluating questions. Similar to the previous part, in designing the questions of this section, computerized analyses and the specialists' comments on their perception of questions were used to validate the questions.

The reliability of questions was then examined by three specialists in periodontics. Finally, the questions of the attitude section were prepared in two sections: group with Likert scale (7 questions), and batch on a linear numerical scale (5 questions).

*The mode of rating and scoring of the attitude questions:* In questions with Likert scale, the attitude was determined as

positive, negative, and neutral. Since the number of questions in this section was 7, and each question had 5 choices, the mean score range of negative attitude was 7 to 16.3, neutral attitude between 16.4 and 25.6, and positive attitude was ranged of 25.7 to 35.

In the questions with linear numerical scale, due to the fact that the number of questions was 5 and each question had 5 choices, the level of significance was categorized as low if the range of mean score was between 5-11.6, intermediate if between 11.6 and 18.32 (the patient had not a specific idea on this topic), and high if the mean was in the range of 18.33-25. To calculate the reliability of questions in the attitude section, computation of Cronbach's alpha coefficient in 10% of the sample volume was used, which achieved to 0.7. Then data were analyzed using t-test (to compare means of knowledge and attitude in relation to gender, living in city or village, placement of implant in dental school or clinic), Spearman's correlation coefficient (to compare means of knowledge and attitude due to economic status and evaluating the relationship between mean of knowledge and mean of attitude), and one-way analysis of variance (ANOVA) (to compare means of knowledge and attitude in different age groups and educational level) with application of SPSS software (version 17, SPSS Inc., Chicago, IL, USA).

## Results

The present research was conducted on

248 patients (94 men, 154 women). The mean age of participants was  $47.7 \pm 14.0$  among the men and  $39.38 \pm 12.24$  among the women. The mean score of knowledge was calculated as  $5.3 \pm 2.1$ , on the total scale. Table 1 shows the frequency distribution of responses in the knowledge evaluating section.

In response to the question of implant site in the mouth, 64.1% said that it is intra-osseous and 24.6% thought that it would be intra gingival. In regard to the hygienic implant care 65.5% believed that implants require more care than natural teeth, 36.3% said that equal care is needed for implant and natural teeth, and 0.8% believed that natural teeth required more care. Of the individuals participating in this description study 5.7% believed in success rate of less than 50% for implant therapy, 22.7% agreed with a success rate between 50.0%-75.0%, 40.1% said it is between 75%-90%, and 31.6% stated a success rate of more than 90% for implant treatment. The mean score of attitude in questions with Likert scale was  $25.84 \pm 3.38$  (positive attitude), and mean score with linear numerical scale was calculated to be  $21.44 \pm 5.38$ .

Tables 2 and 3 show the frequency distribution in Likert scale and the linear numerical scale, respectively. Amongst all tooth replacement strategies suggested to patients in the questionnaire, 77.2% chose implant therapy. 73.2% believed that the benefits of implant therapy are more acceptable than its side effects such as pain and swelling.

**Table 1.** Frequency distribution of responses of implant seekers to knowledge questions

Knowledge components	Correct [n (%)]	Incorrect [n (%)]	Average weighted score
Implant application for each physical body status	90 (36.3)	158 (63.7)	0.36
Knowledge of the proper age for implant insertion	70 (28.2)	178 (71.8)	0.28
Implant placement immediately after tooth extraction	75 (30.2)	173 (69.8)	0.30
The site of implant insertion in the mouth	159 (64.1)	89 (35.9)	0.64
Hygiene care of implant	90 (36.3)	158 (63.7)	0.36
The possibility of damage of natural tooth adjacent to implant	70 (28.2)	178 (71.8)	0.28
The terms of implant use	219 (88.3)	29 (11.7)	0.88
Implant material	113 (45.6)	135 (54.4)	0.45
Parts of the tooth which is replaced by implant	60 (24.2)	188 (75.8)	0.24
Implant usage in a diabetic patient	167 (67.3)	81 (32.7)	0.67
Success rate for dental implants	78 (31.5)	170 (68.5)	0.31
Checkup cycles needed after implant insertion	120 (48.4)	128 (51.6)	0.48



**Table 2.** Frequency distribution of responses of implant seekers to attitude questions (with Likert scale)

Attitude components	Totally agree [n (%)]	Agree [n (%)]	No idea [n (%)]	Disagree [n (%)]	Totally disagree [n (%)]
Implant fulfill my expectations	70 (28.2)	134 (54.0)	42 (16.9)	2 (0.8)	0 (0)
Anterior tooth replacement must be done with implant	108 (43.7)	96 (38.9)	37 (15.0)	6 (2.4)	0 (0)
Posterior tooth replacement must be done with implant	53 (21.5)	25 (50.6)	57 (23.1)	11 (4.5)	1 (0.4)
Tendency to treatment compared with other methods	81 (32.9)	109 (44.3)	38 (15.4)	16 (6.5)	2 (0.8)
Implant treatment side effects is acceptable	55 (22.4)	125 (50.8)	52 (21.1)	13 (5.3)	1 (0.4)
Implant treatment cost is affordable	12 (4.8)	64 (25.8)	62 (25.0)	82 (33.1)	28 (11.3)
Implant treatment success rate is identical in the elderly and young	11 (4.5)	47 (19.0)	113 (45.7)	70 (28.3)	6 (2.4)

The cost effectiveness of implant was reported as acceptable for 30.6% of cases, and 44.4% believed this therapy is not affordable. From individuals, 82.2% stated that implant therapy is successful and has met their expectations.

The mean number of knowledge and attitude was compared on the basis of the individual's sex with t-test analyses. The mean number of knowledge was  $5.26 \pm 2.02$  for men and  $5.33 \pm 2.15$  for women ( $P = 0.84$ ). Furthermore, the average score of attitude with numerical linear scale was  $21.50 \pm 5.51$  in men and  $21.60 \pm 5.31$  in women ( $P = 0.53$ ).

Tables 4 and 5 show mean scores of knowledge and attitude between different educational levels and P values obtained by two by two comparisons of different educational levels in evaluating subjects' knowledge, respectively.

It was showed that there was a poor relationship between knowledge and economic status ( $P = 0.026$ ,  $r = 0.046$ ), and knowledge with attitude in Likert scale ( $P = 0.001$ ,  $r = 0.243$ ). In contrast, the relationship between economic status and attitude in numeric-linear scale was not

significant ( $P = 0.481$ ,  $r = 0.046$ ). It was also showed that there were significant differences between amounts of knowledge and attitude ( $P = 0.010$ ,  $r = 0.166$  and  $P = 0.018$ ,  $r = 0.151$ ; with Likert and linear numerical scales, respectively).

There was a significant difference between knowledge scores of patients presented to city implant clinics and dental school clinic ( $P = 0.007$ ), with more knowledge in participants of city clinics. On the other hand, there was no significant difference between attitude scores of patients in these two different places ( $P > 0.050$ ). The source of information about dental implants was reported as: 46.9% dentists, 30.6% friends and relatives, 3.7% magazines, 10.2% TV and radio, 4.1% web sites, and 4.5% named other sources.

## Discussion

The present study gives information on knowledge and attitude of patients demanding dental implants. In this study, the mean score of knowledge in total was  $5.3 \pm 2.1$ , which shows a moderate level of knowledge about dental implants in people of Isfahan City.

**Table 3.** Frequency distribution of responses of implant seekers to attitude questions with numerical linear scale

Attitude components	Incredibly important [n (%)]	Important [n (%)]	No idea [n (%)]	Not important [n (%)]	Super trivial [n (%)]
Aesthetic of implant	169 (69.0)	31 (12.7)	26 (10.6)	4 (1.6)	14 (5.7)
Mastication comfort ability with implant	172 (70.2)	40 (16.3)	25 (10.2)	5 (2.0)	3 (1.2)
Implant costs	131 (53.7)	49 (20.1)	41 (16.8)	12 (4.9)	10 (4.1)
Number of sessions needed for this treatment	85 (34.8)	59 (24.2)	65 (26.6)	18 (7.4)	17 (7.0)
Bone resorption prevention with implant	145 (59.2)	51 (20.8)	33 (13.5)	9 (3.7)	7 (2.9)

**Table 4.** Mean of amount of knowledge and attitude according to educational level

Educational level	Knowledge	Attitude (Likert scale)	Attitude (numerical linear scale)
Below diploma	4.96 ± 2.15	25.76 ± 3.72	20.69 ± 3.64
Diploma (mean ± SD)	5.22 ± 2.16	25.64 ± 3.46	22.04 ± 7.88
Bachelor (mean ± SD)	5.43 ± 1.90	25.97 ± 3.21	21.49 ± 3.26
MSc-PhD (mean ± SD)	7.08 ± 2.06	26.54 ± 2.69	20.41 ± 2.46
P	0.013	0.826	0.455

SD: Standard deviation

**Table 5.** Comparison of the amount of P-values "two by two" in evaluation of knowledge according to different educational level

	Below diploma	Diploma	Bachelor	MSc-PhD
Below diploma	-	0.460	0.170	< 0.001
Diploma	-	-	0.490	0.004
Bachelor	-	-	-	0.010
MSc-PhD	-	-	-	-

Likewise, in a study conducted in Tabriz, Iran, the rate of knowledge was reported as moderate.<sup>16</sup> On the other hand, this level was low in a similar study conducted by Ozcakir Tomruk et al. in the Turkish population.<sup>20</sup> In Satpathy et al. investigation in India, 15.91% had knowledge about the implant method which was significantly low.<sup>15</sup>

In the Zimmer et al. study, the percent of knowledge was 77.0%,<sup>13</sup> which was similar to the Pommer et al. study in Australia which was reported as 79.0%.<sup>21</sup> Furthermore, in the Berge study in Norway, 70.0% had knowledge about the intra oral site of implant, 64.1% of patients responded that implant is placed intra-osseous, and 24.6% said that it is intra-gingival. 65.5% of patients believed in more hygiene care for implants than natural teeth, 36.3% stated equal hygiene need, and 0.8% stated lower need to care for implants than natural teeth.<sup>22</sup>

In the present study, the mean number of attitude in questions with the Likert scale and the numeric-linear index was  $25.8 \pm 3.3$  and  $21.4 \pm 5.3$ , respectively; which shows that generally the patients' attitude about dental implants is positive. This result is in consistency with the Zimmer et al. results.<sup>13</sup> Furthermore, in the Grogono et al. investigation, 90%-97% of patients with knowledge of implants had positive attitudes toward it.<sup>11</sup> Similarly, in the Berge study, 60%

of patients had positive attitude toward implants;<sup>22</sup> interestingly enough, this attitude was mostly reported by patients who had already employed to this kind of treatment.

In our study, although there was not any significant difference in means of knowledge and attitude (with Likert scale) between different age groups, but there was significant difference when considering mean of attitude (with linear numerical scale) ( $P < 0.05$ ). Esthetic, ease of function, prevention of bone loss, cost, and follow up sections needed for implant placement for subjects in the range of 30-50 years old were more important than those under 30 years old.

In the Pragati and Mayank study, the most important factor which inhibited implant treatment was the cost of treatment.<sup>18</sup> Satpathy et al. also stated that 58% of patients believed that the high cost of implant is the major disadvantage.<sup>15</sup> In the Ozcakir Tomruk et al. investigation, 60.3% of patients reported high cost of implant as the major disadvantage, 34.7% the need to undertake surgery procedures, and 32.1% the long period of treatment.<sup>20</sup> In the present study, 44.4% of patients reported that this method of treatment was not affordable and it could be an inhibitory factor in implant application. Therefore, this problem should be taken into consideration in policy-makings, i.e. having part of such costs paid by insurance companies.

In the present study, there was a significant difference between mean scores of knowledge between patients of the dentistry department and ones referring to dental clinics in the city; the latter had more knowledge ( $P = 0.007$ ). This discrepancy can be explained by better economic status and higher educational level of patients referred

to city implant clinics than the ones referring to dental school clinics. Improvement of economic status leads to a trend to costly and modern dental treatments. The present study also demonstrated that people with higher educational levels have better information on dental implants. Increasing in the level of education can result in more referring to therapeutic centers, more communication with doctors, and also doing more scientific searches, and finally more trusting the clinicians. Additionally, patients with better economic status had more information. There was also a direct and poor relationship between economic status and attitude in the Likert scale ( $P < 0.001$ ,  $r = 0.243$ ).

In an assessment by Berge in Norway, media was introduced as the source of patients' information on dental implants.<sup>22</sup> In spite of the fact that in media (such as magazines, TV or radio) there is a significant focus on problems and failures of implant, the general attitude of people about dental implants was positive; this can be due to the fact that individuals mostly gather their information from multiple sources. In contrast, Rustemeyer and Bremerich documented that the main source of information about dental implants for German people was dentists and the lowest score belonged to web services.<sup>23</sup> In the present study, also it was found that dentists were the most important source of patients' information, followed by friends, and the very least important source was network information. This can be explained by the age range of the studied population in this study (47 for men and 39 for women). It is thought that usage of internet in this range of age in our country is limited; and therefore, most of

the patients' data is provided by clinicians and peer groups.

In the present investigation, there was a significant relationship between mean scores of knowledge and questions of attitude evaluation with both Likert and linear numerical scales. This shows that with increase in the level of knowledge about dental implants, the attitude would become more positive toward it.

Hence, by gathering the results of this study in general, it can be concluded that in our country, if dentists improve the evidence-based knowledge of their patients, there is hope that the community attitude toward this method of treatment would be more positive and realistic.

### Conclusion

The results of the present study showed that the knowledge of patients about dental implant was moderate, and there was a positive attitude toward this method. The level of knowledge regarding dental implanting was in direct relationship with educational degree and economic status, and was higher in patients referred to city clinics than the ones referred to the dental school clinics. In addition, the more the knowledge of patients, the better their attitude toward dental implants. The source of implant information was mostly from the patients' dentist.

### Conflict of Interests

Authors have no conflict of interest.

### Acknowledgments

The authors are grateful to the Vice Chancellor for Research of Isfahan University of Medical Sciences for the financial support provided.

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## The inter relationships among growth parameters (weight, height) and ectopic eruption of permanent first molars of children aged 6-9 years in Kerman, Iran

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### Original Article

#### Abstract

**BACKGROUND AND AIM:** Ectopic eruption (EE) of the permanent first molars (PFMs) results from a discrepancy between the jaw growth rate and the growth rate of these teeth. The present study was undertaken to evaluate the prevalence of EE of PFMs in Kerman, Iran, and then determine the relationship between growth parameters (height and weight) and this developmental anomaly.

**METHODS:** In the present study, 2025 children aged 6-9 years were examined to determine the prevalence of eruption of PFMs. Examinations were carried out with the use of tongue depressors under adequate light. Height and weight were determined in the control (without EE of PFM) and the case (with EE of PFM) groups, and then registered in the relevant checklist. Descriptive statistical methods were used for the analysis of qualitative data at a confidence interval (CI) of 95%. Chi-squared test was used for comparisons between the two groups in relation to age and gender.

**RESULTS:** In the present study, prevalence of the EE of PFMs was 2.8% in 6 to 9-year-old children in Kerman. The rate of this developmental anomaly was higher in boys compared to girls and higher in the maxilla than in the mandible; however, the differences were not significant ( $P > 0.05$ ). The prevalence of EE was higher in children with a lower mean age and a lower mean height and weight, which was significant statistically ( $P < 0.05$ ). EE was more common unilaterally than bilaterally, but the difference was not significant ( $P > 0.05$ ). In addition, there was no significant relationship between cleft palate or lip and EE ( $P > 0.05$ ).

**CONCLUSION:** Children in the lower than normal height and weight percentile are more susceptible to the EE developmental anomaly.

**KEYWORDS:** Height; Weight; Ectopic Eruption

**Citation:** Shojaeipoor R, Ghorbani-Gandomani M, Madani F, Malek-Mohammadi T. **The inter relationships among growth parameters (weight, height) and ectopic eruption of permanent first molars of children aged 6-9 years in Kerman, Iran.** J Oral Health Oral Epidemiol 2018; 7(3): 107-12.

Ectopic eruption (EE) is a disturbance of tooth eruption, in which a tooth moves in a path other than its normal path; and if it is not diagnosed on time, it will lead to occlusal problems.<sup>1</sup> Several factors have a role in EE, including a small dental arch, premature eruption of permanent first molars (PFMs), and deviation from the normal path of eruption. The prevalence of EE of PFM has been reported to range from 1.6% to 6%. It

occurs more commonly in boys than girls and in the maxilla than in the mandible. In children with cleft lip and/or cleft palate, EE is more prevalent than healthy children; it is also more prevalent in the family members of an afflicted individual than the general population. In 66% of cases, the PFM with EE is released from its locked position and erupts to reach the occlusal level, which is referred to as reversible EE (jump). In the irreversible state (hold), the PFM remains in

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its locked position, pending treatment.<sup>2</sup> The odds of spontaneous correction of EE are higher in girls than boys.<sup>1</sup> The EE of PFM is classified in terms of the extent of resorption of the distal root of deciduous second molars.<sup>3</sup> Since early diagnosis and informing the parents of the problem are important for managing EE and treatment if necessary, and due to the wide range of the prevalence of EE of PFM, the present study was undertaken to determine the prevalence of EE of these teeth in children in Kerman, Iran. A study on Britain population indicates that EE agent is multifactorial,<sup>4</sup> and the criteria for the normal growth in children are their height and weight. Developing teeth provides a reliable indication of maturation and biological age; and a balanced diet contains all the elements necessary for the growth of the teeth.<sup>5</sup>

Therefore, in this study, the growth parameters (height and weight) were determined and compared in the control group (without EE of PFM) and the case group (with EE of PFM). The influences of height and weight on the eruption of individual teeth were inconclusive.<sup>5</sup> A limited number of studies are available in this field, and researchers have suggested further evaluations in order to determine the relationship between growth parameters and EE of PFMs.

## Methods

In the present study, 2025 children aged 6-9 years (one third of self-corrections occurred after nine years of age<sup>2</sup>) were examined to determine the prevalence of EE of PFMs. The children were randomly selected from the private and public sector kindergartens at 6 years of age and from the non-profile and public sector elementary schools in preschool period and in first, second, and third grades up to 9 years of age, which is the normal period for the eruption of PFMs, from the educational districts 1 and 2 in Kerman, Iran. Clinical examinations were carried out using a tongue depressor under proper light by one dental student. The

growth parameters that consisted of height and weight were determined in both the control (without EE of PFM) and case (with EE of PFM) groups. Weight was determined with the use of a perfect glass digital weighing machine and height was determined with the use of a G-Time engineering measuring tape, and they were recorded in a checklist. The criteria for EE of the tooth in question consisted of the following: 1) a tooth with only its occlusal surface visible in the oral cavity, with no visible mesial marginal ridge; 2) a tooth with its occlusal surface visible in the oral cavity and with a definite distal inclination in the tooth axis of the deciduous second molar of the affected side.<sup>2</sup> A checklist was completed for children with EE in school, consisting of data on gender, the affected jaw, unilateral or bilateral nature of the problem, and the presence or absence of cleft lip and/or palate. The following formula was used to calculate the samples' size by considering the minimum prevalence rate of 1.6% for EE of PFM and by considering  $\alpha = 0.05$ ,  $d = 0.01$ ,  $Z = 1.96$ , and  $P = 0.05$ .

$$n = \frac{Z^2_{(1-\alpha/2)} P(1-P)}{d^2}$$

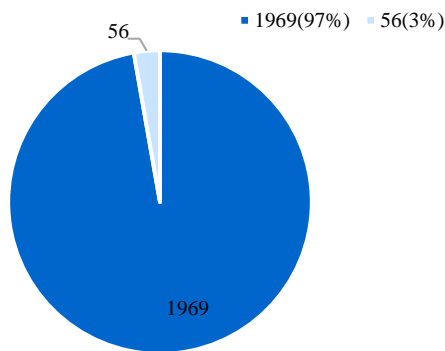
The protocol of the study was approved by the Ethics Committee of Kerman University of Medical Sciences under the code IR.KMU.REC.1394.733 after gaining permission from the Kerman Education Organization.

## Results

A total of 2025 children aged 6-9 years underwent dental examinations for the evaluation of EE of PFM. To achieve the aims of the study, data were analyzed with descriptive statistics at a confidence interval (CI) of 95%. Chi-squared test and logistic regression analysis were used to compare variables such as gender, age, cleft lip and palate, jaw type, the unilateral or bilateral nature of the problem, and growth parameters (height and weight) between the control and case groups.

The subjects had a mean age of 7.17 years, with a mean height of 124.33 cm and a mean weight of 24.59 kg. A total of 1248 subjects (61.6%) were male and 777 (38.4%) were female.

Based on figure 1, 56 subjects (2.8%) of all the children evaluated exhibited EE of PFM.



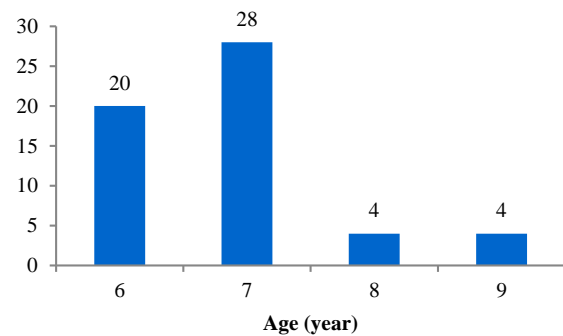
**Figure 1.** Children' frequencies (percent) in terms of ectopic eruption (EE) of permanent first molar (PFM)

The results of the present study showed a higher rate of EE of PFM in children with a lower mean age, with a significant relationship between the mean age and EE ( $P = 0.001$ ). In addition, there was a significant relationship between EE in any age group and growth parameters (height and weight) in the subjects ( $P = 0.001$ ).

Based on data presented in table 1, in children with lower mean weight and height, there was a higher rate of EE.

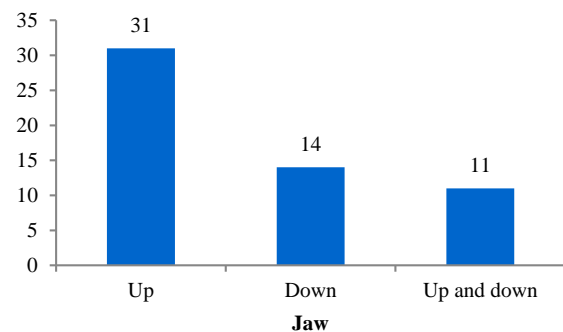
In this study, the frequency was higher in boys compared to girls but the difference was not significant ( $P = 0.673$ ).

Figure 2 shows the frequencies of children with EE of PFMs in terms of age. The frequency was higher in 6 and 7 years old.



**Figure 2.** Frequencies of children with ectopic eruption (EE) of permanent first molar (PFM) in terms of age

Figure 3 presents the frequencies of children with EE of PFM in terms of jaw type. Of 56 children with EE, 31 cases were in the upper jaw and 14 were in the lower jaw, with 11 in both jaws.



**Figure 3.** Frequencies of children with ectopic eruption (EE) of permanent first molar (PFM) in terms of jaw type

In the present study, of 56 children with EE, 39 cases were unilateral and 17 were bilateral; however, the difference was not significant, and of 56 children with EE, 3 had cleft lip and/or palate, and the relationship was not significant.

**Table 1.** Comparison of age and growth parameters (height and weight) in both control (without ectopic eruption of permanent first molar) and target (with ectopic eruption of permanent first molar) groups

Variable	EE	n	Mean $\pm$ SD	P	SE
Age	Yes	56	6.8571 $\pm$ 0.8405	0.0001	0.11232
	No	1969	7.6369 $\pm$ 1.0210	0.0001	0.02301
Height	Yes	56	119.8554 $\pm$ 14.2334	0.0001	1.90202
	No	1969	124.4664 $\pm$ 7.3860	0.0190	0.16645
Weight	Yes	56	21.7866 $\pm$ 4.4343	0.0001	0.59255
	No	1969	24.6760 $\pm$ 5.6647	0.0001	0.12766

SD: Standard deviation; SE: Standard error; EE: Ectopic eruption



## Discussion

In the present study, 2025 children who were 6-9 years old, which is the normal period for the eruption of PFM,<sup>7</sup> underwent clinical examinations for the evaluation of EE of PFM. The prevalence of EE in the study population was 2.8%. The reported prevalence of EE of the first PFM varies from 1.8% to 6.0% in normal population.<sup>8</sup> Minor difference between the values might be attributed to sample sizes, the age of the children evaluated, and differences in study populations. The prevalence of eruption disturbances was higher than reported earlier, and, even if the disturbances do not occur frequently, it is important to develop an early diagnosis in order to start the treatment at the optimal time.<sup>9</sup> It was shown in the present study that EE was more prevalent in children with a lower mean age. Although no similar study was found in order to explain the relationship between EE of PFMs and lower mean age in the present study, it might be pointed out that EE of molars is common during the early mixed dentition period;<sup>7</sup> and the majority of these cases are reversible and are spontaneously corrected before 7 years of age.<sup>10</sup> Therefore, such cases are seen at younger ages rather than at older ages, as confirmed in the present study.

It was shown in the present study that EE of PFMs was more prevalent in children with lower growth parameters (lower means of height and weight). A large number of studies have shown a relationship between the dental system and different variables of growth and development. Physical parameters such as weight, height, skeletal maturation, and tooth development are biometric tests that are considered as standard health parameters in large communities. Height and weight are the physical manifestations of growth and development that have the highest use in diagnostic procedures.<sup>11</sup> Kutesa et al. evaluated the relationship between the time of the eruption of permanent teeth and height

and weight in 4 to 15-year-old children and adolescents in Uganda and concluded that there was no significant relationship between them.<sup>12</sup> In many cases, however, the etiology of EE cannot be identified.<sup>13</sup> EE might be an indication of a discrepancy in the individual's growth and development due to congenital problems or environmental interferences.<sup>1</sup> Of all the numerous studies that have evaluated growth parameters, there was no similar study to show a significant relationship between a low growth parameters and EE; however, the present study showed that although the main reason for EE is still unknown,<sup>2</sup> the growth parameters (weight and height) might be a factor effective in EE.

In the present study, the relationship between EE and gender was not statistically significant. Yaseen et al. reported that boys exhibited EE at a higher rate compared to girls.<sup>1</sup> In studies by Barberia-Leache et al.<sup>3</sup> and da Silva Filho et al.,<sup>14</sup> also, there was no significant relationship between gender and EE. Therefore, despite the absence of a significant relationship between gender and EE in children, this developmental anomaly is more common in boys compared to girls, which might be attributed to the higher possibility of spontaneous correction in girls compared to boys.<sup>1</sup>

In the present study, the relationship between EE and upper or lower jaw was not statistically significant. Other studies also have reported a higher rate of EE in the upper jaw.<sup>2,15</sup> In a study by Afshar et al., the difference was statistically significant.<sup>15</sup> Therefore, despite the absence of a significant relationship between the jaw type and EE, this anomaly in the present study was more prevalent in the upper jaw compared to the lower jaw, consistent with other studies.

The most frequent tooth to exhibit EE is the maxillary PFM, with Moyers<sup>17</sup> reporting a prevalence rate of 10.3% for this anomaly in American children. Cheyne and Wessels<sup>18</sup> reported that of every 50 children, one exhibits the EE of maxillary PFM.

In the present study, of 56 children with

EE, 39 exhibited it unilaterally and 17 exhibited it bilaterally. Although unilateral EE of PFM was more frequent than bilateral EE, the difference was not statistically significant. Moreover, In the study by Barberia-Leache et al., 36.4% of the cases were bilateral and 63.6% were unilateral.<sup>3</sup> However, in the study by Afshar et al., bilateral EE was more frequent than unilateral cases, with a statistically significant difference.<sup>15</sup> Bilateral EE in boys increases the odds of tooth impaction and is an indication of irreversible EE, which requires early intervention for treatment.<sup>2</sup>

However, more than half of the cases of EE of PFMs are corrected spontaneously in a few months.<sup>16</sup> Therefore, it might be guessed that the majority of cases are unilateral, and in the present study, also, unilateral cases were twice as frequent as bilateral cases, indicating that they are normal in many cases and do not require therapeutic intervention.

In the present study, the relationship between EE and cleft lip and/or palate was not statistically significant. Bjerklin et al. reported a prevalence rate of 25% for EE in

children with cleft lip and/or palate,<sup>16</sup> with Bjerklin et al.<sup>16</sup> and da Silva Filho et al.<sup>14</sup> reporting prevalence rates of 21.8% and 20.0%, respectively.

Limitation of this study is that primary diagnosis of EE is carried out with radiography; therefore, the prevalence of EE of PFMs in children in Kerman is higher than that reported in the present study based on clinical observations; moreover, a large number of self-corrected teeth are missed.

### Conclusion

The children in lower means of height and weight are more susceptible to the EE developmental anomaly.

### Conflict of Interests

Authors have no conflict of interest.

### Acknowledgments

The authors would like to thank all the children participating in this study. The authors also thank the teachers who assisted in the collection of data.

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## Onset and duration of 2% lidocaine as inferior alveolar nerve block versus buccal/lingual infiltration of 4% articaine in mandibular second molars: Clinical trial study

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Bahareh Nazari DDS<sup>3</sup>, Shadi Mirzaei DDS<sup>3</sup>, Sohrab Tour-Savadkouhi DDS, MSc<sup>1</sup>

### Original Article

#### Abstract

**BACKGROUND AND AIM:** The effectiveness of buccal or lingual (B/L) infiltration of 4% articaine as supplemental injection for pulp anesthesia of mandibular teeth was confirmed in previous studies. However, this study was aimed to compare the effectiveness of 2% lidocaine as inferior alveolar nerve block (IANB) versus B/L infiltration of 4% articaine for pulp anesthesia, as primary injection in mandibular second molars.

**METHODS:** Thirty adult volunteers ranging from 18 to 40 years old with no systemic disease or medicine intake were included in this split-mouth, double-blind, randomized clinical trial study. Each mandibular side of included subjects was allocated randomly to control group (IANB using 2% lidocaine and 1/80000 epinephrine using direct technique) and B/L infiltration group using 4% articaine (Septanest; Septodont, Saint-Maur-des-Fosses, France). After obtaining base line sensitivity, electric pulp testing (EPT) was done at 5, 8, 11, 15, 20, 25, 30, 45, 60, 75, and 90 minutes post injections. The data were analyzed using chi-square test.

**RESULTS:** The success rate of anesthesia for IANB group was 83.3% (25 of 30 subjects) and 30% (9 of 30 subjects) for B/L infiltration group, and the difference between the groups was statistically significant ( $P = 0.0005$ ). The mean onset time of pulp anesthesia for IANB group was  $22.6 \pm 30.9$  minutes and  $65.5 \pm 38.0$  for B/L infiltration group, and the difference between the groups was statistically significant ( $P = 0.0001$ ). The mean duration time of pulp anesthesia for IANB group was  $53.0 \pm 27.4$  minutes and  $10.6 \pm 17.2$  for B/L infiltration group, and the difference between the groups was statistically significant ( $P = 0.0001$ ).

**CONCLUSION:** The results indicated that IANB using 2% lidocaine was more successful than B/L infiltration of 4% articaine in onset and duration of pulp anesthesia of mandibular second molars as primary injections.

**KEYWORDS:** Articaine; Lidocaine; Local Anesthesia; Molar; Inferior Alveolar Nerve; Volunteers

**Citation:** Esnaashari E, Bakhtiar H, Nazari B, Mirzaei S, Tour-Savadkouhi S. Onset and duration of 2% lidocaine as inferior alveolar nerve block versus buccal/lingual infiltration of 4% articaine in mandibular second molars: Clinical trial study. *J Oral Health Oral Epidemiol* 2018; 7(3): 113-7.

Predictable anesthesia has an essential role in successful endodontic treatment, and failing to reach this point causes patient miss management. A range of local anesthetic drugs and techniques have been used which lidocaine is the most popular of them, and after a long time articaine was introduced in the United States of America.<sup>1</sup> The inferior

alveolar nerve block (IANB) is the technique of choice for pulpal anesthesia of mandibular teeth. However, the technique is not always successful, and failure rates of 7% to 75% have been reported.<sup>2-4</sup> Therefore, alternatives to this technique were studied in several studies, such as intra ligament, intra osseous, mylohyoid, and infiltration injections.<sup>5-8</sup>

Articaine is an amide local anesthesia

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including a thiophene ring, benzene ring, and ester linkage.<sup>1</sup> High lipophilic properties of this solution has made it suitable for infiltration techniques in maxillary and mandibular teeth.<sup>9-11</sup>

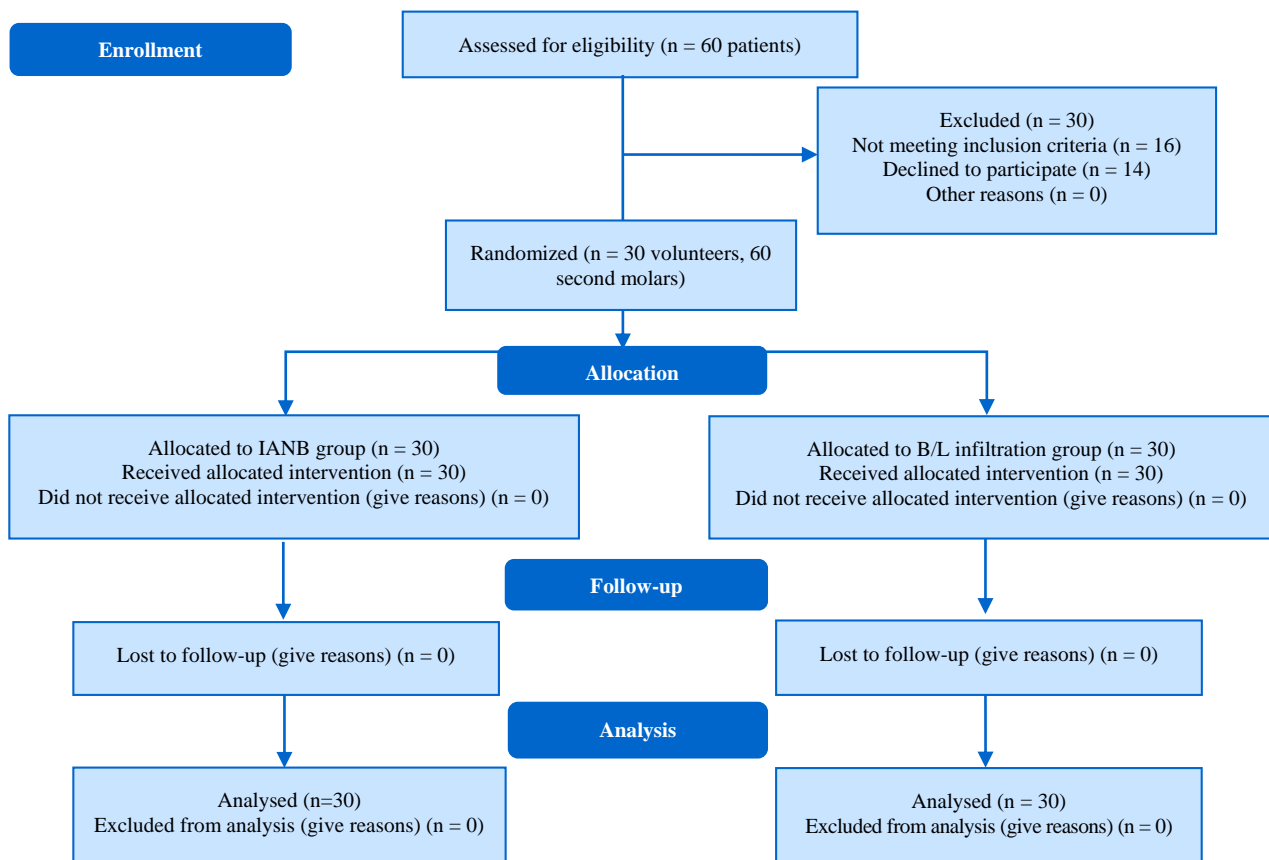
Several studies have shown the effectiveness of buccal or lingual (B/L) infiltration of 4% articaine as supplemental injection for pulp anesthesia of mandibular teeth.<sup>9,11</sup> Some studies showed anesthetic effect of B infiltration (BI) of 4% articaine as primary injection on mandibular first molar;<sup>4,12</sup> however, no one showed its effectiveness as primary injection compared to IANB for pulp anesthesia of second molar.

This study was aimed to compare the effectiveness of 2% lidocaine with 1/80000 epinephrine as IANB versus B/L infiltration of 4% articaine with 1/100000 epinephrine in mandibular second molar pulp anesthesia.

40 years old with no contributing systemic disease or medicine intake, with at least one intact second mandibular molar were included in this split-mouth, double-blind, randomized clinical trial study in Endodontic Department, Dental Branch, Islamic Azad University, Tehran, Iran, from 2015 to 2016 (Figure 1). Exclusion criteria were volunteers younger than 18 or older than 40 years old, allergies to local anesthetics or intolerance of vasoconstrictors, pregnancy, and inability to give informed consent. Sample size was determined based on the results of an initial pilot study on five patients at  $\alpha = 0.05$  and a study power of 80%. The Ethics Committee of Islamic Azad University of Tehran approved the study (IR.IAU.DENTAL.REC.1395.19), and informed consent was signed by each volunteer. The proposal of this study was reviewed, confirmed, and recorded in Iranian Registry of Clinical Trials (IRCT) (code No: IRCT2017021523620N7).

## Methods

Thirty adult volunteers ranging from 18 to



**Figure 1.** Consort flow diagram  
IANB: Inferior alveolar nerve block; B/L: Buccal/lingual



Each mandibular side of included subjects was randomly (coin flipping method by the patients) allocated to control group (IANB using 2% lidocaine and 1/80000 epinephrine 1.8 ml using direct technique) and the group of B/L infiltration of 4% articaine (Septanest, Septodont, Saint-Maur-des-Fosses, France) using half the solution (0.9 ml) at B and the other half (0.9 ml) at L vestibule just close to the target tooth (second molar). The injections were done in separate sessions by one-week intervals. All the injections were done after negative aspiration at rate of 1 ml/min by one blinded skilled operator; the injections for each volunteer were done by one-week interval.

One of the intact maxillary canines was considered as the control for the pulp tester set up. Base line sensitivity of subjected teeth was determined using electric pulp tester (EPT) (Gentle-Pulse vitality tester; Parkell Inc., Farmingdale, N.Y.) before any injection by blinded trained personnel.

Toothpaste was used as contact media on coronal third of B surface of the crown, and the EPT tip was placed over that. The power was increased incrementally from 1 to 10, until the patient became aware of the electric stimuli. During the EPT test of the teeth, a well-sealed rubber dam was placed over the target tooth (mandibular second molar) to avoid false positive responses due to close contact with neighboring teeth. The pulp testing repeated at 5, 8, 11, 15, 20, 25, 30, 45, 60, 75, and 90 minutes' post injections.<sup>4</sup>

Success in obtaining the pulp anesthesia was considered as at least two subsequent negative responses to EPT in maximum degree. When the pulp anesthesia in subjects was not achieved, the onset was considered

as the maximum follow up time (90 minutes) and the duration as 0.

Comparisons between IANB and B/L infiltration groups for anesthetic success, and onset and duration of pulpal anesthesia were analyzed using chi-square test by SPSS software (version 17, SPSS Inc., Chicago, IL, USA).

## Results

All the thirty volunteers (60 subjects which 30 received IANB on one side and 30 received B/L infiltration on the other side) subjected for comparison of success, onset, and duration of pulp anesthesia of mandibular second molars (60% male and 40% female, with mean age of  $26.8 \pm 1.4$ ).

The success rate of anesthesia for IANB group was 83.3% (25 of 30 subjects) and 30% (9 of 30 subjects) for B/L infiltration group, and the difference between the groups was statistically significant ( $P = 0.0005$ ) (Table 1).

The mean onset time of pulp anesthesia for IANB group was  $22.6 \pm 30.9$  minutes and  $65.5 \pm 38.0$  minutes for B/L infiltration group, and the difference between the groups was statistically significant ( $P = 0.0001$ ) (Figure 2).

The mean duration time of pulp anesthesia for IANB group was  $53.0 \pm 27.4$  minutes and  $10.6 \pm 17.2$  for B/L infiltration group, and the difference between the groups was statistically significant ( $P = 0.0001$ ) (Figure 2).

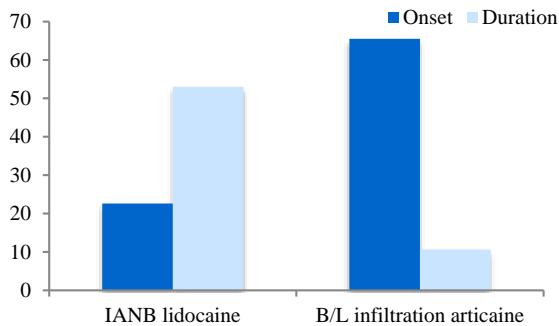
## Discussion

The result of this clinical trial study showed that IANB is advantageous over B/L infiltration of articaine as primary injection in success rate, onset, and duration of pulp anesthesia of mandibular second molars.

**Table 1.** The success, onset, and duration of pulp anesthesia of mandibular second molar in inferior alveolar nerve block (IANB) and buccal/lingual (B/L) infiltration groups

Groups	Indexes	Success [n (%)]	Failure [n (%)]	Onset (minute) (mean $\pm$ SD)	Duration (minute) (mean $\pm$ SD)
IANB group (n = 30)		25 (83.3)	5 (16.7)	$22.6 \pm 30.9$	$53.0 \pm 27.4$
B/L infiltration group (n = 30)		9 (30.0)	21 (70.0)	$65.5 \pm 38.0$	$10.6 \pm 17.2$
P		0.0005	0.0005	0.0001	0.0001

SD: Standard deviation; IANB: Inferior alveolar nerve block; B/L: Buccal/lingual



**Figure 2.** Comparing onset and duration of pulp anesthesia of second mandibular molar in inferior alveolar nerve block (IANB) and buccal/lingual (B/L) infiltration groups

Although some studies did not show any significant difference between articaine and lidocaine solutions in obtaining pulp anesthesia of mandibular molars,<sup>13,14</sup> recent studies found that articaine was remarkably better than lidocaine in pulpal anesthesia of mandibular molars after B/L infiltration.<sup>11,15,16</sup> For that reason, we analyzed pulpal anesthesia using articaine B/L infiltration for mandibular second molar teeth.

The suspected mechanism of articaine is its better bone-penetration efficacy. Articaine contains a thiophene and benzene ring, which makes the solution to penetrate better through natural barriers.<sup>17</sup> This phenomenon makes the solution suitable for infiltration injections, especially for mandibular molars with thick cortical in both B/L sides.

In a clinical trial study by Jung et al. on mandibular first molar anesthesia after IANB or BI of 4% articaine, they concluded that BI group had faster and more predictable pulp anesthesia at 5 and 8 minutes post injection, and the total success rate was close to IANB group.<sup>4</sup> The result was totally against our study, and this difference can be explained by the fact that in our study we analyzed pulp anesthesia of second mandibular molars instead of first mandibular molar, which has thicker B cortical bone. Moreover, we used half the articaine solution at B and half at L vestibule, same as Corbett et al.<sup>12</sup> and Foster et al.,<sup>9</sup> which had used the same technique for obtaining pulp anesthesia of mandibular molars.

In the previous studies, the B/L infiltration of articaine for local anesthesia of mandibular molars was studied as primary or supplementary anesthesia.<sup>10-12,15,18,19</sup> Most of the studies found B/L infiltration of 4% articaine as an effective technique for pulp anesthesia of mandibular first molars as primary local anesthesia, but the effect was more manifest for B instead of L or B/L injections.<sup>12</sup> However, we found B/L infiltration of articaine as an ineffective technique for pulp anesthesia of mandibular second molars. The success rate of pulp anesthesia of mandibular second molar for this technique was only 30%, which was close to Aggarwal et al. study; however, they had irreversible pulpitis cases, and their pain assessment was during access cavity preparation and root canal instrumentation instead of normal pulp cases and EPT sensibility test in this study.<sup>20</sup> The higher success rate of IANB using 2% lidocaine in this study compared to other studies can be explained by using normal healthy dental pulps instead of teeth with irreversible pulpitis subjected to other studies.<sup>19,21</sup>

One of the main concerns, when using articaine as local anesthesia especially in mandibular nerve block, is the paresthesia as an important side effect.<sup>22</sup> In a comprehensive review study on articaine as local anesthesia by Kakroudi et al., it was concluded that the solution appears safe and the adverse effects are very rare.<sup>23</sup> One of the main limitations of this study was non-inflamed and normal pulp of subjects for maximum unification, while most of the anesthetic failures suspected in inflamed pulp conditions.

### Conclusion

It seems that IANB using 2% lidocaine was more effective than B/L infiltration of 4% articaine in success, onset, and duration of pulp anesthesia of mandibular second molars as primary injections.

### Conflict of Interests

Authors have no conflict of interest.



## Acknowledgments

The authors acknowledge generous support

by research committee of Dental school, Islamic Azad University, Tehran, Iran.

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## The caries pattern of primary teeth and its determinants among 5-7-year-old children in Tehran, Iran

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### Original Article

#### Abstract

**BACKGROUND AND AIM:** Dental caries is one of the most common chronic diseases in children that affects oral health, general health, and quality of life; and often leads to pain and discomfort when left untreated. This study aimed to evaluate the severity and location of dental caries based on background determinants, nutritional status, oral health behaviors, and fluoride therapy status in the primary teeth of children aged 5-7 years old in Tehran, Iran.

**METHODS:** This descriptive-analytical cross-sectional study was performed on 572 children. Data were collected by two calibrated dentists by a questionnaire in 4 parts: demographic information, medical history, nutritional status, and oral health behaviors. The severity and location (surfaces) of dental caries were recorded for canine, primary first and second molar teeth according to the World Health Organization (WHO) criteria. Data were analyzed with backward linear regression analyses.

**RESULTS:** The mean of decayed, missing, filled teeth (DMFT) was 4.9 for all examined teeth. Dental caries was more prevalent in boys [odds ratio (OR) = 1.83, 95% confidence interval (CI): 0.81-2.80], those who had dental visits due to dental problems with pain (OR = 1.17, 95% CI: 0.73-1.60), and those who did not receive fluoride therapy (OR = 1.64, 95% CI: 0.58-2.60). The mandibular jaw had a higher frequency of carious surfaces. Proximal caries was about 0.47 times higher in non-affluent versus affluent areas (95% CI: 0.06-0.90). Buccolingual caries was 0.25 times more prevalent in boys than girls (95% CI: 0.04-0.50), and occlusal caries was 0.5 times more frequent in children with irregular fluoride therapy than those with regular one (95% CI: 0.06-0.90).

**CONCLUSION:** Gender, mother's level of education, type of snack consumption, age when the child started tooth brushing, fluoride therapy, and reason for dental visit affected the severity of dental caries.

**KEYWORDS:** Dental Caries; Children; Risk Factors; Diet; Oral Hygiene; Decayed, Missing, Filled Index

**Citation:** Khazaei P, Hamedani-Golshan M, Hessari H. **The caries pattern of primary teeth and its determinants among 5-7-year-old children in Tehran, Iran.** *J Oral Health Oral Epidemiol* 2018; 7(3): 118-25.

Dental caries is one of the most common chronic diseases in children and adolescents, and imposes an enormous cost on the societies. Globally, 60%-90% of children and almost all adults have experienced dental caries, usually leading to pain and discomfort.<sup>1</sup> Dental caries in childhood affects oral health, general health, and quality of life, and often leads to pain and discomfort when left untreated.<sup>2</sup>

Dental caries may cause several problems such as toothache, decreased chewing ability,

sleep disorders, stress, anxiety, and lack of concentration in children. This may consequently result in restricted food choices, loss of appetite and eating satisfaction, weight loss, delayed development, absence from school, being ashamed to smile, and stopping playing with other children.<sup>3,4</sup>

Dental caries is affected by several factors including the parents' socioeconomic status, oral hygiene status, food type, consumption of sugary snacks, frequency of dental visits, and fluoride therapy.<sup>5</sup> The progression of dental caries can be prevented by detecting it in

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early stages or identifying aggravating factors.

The most common indices for evaluating dental caries are decayed, missing, filled teeth (DMFT) and decayed, missing, filled surfaces (DMFS). The mean DMFT of Iranian children aged 5-6 years was about 5 in 2012, and the corresponding value was about 2.32 for children aged 3-7 years in Tehran, Iran, in 2014.<sup>6</sup> To the best of our knowledge, there are only few updated studies on the DMFS index in Tehran.

The present study aimed to evaluate the severity and location of dental caries according to the background determinants, nutritional status, oral health behaviors, and fluoride therapy status in primary teeth among 5- to 7-year-old children in Tehran. The findings help to identify high-risk patients and tooth surfaces most prone to dental caries.

## Methods

There are more than 12 million inhabitants in Tehran, and the total number of 5-7-year-old children is about 270000 according to statistical center of Iran.<sup>7</sup> The present cross-sectional study was carried out on students aged 5-7 years old in public schools of Tehran (over 90% of children in Tehran) between January and March 2016.

To have a representative random sample, the city was divided into two affluent (districts 1 to 8) and non-affluent (districts 9 to 19) parts based on a previous study.<sup>8</sup> Three districts in each part, i.e. 6 out of 19 administrative districts of Ministry of Education, were selected randomly. In each selected district, one girls' and one boys' school was chosen, and in each school, preschool and grade one students were selected. The total sample size was 572 children aged 5-7 years old (response rate = 99%).

The present study was approved by the Ethics Committee of Tehran University of Medical Sciences according to a written permission (letter number: IR.TUMS.REC.1394.1730 dated 24 January 2016). Participation was voluntary, and

informed consent was obtained from the participants' parents or legal guardians.

To calibrate the two examiners, a pilot study was carried out on 25 girls (5-7 years old), in one public school prior to data collection (kappa value = 0.9). The self-administered questionnaire was completed by parents to collect the data about some common risk factors for dental caries based on World Health Organization (WHO) recommendations.<sup>9</sup>

The questionnaire had 4 parts: demographic information, medical history, nutritional status (snack consumption), and oral health behaviors.

Demographic information included the child's age (5, 6, and 7 years old), child's sex, mothers' level of education (4 levels: high school diploma or less, technician, bachelor's degree, and doctorate degree).

Nutritional status was reported by type of snack and frequency of consumption. There were 4 types of snacks: sugary snacks, fruits and vegetables, nuts, and dairy products. It was multi-optional, and was then categorized as protective, neutral, and cariogenic nutrients or snacks. According to the results of an expert panel, the cariogenic potential of the nutrients was scored as follows: sweets = +2, fruits and vegetables = +1, nuts = 0, and dairy = -2. The multi-optional answers were calculated and divided into 6 groups accordingly:

-2 = dairy, nuts + dairy

-1 = fruits and vegetables + dairy, fruits and vegetable + nuts + dairy

0 = nuts, sugary snacks + dairy, sugary snacks + nuts + dairy

1 = fruits and vegetables, fruits and vegetables + nuts, sugary snacks + fruits and vegetables + dairy, fruits and vegetables + sugary snacks + nuts + dairy

2 = sugary snacks, sugary snacks + nuts

3 = sugary snacks + fruits and vegetables, sugary snacks + fruits and vegetables + nuts

The consumption frequency was categorized into four groups of never, 1-2 times, 3 times, and more than 3 times per day.

Oral health behaviors were evaluated by the age when the child started to brush his/her teeth (1-7 years), frequency of tooth brushing and flossing (never, 1-2 times, 3 times, and more than 3 times per day), dental visits in the past year (yes/no), and fluoride therapy status.

The reasons for dental visits were recorded and then categorized in four groups from the best to the worst: 1 = periodic examinations, 2 = no dental visit, 3 = dental problems without pain, 4 = dental problems with pain.

Fluoride therapy and its regularity were reported as yes or no.

Children were clinically examined using examination gloves, WHO probe, dental mirror, and headlamp on a comfortable chair during school hours based on the WHO criteria.

The incisor teeth are usually in the transitional phase in children aged 5-7 years, and the first permanent molars are not completely erupted. Therefore, the dental status was recorded for only canine, primary first and second molar teeth in both jaws. The oral health status was described by DMFT and DMFS indices. DMFS was recorded for five surfaces, including the mesial, distal, buccal, lingual, and occlusal, and then categorized into three groups of proximal, buccolingual, and occlusal surfaces.

The severity of dental caries was defined by the number of decayed surfaces, ranging from 1 to 5 surfaces for primary first and second molar teeth and 1 to 4 surfaces for the canine tooth.

Data were analyzed with backward linear regression analysis using SPSS software (version 20, IBM Corporation, Armonk, NY, USA).<sup>10</sup> The associations were assessed and reported by both odds ratio (OR) and 95% confidence interval (CI) as well as beta statistic (P-value). Differences with a P-value < 0.05 were considered statistically significant.

## Results

Totally, 572 children aged 5-7 years old were

examined, of whom 52% were girls and 50% were 6 years old. The mothers' level of education was high school diploma or less in 51% of all subjects. As for the nutrition status, consumption of fruits and vegetables was reported by 68%, and snack consumption 1-2 times per day was mentioned by 83% of the subjects (Table 1).

Among all subjects, 41% reported starting tooth brushing at the age of 2 or 3 years old, 75% of subjects brushed once a day, and 78% visited a dentist last year of whom 32% reported dental problems with pain as the reason for the dental visit (Table 2). The parents of 41% of the subjects reported their children experienced fluoride therapy, but 28% of them did not do it on a regular basis.

The mean DMFT of all subjects was 4.9 for all canines, primary first and second molars. Decayed teeth (DT), missing teeth (MT), and filled teeth (FT) comprised 72%, 5%, and 23% of DMFT, respectively. Assessment of the severity of dental caries according to the number of decayed surfaces showed generally higher figures in the upper jaw. The canine teeth had the lowest and the primary second molars had the highest mean severity (mean number of DMFS) in both jaws. Moreover, the primary maxillary first molars demonstrated the highest and primary mandibular canine teeth demonstrated the lowest frequency of dental caries.

The severity of dental caries was higher ( $P < 0.001$ ) among children residing in non-affluent districts [decayed surfaces = 7.9, standard deviation (SD) = 6.7] as compared with affluent districts (decayed surfaces = 5.9, SD = 6.5). According to the results of linear regression analysis (Table 3), the severity of dental caries decreased by 0.09 tooth surface for each level of increase in maternal education ( $P = 0.010$ ), and increased by 0.15 for each unit of increase in start age of tooth brushing ( $P < 0.001$ ).

The mandibular jaw had the highest frequency of carious surfaces (proximal,

**Table 1.** Background information, nutritional status, and total caries severity of children aged 5-7 years (n = 572)

Variable	n (%)	Total caries severity (mean ± SD)	
Background information			
Living area			
Affluent (districts 1-8)	290 (50.7)	5.88 ± 6.53	
Non-affluent (districts 9-19)	282 (49.3)	7.94 ± 6.66	
Child's sex			
Girls	300 (52.4)	5.78 ± 5.48	
Boys	272 (47.6)	8.13 ± 7.60	
Child's age (year)			
5	128 (22.4)	7.45 ± 7.03	
6	287 (50.2)	6.45 ± 6.42	
7	157 (27.4)	7.26 ± 6.82	
Mother's level of education			
Diploma or less	289 (50.5)	8.18 ± 7.00	
Technician	70 (12.2)	6.27 ± 5.47	
Bachelor's degree	209 (36.5)	5.44 ± 6.26	
Doctorate degree	4 (0.7)	1.25 ± 1.50	
Nutrition status			
Snacks type			
Protective	-2	59 (10.3)	5.83 ± 6.48
	-1	106 (18.5)	6.46 ± 6.34
Neutral	0	61 (10.7)	6.59 ± 6.71
Cariogenic	1	246 (43.0)	6.59 ± 6.51
	2	64 (11.2)	8.69 ± 6.63
	3	36 (6.3)	9.33 ± 8.22
Consumption frequency			
Never	0 (0)	0 ± 0	
1-2 times	475 (83.0)	6.89 ± 6.54	
3 times	67 (11.7)	6.91 ± 7.18	
More than 3 times	30 (5.3)	6.90 ± 7.73	

SD: Standard deviation

buccolingual, occlusal) in all teeth. Figure 1 shows the prevalence of DMFS according to tooth surface and name for both jaws. The highest percentage of caries was found in the proximal surface of primary first molars and the lowest was seen in the incisal surface of canine teeth. Among 12 examined teeth, the primary mandibular left first molars demonstrated the highest and the primary mandibular right canine teeth demonstrated the lowest frequency of carious surfaces.

According to the results of linear regression analysis (Table 4), proximal caries was 0.47 times more prevalent in non-affluent versus affluent areas (95% CI: 0.06-0.90), and 0.5 times more prevalent in boys than girls (95%

CI: 0.09-0.90). Proximal caries increased by 0.19 unit for each one-year increase in start age of brushing ( $P < 0.001$ ).

Table 4 shows that buccolingual caries was 0.25 times more prevalent in boys than girls (95% CI: 0.04-0.50), and subjects without fluoride therapy had 0.27 times more buccolingual dental caries than those with fluoride therapy (95% CI: 0.05-0.50).

According to table 4, occlusal caries was 0.63 times more prevalent in boys than girls (95% CI: 0.34-0.90), and 0.5 times more prevalent in those with irregular fluoride therapy than those with regular fluoride therapy (95% CI: 0.06-0.90). Occlusal caries increased by 0.11 unit for each level of dental visit status ( $P = 0.010$ ).



**Table 2.** Mean number of decayed, missing and filled surfaces (DMFS) of canine, primary first and second molar teeth according to oral health behaviors among children aged 5-7 years (n = 572)

Variable	n (%)	Total caries severity (mean ± SD)
Start age of tooth brushing (year)		
1-3	320 (56.0)	5.53 ± 5.90
4-7	252 (44.0)	8.57 ± 7.2
Frequency of tooth brushing (per day)		
Never	21 (3.7)	6.90 ± 8.52
Once	426 (74.5)	6.85 ± 6.45
Twice	115 (20.1)	7.30 ± 7.12
More than twice	10 (1.7)	4.40 ± 6.80
Frequency of dental flossing (per day)		
Never	445 (77.8)	7.27 ± 6.92
Once	113 (19.8)	5.92 ± 5.74
Twice	9 (1.6)	3.00 ± 2.29
More than twice	5 (0.9)	2.60 ± 2.60
Dental visit during past year		
Yes	444 (77.6)	6.63 ± 6.43
No	128 (22.4)	7.83 ± 7.41
Reason for dental visit		
Periodic check-up	136 (23.8)	3.66 ± 4.52
No visit	128 (22.3)	7.83 ± 7.41
Dental problems without pain	124 (21.7)	7.15 ± 6.73
Dental problems with pain	184 (32.2)	8.47 ± 6.66
Fluoride therapy		
Yes	233 (40.7)	5.64 ± 6.13
No	339 (59.3)	7.76 ± 6.90
Regular fluoride therapy		
Yes	75 (13.1)	4.04 ± 4.58
No	497 (86.9)	7.33 ± 6.83

SD: Standard deviation

## Discussion

We evaluated the severity and location of dental caries in primary teeth in 5- to 7-year-old children in Tehran in 2016.

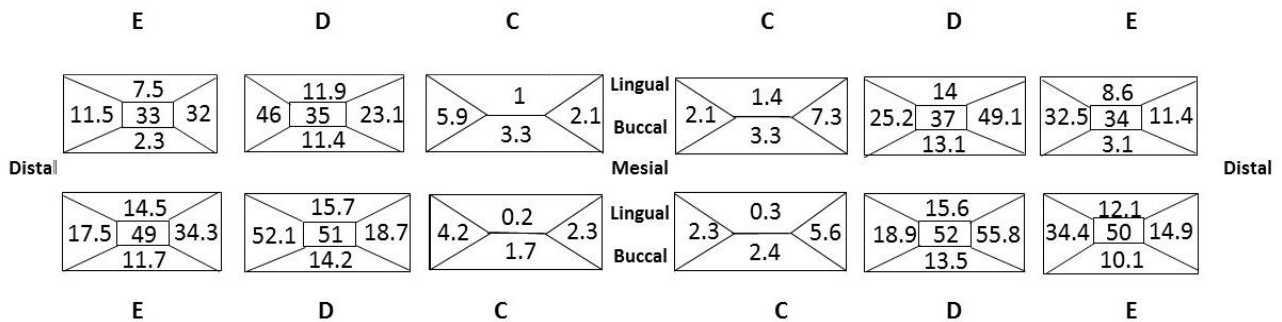
According to the results of this study, several indicators including the child's sex, mother's level of education, type of snack

consumption, the age at which the child started tooth brushing, fluoride therapy, and reason for dental visits affected the severity of dental caries. The school location (district), child's sex, mother's level of education, and oral health behaviors were the potential indicators for the location of dental caries.

**Table 3.** Severity of dental caries in canine, primary first and second molar teeth according to linear regression analysis for children aged 5-7 years (n = 572)

Explanatory variables	Beta	B	CI for B		P
			Minimum	Maximum	
Child's sex (girls to boys)	0.13	1.83	0.81	2.85	< 0.001
Mother's level of education (low to high)	-0.09	-0.69	-1.25	-0.13	0.010
Type of nutrition (protective to cariogenic)	0.09	0.46	0.08	0.83	0.010
Start age of tooth brushing (1 to 7 years)	0.15	0.61	0.29	0.93	< 0.001
Frequency of dental flossing (never to more than twice a day)	-0.06	-0.83	-1.81	0.14	0.090
Reason for dental visit (periodic check-up to dental visit with pain)	0.20	1.17	0.73	1.61	< 0.001
Fluoride therapy (yes to no)	0.12	1.64	0.58	2.69	< 0.001

Excluded factors: child's age, consumption frequency, frequency of tooth brushing, dental visit status, regular fluoride therapy, CI: Confidence interval



**Figure 1.** Prevalence (%) of caries history [decayed, missing, filled surface (DMFS)] according to tooth surface (mesial, distal, buccal, lingual, and occlusal) and name canine, primary first and second molar teeth for both jaws

The subjects of the present study well represented the oral health status and behaviors among schoolchildren in Tehran.

Randomized cluster sampling based on previous studies and very low missing data were the advantages of the present study.

**Table 4.** Results of linear regression analysis showing the role of explanatory variables on the location of dental caries in canine, primary first and second molar teeth for children aged 5-7 years (n = 572)

Tooth surface*	Explanatory variables	Beta	B	CI for B		P
				Minimum	Maximum	
Proximal	District	0.09	0.47	0.06	0.880	0.020
	Child's sex	0.09	0.50	0.09	0.900	0.010
	Start age of tooth brushing	0.19	0.30	0.18	0.430	< 0.001
	Frequency of tooth brushing	0.06	0.32	-0.05	0.710	0.090
	Dental visit status	0.10	0.66	0.15	1.180	0.010
	Reason for dental visit	0.12	0.28	0.09	0.460	< 0.001
	Fluoride therapy	0.10	0.57	0.10	1.030	0.010
	Regular fluoride therapy	0.07	0.59	-0.08	1.260	0.080
	Child's sex	0.09	0.25	0.04	0.460	0.010
Buccolingual	Child's age	0.07	0.13	-0.02	0.290	0.080
	Frequency of dental flossing	-0.12	-0.29	-0.50	-0.090	0.004
	Reason for dental visit	0.14	0.16	0.07	0.240	0.001
	Fluoride therapy	0.10	0.27	0.05	0.500	0.010
	Child's sex	0.16	0.63	0.34	0.920	< 0.001
Occlusal	Mother's level of education	-0.08	-0.16	-0.32	-0.006	0.040
	Type of nutrition	0.06	0.09	-0.01	0.200	0.080
	Start age of tooth brushing	0.10	0.12	0.03	0.210	0.009
	Frequency of tooth brushing	0.08	0.31	0.02	0.600	0.030
	Frequency of dental flossing	-0.09	-0.32	-0.61	-0.030	0.020
	Dental visit status	0.11	0.49	0.12	0.870	0.010
	Reason for dental visit	0.14	0.23	0.10	0.360	0.001
	Regular fluoride therapy	0.09	0.50	0.06	0.950	0.020

\*Dependent variables are mean number of decayed, missing and filled surfaces (DMFS) in each of proximal, buccolingual, and occlusal locations. CI: Confidence interval

Excluded factors for proximal surfaces: child's age, mother's level of education, type of nutrition, consumption frequency, frequency of dental flossing

Excluded factors for buccolingual surfaces: mother's level of education, type of nutrition, consumption frequency, start age of tooth brushing, frequency of tooth brushing, dental visit status, regular fluoride therapy

Excluded factors for occlusal surfaces: child's age, consumption frequency, fluoride therapy

Living area [Affluent (districts 1-8), non-affluent (districts 9-19)]; child's sex (girls, boys); child's age (5 years, 6 years, 7 years); mother's level of education (diploma or less, technician, bachelor's degree, doctorate degree); snacks type (protective, neutral, cariogenic); consumption frequency (never, 1-2 times, 3 times, more than 3 times); start age of tooth brushing (at ages 1-3, at ages 4-7); frequency of tooth brushing (never, 1 time per day, 2 times per day, more than 2 times); frequency of dental flossing (never, once, twice per day, more than twice); dental visit during past year (yes, no); reason for dental visit (periodic check-up, no visit, dental problems without pain, dental problems with pain); fluoride therapy (yes, no); regular fluoride therapy (yes, no).



The results of our study are similar to previous findings in Australia<sup>11</sup> and Iran.<sup>12,13</sup> According to the results of these studies, dental caries is more prevalent among older children who eat more cariogenic foods, brush their teeth less often, do not use dental floss, and have low educated mothers.

Potential determinants of the severity and location of dental caries:

The present study showed that proximal caries was significantly more frequent in non-affluent districts, since they might have less access to oral hygiene facilities as compared with other children. This finding was similar to the result of another study.<sup>14</sup>

Boys showed more dental caries in terms of severity and location, as reported in previous studies.<sup>15,16</sup> More dental caries in boys might be related to more carbohydrate intake and continuity of consumption. However, Lin et al. showed no difference in dental caries between boys and girls in China.<sup>17</sup>

There was no significant relationship between the location and severity of dental caries and the child's age, while some studies reported significant associations.<sup>12,14,18</sup> This difference might be related to the narrow age range in the present study in comparison with other investigations.

The severity of dental caries and the prevalence of occlusal caries decreased with an increase in the maternal educational level as confirmed by earlier studies.<sup>10,17</sup> Educated mothers might be more careful about their children's oral health, because they have more knowledge in this regard.<sup>19</sup>

The severity of dental caries increased with an increase in the level of nutrient cariogenicity. The snack type demonstrated a significant association with the severity of dental caries as confirmed in other studies.<sup>16,20</sup> However, there was no significant association between the snack type and the location of dental caries.

Similar to the results of other studies,<sup>13</sup> we found that the severity and location of dental caries (proximal and occlusal) increased when tooth brushing started with a delay.

In the present study, the frequency of tooth brushing had no or a weak relationship with outcome variables, indicating a biased self-report of the variable or ineffective tooth brushing. This finding reveals the importance of supervised tooth brushing as suggested in another study.<sup>21</sup>

It is usually assumed that dental flossing protects the tooth from proximal caries, while our findings did not confirm it. A systematic review failed to find a relationship between self-performed dental flossing and interproximal caries.<sup>22</sup> The prevalence of dental caries decreased with an increase in the frequency of dental flossing. On the contrary, dental flossing was related with lower odds of occlusal and buccolingual caries, as reported by other studies;<sup>13,22</sup> probably due to the fact that flossing is associated with a better oral hygiene.

In the present study, part of the data was acquired through the self-administrated questionnaire by parents, that is prone to self-report bias. Prior coordination was also necessary to access the subjects in the schools. This was attained after several correspondence and approval of related authorities and committees. The examiners referred to the schools several times to complete the missing data.

### Conclusion

The potential predictors of the severity and location of dental caries were the child's sex, age at which the child started tooth brushing, and the reason for dental visits. Besides these indicators, fluoride therapy and dental visits during the past year had a strong relationship with the location of dental caries.

### Conflict of Interests

Authors have no conflict of interest.

### Acknowledgments

The authors wish to thank the authorities of Tehran General Office of Education, Ministry of Education, who facilitated data collection in primary schools. They are also grateful to

the directors, teachers, students, and their parents for participation in the study.

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## Effect of extraction of permanent first molars on the development and eruption of third molars

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### Original Article

#### Abstract

**BACKGROUND AND AIM:** It is required in many young patients that permanent first molars (PFMs) be extracted due to poor prognosis. This study investigates whether the extraction of such teeth is effective on the development of third molars and even their crown and root morphologies.

**METHODS:** A total of 7000 panoramic radiographs were evaluated and 128 radiographs showing a history of extraction of PFMs on one side in one jaw or both jaws, with the third molars present in the same jaw on both sides, were selected. The third molar on the first molar extraction side was considered the case and the third molar on the other side was considered the control. The case and control third molars were compared in relation to their development, impaction, number of roots, mesiodistal width, root length, and curvature of apex.  $P < 0.05$  was considered significant. Data were analyzed using SPSS software.

**RESULTS:** On 128 panoramic radiographs evaluated, Olze and Demirjian factors showed that in most cases the crown development of the third molars on the control side lagged behind that on the case side. On the control side, the third molars had two roots in 66.9% and on the case side had two roots in 75.8%.

**CONCLUSION:** Extraction of PFMs at a proper time might accelerate the development of the third molars on the same side and affect the morphologies of the crown and root(s) of third molars.

**KEYWORDS:** Extraction; Permanent; Molar

**Citation:** Shojaeipour R, Horri A, Sharifi H, Mohseni S. **Effect of extraction of permanent first molars on the development and eruption of third molars.** J Oral Health Oral Epidemiol 2018; 7(3): 126-31.

Treatment of a permanent first molar (PFM) with a poor long-term prognosis is challenging in terms of the dentist's knowledge and expertise.<sup>1,2</sup> Caries is the most common reason for extraction of such teeth,<sup>3-5</sup> and other reasons include chronological enamel defects,<sup>6,7</sup> unrestorable nature of the tooth, and lack of patient cooperation.<sup>8</sup> One of the conditions for the extraction of PFMs is the presence of the third molar tooth bud on the radiograph on the extraction side.<sup>9</sup> Third molars are the last teeth in the permanent

dentition to erupt and their time of development is very variable. They are the most common teeth to be missing. The impaction of these teeth is very prevalent and is mainly bilateral, and variations in the anatomy of their crowns and roots are not uncommon.<sup>10</sup> Research has shown that extraction of PFMs accelerates the development of third molars.<sup>11</sup> The morphology of the third molar root can be evaluated on radiographs. The anatomy of the root canal and morphology of third molars are very variable, the presence of two

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roots in mandibular third molars is considered a normal anatomy.<sup>12-14</sup> In 80.5% of cases, the root morphologies of the same teeth are similar on both sides of the mandible.<sup>15</sup> The eruption times of teeth in the same class are very similar.<sup>16</sup> Halicioglu et al. evaluated 2925 panoramic radiographs in a retrospective study, belonging to subjects with 13-20 years of age, in order to diagnose cases with at least one PFM having been extracted. A total of 294 eligible radiographs were selected for the evaluation of the developmental stage of third molars. The results showed that the eruption of the third molar on the extraction side accelerated significantly in both the upper and lower jaws.<sup>1</sup> Yavuz et al. evaluated the panoramic radiographs and dental casts of 165 adolescents who had lost the PFM on one side, in order to determine the developmental stage of third molars, reporting that early loss of PFM on one side accelerated the development of the third molar compared to the contralateral side.<sup>2</sup> So far, researches have shown that extraction of PFM can accelerate the eruption of the third molar on the same side. However, the present study evaluates the effect of early loss of PFMs on the development and eruption of third molars. In this context, apart from affecting the eruption time of the third molar on the same side, morphologies of the crown and root of the third molar might be affected.

### Methods

The protocol of the present retrospective descriptive-analytical study was approved by the Ethics Committee of Kerman University of Medical Sciences, Kerman, Iran, (under the code IR.kmu.rec.1394.337). A total of 7000 panoramic radiographs available in an oral and maxillofacial radiology center were evaluated by two pedodontists to select radiographs based on inclusion and exclusion criteria by visualizing the radiographs on a computer monitor. All the radiographs had been taken with a PaX-i x-ray machine (Vatech, South Korea) using the following

exposure conditions: current = 10 mA, time = 10 s, voltage = 68-71 kVp, based on age, gender and frame size of the patients. The radiographs were visualized on a Ben XL2430T LED monitor with a resolution of 1920×1080 pixels in the milieu of Easy Dental software program. A total of 128 eligible radiographs were selected for the evaluation of third molars based on the following criteria:

Radiographs with no distortion and anomalies

Extraction of one PFM in the jaw in which two third molars were present

The following cases were excluded from the study:

No agreement between the two observers to reach a diagnosis

Low-quality radiographs

Presence of a definite lesion on the radiograph

On the radiographs, the third molar on the PFM extraction side was considered to be the case side and the contralateral side in the same jaw was considered as the control side, which was compared for the following criteria:

1. Comparison of the eruption status based on Olze classification<sup>17</sup>

Stage A: The occlusal plane of the tooth is covered with the alveolar bone.

Stage B: Alveolar emergence; complete resorption of the alveolar bone on the occlusal plane

Stage C: Gingival emergence; penetration of at least one tooth cusp into the gingiva

Stage D: Complete observation of the tooth in the occlusal plane

2. Comparison of the developmental stage based on Demirjian method<sup>17</sup>

Stage A: The cusp tips are calcified but are not connected to each other.

Stage B: Calcified cusps are connected to each other and the occlusal surface morphology is clearly visible.

Stage C: Half of the crown has been formed and the pulp chamber is visible.

Stage D: The tooth crown formed up to the pulp chamber is visible.

Stage E: The formation of the root and inter-radicular bifurcation has begun and the root length is less than the crown length.

Stage F: The length of the root is at least the same as the length of the crown and the root end is funnel-shaped.

Stage G: The root walls are parallel but the apex is open.

Stage H: The apex has been closed completely and the periodontal ligament has surrounded the root with a homogeneous width.

3. Comparison of the position (impaction):<sup>18</sup> the presence of hard tissue on the occlusal surface partially or completely was considered impaction and the absence of hard tissue on the occlusal surface was considered absence of impaction.

4. Comparison of the number of roots<sup>18</sup>

5. Comparison of the morphology:<sup>18</sup> the largest mesiodistal widths of the two teeth were measured and compared with the use of SCANORA 4.3.1 software program.

Data were analyzed with McNemar's and Wilcoxon's tests in SPSS software (version 21, IBM Corporation, Armonk, NY).  $P < 0.05$  was considered significant.

## Results

Of 128 eligible radiographs, 78.0% and 21.9% exhibited extraction of PFMs in the mandible and maxilla, respectively. Descriptive analyses were used for qualitative data and estimation of 95% confidence interval (CI).

In the present study, Olze factor was used to compare the development of tooth crowns between the case and control sides. In 75% of cases, the two sides were in stage D of development, and in 25% of cases the developmental stages were different on the two sides; in the majority of cases (30 of 32 cases) the development of the crown of the third molar on the control side lagged behind that on the case side, which was statistically significant ( $P = 0.001$ ) (Figure 1).

Table 1 presents the frequencies of the developmental stages of third molar crowns on the case and control sides in terms of Olze factor.



**Figure 1.** The case and control lower third molars were compared in relation to their development, impaction, number of roots, and the mesiodistal width of crown

Based on Demirjian factor, the differences in the development of third molars were compared between the case and control sides. In 85.2% of cases the developmental stage of the third molars was H on both sides, and in 8.5% of cases (11 of 128 cases), mostly the developmental stage of the third molar on the case side was higher (more developed) than that on the control side, which was statistically significant ( $P = 0.002$ ).

**Table 1.** The frequencies of the developmental stages of third molar crowns on the case and control sides in terms of Olze factor

Control Case	A	B	C	D	Total
A	3	0	0	0	3
B	1	0	0	0	1
C	0	0	1	2	3
D	0	4	23	94	121
Total	4	4	24	96	128

The P-value is significant at the 0.001 level.

Table 2 presents the frequencies of the developmental stages of third molars on the case and control sides in terms of Demirjian factor.

In the present study, of 128 radiographs, in 123 radiographs the impaction status of third molars was the same on both sides, and in the remaining 5 cases it was different; in 80% of these cases (4 out of 5) the third molar on the case side had erupted but it was impacted on the control side. This difference was statistically significant ( $P = 0.001$ ) (Figure 2).



**Table 2.** The frequencies of developmental stages of third molars on the two sides in terms of Demirjian factor

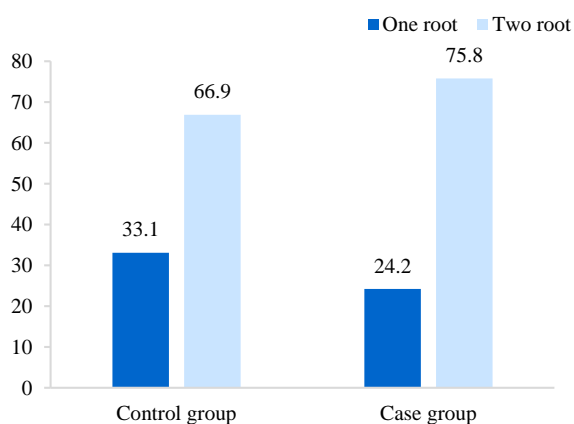
Case	Control	C	D	E	F	G	H	Total
C	2	0	0	0	0	0	0	2
D	0	2	0	0	0	0	0	2
E	0	0	0	1	0	0	0	1
F	0	0	0	0	0	0	0	0
G	0	0	0	0	1	3	0	4
H	0	0	0	0	4	6	109	119
Total	2	2	2	1	5	9	109	128

The P-value is significant at the 0.002 level.



**Figure 2.** The case and control lower third molars were compared in relation to their impaction

In 124 radiographs, the formation of the root(s) of third molars was comparable on both sides. On the control side, the third molars were two-rooted and single-rooted in 66.9% and 33.1% of cases, respectively; however, on the case side, the third molars were two-rooted and single-rooted in 75.8% and 24.2% of cases (Figure 3). This difference was significant statistically ( $P = 0.013$ ).



**Figure 3.** The frequencies of the number of roots in third molars on the case and control sides

Of 128 radiographs evaluated, 15 radiographs (11.7%, 95% CI: 6.7-18.6) exhibited differences in the third molar tooth morphology between the two sides; in 14 out

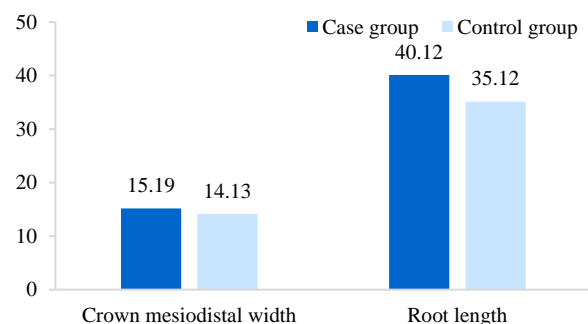
of 15 such cases, the mesiodistal width of the tooth on the case side was larger than the control side.

In 128 radiographs evaluated, 5 cases were excluded from the study due to the absence of root formation; in 40 of the 123 remaining cases (32.5%, 95% CI: 24.4-41.6), there were differences in the root length between the case and control cases, with longer roots in 95 cases (87.5%) and longer roots in 5 cases on the control side (Figure 4).



**Figure 4.** The case and control upper third molars were compared in relation to their root length

Figure 5 presents differences in the mesiodistal width of the crowns and root lengths.



**Figure 5.** Differences (percent) in root lengths and the mesiodistal widths of the crowns between the case and control sides

Of 128 radiographs evaluated, 6 radiographs were excluded from the study due to the absence of root formation or lack of agreement between the two observers on apex curvature. Of 122 remaining cases (29.5%, 95% CI: 21.6-38.4), 36 cases exhibited differences between the case and control sides, with apex curvature in 33 cases on the control side (Figure 6).



**Figure 6.** The case and control lower third molars were compared in relation to their impaction, the root length, and the curvature of the apex

### Discussion

There is limited research available on the effect of extraction of PFMs on acceleration of eruption of third molars on the extraction side compared to the other side of the same jaw. The results showed that the third molars on the case side were more developed than those on the control side. Studies by Halicioglu et al.<sup>1</sup> and Yavuz et al.<sup>2</sup> also confirmed this finding.

In the present study, in 5 radiographs, on the side where the PFM had been extracted the third molar had erupted, and on the other side of the same jaw the third molar was impacted. However, it is possible to follow up the idea that although the eruption times of teeth in the same class are very close to each other,<sup>16</sup> the development and eruption of the third molar, compared to the other side of the jaw, is affected by the extraction of PFMs. Evaluation of radiographs in the present study showed that extraction of PFMs can affect the third molars in relation to their having separate roots irrespective of the separate or fused roots of the third molar on the contralateral side; this is despite the fact that in 80.5% of individuals the morphology

of the roots of the same teeth on the two sides of the same jaw is similar.<sup>15</sup> In the present study, the third molar teeth on the PFM extraction side had larger crowns and longer roots with no curvature in the apex compared to the third molar on the contralateral side of the jaw. No similar study was found; therefore, it is suggested that further studies be carried out, especially prospective studies, on the subject in order to determine the proper time for the extraction of PFMs in terms of its effect on the development and morphology of the crown and root(s) of third molar, so that such teeth can play a better role in the occlusion of patients who have lost their PFMs.

Some of the limitations of the present study consisted of its retrospective nature and the fact that the time of extraction of PFM was not decided by the researchers. Therefore, this study points to a possible hypothesis that might be substantiated by prospective studies, indicating that if the extraction time of a PFM with poor prognosis is ideal, it not only does provide adequate space for the eruption of the third molar, but also this space helps express the genes of teeth with long, straight and separate roots, even affecting the morphology of the crown in the form of a larger mesiodistal width. In the present retrospective study, it was not possible to evaluate age and gender. In addition, as shown on some panoramic radiographs, the PFM had not been extracted at an ideal time; therefore, the edentulous space had not been closed completely or an abnormal deviation in the longitudinal axis of the teeth adjacent to the edentulous space was evident; however, the development of the third molar had been affected.

### Conclusion

If PFMs with poor prognosis are extracted at a proper time, adequate space will be provided for the eruption of third molars, and it is probable that a third molar tooth with a larger crown, longer root(s) with no curvature and even separate roots, compared



to the third molar tooth on the contralateral side, will prove efficacious in the long-term function of the oral cavity.

### Conflict of Interests

Authors have no conflict of interest.

### Acknowledgments

The authors of the present study sincerely appreciate the authorities of research committee of Kerman University of Medical Sciences for their financial support of the project.

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## Evaluation of the performance and problems of general dentists during and after the placement of composite in the posterior teeth in Kerman, Iran, 2016

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### Original Article

#### Abstract

**BACKGROUND AND AIM:** Nowadays, resin composites are the preferred material for direct posterior restorations. The present study was conducted to assess the performance and problems of general dental practitioners during and after posterior direct composite restorations in Kerman, Iran.

**METHODS:** 160 general dentists (63% men and 37% women) participated in this analytic-descriptive study. Data were collected using a researcher-made questionnaire. The questionnaire consisted of 13 close-ended questions about the performance and problems of dentists associated with composite restorations in Kerman, in 2016. Data were analyzed by chi square and t-test using SPSS software.

**RESULTS:** The most frequent complaint of patients after composite restorations was food impaction (45.0%), and the most clinicians' problems during composite restorations were achieving tight proximal contact (59.3%) and proper isolation (59.3%). Most of the dentists used traditional metal matrix systems (70.0%), wet polishing technique (81.2%), light-emitting diode (LED) light curing unit (62.5%), packable composites (51.2%) with incremental technique (83.1%), and two-step total etch bonding (70.0%). The main criteria for selecting composite as restorative material was patient request (55.0%), and most of the dentists preferred to restore the small or moderate class I cavities (67.5%), and after it, class V cavities (57.5%) with composite. Moreover, secondary caries (58.1%) was the most common reason for replacement of composite restorations; and in all questions, there were statistically significant differences between the most prevalent answer and the other answers ( $P < 0.05$ ).

**CONCLUSION:** The most frequent problems of dentists (achieving proper contact) and the most frequent complaints of patients (food impaction) are related to the use of traditional metal matrix systems.

**KEYWORDS:** Composite Resins; Isolation; Patients; Dentist

**Citation:** Hoseinifar R, Eskandarizadeh A, Zolfaghari F. **Evaluation of the performance and problems of general dentists during and after the placement of composite in the posterior teeth in Kerman, Iran, 2016.** J Oral Health Oral Epidemiol 2018; 7(3): 132-8.

The posterior composite restorations have a history of using for about 30 years. Nowadays, many improvements in composite materials, bonding technologies, and instruments to place these restorations have occurred,<sup>1,2</sup> and the clinical studies demonstrated annual failure rates between 1%-3% for posterior direct composite

restorations.<sup>1,3</sup>

Due to their esthetic properties, two types of bonding (mechanical and chemical), conservative tooth preparation, no harmful effect like mercury of amalgam, and good clinical service, resin composites are the preferred material for direct posterior restorations in recent years and are becoming increasingly popular among patients and

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clinicians.<sup>3,4</sup> Although marginal leakage, post-operative sensitivity, secondary caries, food impaction, time-consuming procedure, and occlusal wear were considered limitations of composite resins as posterior restorative material.<sup>5,6</sup>

Sarrett categorized the challenges that affect clinical outcomes of composite restorations as those related to the material properties (surface roughness, occlusal wear, etc.), those related to the dentist (handling properties of resin composite that could ensure void free placement, providing a proper isolation and moisture control, improving carving and shaping ability prior to curing and complete curing of composite to achieve its maximum physical properties), and those related to the patient (salivary composition, occlusal bite forces, parafunctional habits, and dietary factors).<sup>2</sup>

It is noticeable that the success of composite restorations relies not only on the improvement of the material properties and handling technique, but also on the clinician's level of experience and training in using the material and knowledge of the material's limitations and properties.<sup>2,7</sup>

In a study conducted by Judi and Abolghasemzade in Babol, Iran, inadequate proximal contact was found to be the most frequent problem of dentists during composite fillings, and food impaction was the most common complaint of patients after composite fillings.<sup>6</sup>

The present study was conducted to assess the performance and problems of general dental practitioners during and after posterior direct composite restorations in Kerman, Iran, in 2016.

## Methods

This cross-sectional descriptive-analytical study (ethical code: IR.KMU.REC.1395.664) was conducted to assess the problems and performance of general dental practitioners during and after posterior composite fillings, that was performed in Kerman, which is one of the biggest cities in the south-east of Iran,

in 2016.

A questionnaire was designed according to a similar study,<sup>6</sup> and was further modified for use in this study. Validity of the questionnaire was evaluated by eight specialists from Kerman dental school. They were asked to express their opinion on each question from totally appropriate to totally inappropriate. According to the experts' opinions, all of the questions were appropriate and three questions were added to the primary questionnaire. To assess the reliability of the questions, the questionnaires were filled by 20 dentists within 2 weeks (retest method). Inter class correlation coefficient was 90% which was acceptable.

250 general dentists were selected by a random systematic sampling method according to the list of Kerman Medical Council. The questionnaires were distributed by a dental student in the dental clinics and offices of Kerman, and finally 160 general dentists completed the questionnaires. The demographic information such as age and gender were recorded. The questionnaire consisted of 13 close-ended questions. Different items and their answers were as follows:

1. The main complaint of patients after composite fillings (a. dental sensitivity to heat changes, b. sensitivity to sugar, c. dental sensitivity while chewing, which is not relieved by occlusal adjustment, d. food impaction)

2. The clinician's problem during composite restorations (a. proper isolation, b. achieving tight proximal contact, c. appropriate tooth anatomy, d. occlusion adjustment, e. finishing and polishing of gingival restorations, f. color selection)

3. The clinician method in order to achieve proper proximal contact [a. pre-wedging, b. use of sectional matrix (pre-contoured thin metal matrix + ring), c. pressing matrix strip toward adjacent tooth]

4. Techniques used for posterior composite fillings [a. using an incremental curing technique, b. using flowable composite as liner, c. using resin modified glass ionomer (RMGI) base in deep cavities, d. using

sandwich technique in enamel less gingival margin of class II and V cavities]

5. The type of used bonding [a. three step etch and rinse (total etch), b. two step etch and rinse (total etch), c. two step self-etch, d. one step self-etch]

6. Techniques used for bonding application (a. etching time, b. drying dentin with cotton pellet, c. manufacturer's instruction)

7. Techniques used for polishing (a. wet, b. dry)

8. Factors affecting the selection of composite as the material of choice in posterior teeth (a. patient's request, b. extension of cavity, c. esthetic demands, d. possibility of isolation, e. patient's occlusion)

9. Preferred cavities for composite placement (a. small to moderate class I, b. large class I, c. small to moderate class II, d. large class II, e. class V, F. endodontically treated posterior teeth, g. replacement of fractured amalgam restoration)

10. The most frequent reason for replacement of composite fillings (a. secondary caries, b. fracture, c. hypersensitivity, d. food impaction)

11. The type of used composite (a. packable, b. conventional or universal, c. low shrinkage)

12. The type of used light curing unit

[a. light-emitting diode (LED), b. quartz-tungsten-halogen (QTH), c. plasma arch]

13. The period of light intensity checking (a. every week, b. every month, c. every six month, d. every year, e. never)

The participants could choose more than one answer for questions 1, 2, 3, 4, 6, 8, 9, and 10.

After collecting the questionnaires, the obtained data were analyzed by SPSS software (version 21, IBM Corporation, Armonk, NY, USA) using descriptive statistics, t-test, and chi-square tests,

with the significance level of  $P < 0.05$ .

## Results

160 dentists (63% men and 37% women) participated in this study. Table 1 demonstrates the frequency and percentage of the most prevalent answers.

Food impaction (45.0%) was found to be the most frequent complaint of patients after composite fillings, and the most clinicians' problems during composite restorations were achieving tight proximal contact (59.3%) and proper isolation (59.3%).

Most dentists used traditional metal matrix systems, and pushed the matrix strip toward the adjacent teeth for proper proximal contact (70.0%).

**Table 1.** The frequency and percentage of the most prevalent answers (It is noticeable that the participants could choose more than one answer for questions 1, 2, 3, 4, 6, 8, 9, and 10)

Questions	The most prevalent answers	n (%)	P
The main complaint of patients after composite restorations	Food impaction	72 (45.0)	0.001
The most clinicians' problem during composite restorations	Proper isolation and achieving tight proximal contact	95 (59.3)	0.001
The clinician method in order to achieve proper proximal contact	Pressing matrix strip toward adjacent tooth	112 (70.0)	0.001
Techniques used for posterior composite fillings	Using an incremental technique	133 (83.1)	0.002
The type of used bonding	Two step etch and rinse (total etch)	112 (70.0)	0.009
Techniques used for bonding application	Drying dentin with cotton pellet	92 (57.5)	0.001
Techniques used for polishing	Wet	130 (81.2)	0.001
Factors affecting the choice of composite as restorative material in posterior teeth	Patient's request	88 (55.0)	0.001
Preferred cavities for composite placement	Small to moderate class I	108 (67.5)	0.001
The most common reason for replacement of posterior composite restorations	Secondary caries	93 (58.1)	0.001
The type of used composite	Packable	82 (51.2)	0.001
The type of used light curing unit	LED	100 (62.5)	0.001

In all questions, the differences between the most prevalent answer and the other answers were evaluated

Most of the dentists used wet polishing technique (81.2%), packable composites (51.2%) with incremental technique (83.1%), and two-step total etch bonding (70%) with drying the dentin with cotton pellet (57.5%).

The main criteria for selecting composite as restorative material in posterior teeth were patient request (55%) and esthetic demands (53.1%). Most of the dentists preferred to restore the small or moderate class I cavities (67.5%) and after it, class V cavities (57.5%) with composite.

Secondary caries (58.1%) was the most frequent reason for replacement of posterior composite restorations.

Most of the dentists used LED light curing unit (62.5%) and checked its intensity (61.3%); and in all questions, there were statistically significant differences between the most prevalent answer and the other answers ( $P < 0.05$ ) (Table 1). There were no significant relation between demographic variables (age and gender) and the performance of general dentists except the type of used composite and the age (packable composites were used by the general dentists with lower age average).

## Discussion

At one time, amalgam was the most commonly used material for restoring posterior teeth; but now, due to the patient and dentist related factors, it is gradually being replaced by composite resins.<sup>5</sup>

In the present study, the most clinicians' problems during composite restorations were achieving tight proximal contact (59.3%) and proper isolation (59.3%), that is consistent with the results of previous studies.<sup>5,6</sup>

Akbar evaluated the attitude and knowledge of general dentists towards composite restorations in Northern Saudi Arabia, and reported that the most clinicians' problems associated with posterior composites were achieving adequate proximal contact (51%) and moisture control (36.0%).<sup>5</sup> In the study conducted by Judi and Abolghasemzade in Babol, inadequate proximal contact (37.2%) and after it, proper

isolation (29.8%) were found to be the most frequent problems of general dentists during posterior composite fillings.<sup>6</sup>

Proper isolation is a prerequisite for composite fillings. According to American Dental Association, composites (or any other bonded materials) should not be used in sites where isolation cannot be maintained.<sup>5</sup>

On the other hand, creating tight contacts in class II composite fillings still remains difficult. This problem is due to several mechanisms, such as the polymerization shrinkage of resin composites and this fact that resin composite cannot be 'condensed' as amalgam can.<sup>8-10</sup> An insufficient contact may lead to food impaction, caries formation, pain, and periodontal diseases.<sup>11</sup> Different matrix systems and techniques of restoration have been introduced to overcome this problem.<sup>5</sup> In this study, this problem is related to the preferred method of clinician in order to achieve proper proximal contact (pressing matrix strip toward adjacent tooth).

In the current study, most dentists used traditional metal matrix systems and pushed the matrix strip toward the adjacent teeth for proper proximal contact (70%), that is related to the most frequent problems of dentists (achieving proper contact) and the most frequent complaints of patients (food impaction).

Based on the findings of Judi and Abolghasemzade, most of dentists applied pressing matrix strip for proper proximal contact.<sup>6</sup> Loomans et al. also reported that most dentists used traditional metal matrix (64%), and sectional matrix systems (15%) were not commonly used.<sup>12</sup>

Using an incremental technique with pressing the matrix strip toward the adjacent teeth provided only small tighter proximal contacts.<sup>11</sup> The use of sectional matrix system showed the best proximal contact in class II composite fillings in a study by Peumans et al.<sup>13</sup> With the use of sectional matrix system, ring separates the teeth effectively and allows a tighter contact to be developed.<sup>14</sup>

In this study, the most frequent



complaints of patients after composite fillings were food impaction (45%) and dental sensitivity to heat changes (33.8%); which is in agreement with the results of previous studies.<sup>6,12</sup> Judi and Abolghasemzade reported that the most common complaints of patients after composite filling was food impaction (33.4%).<sup>6</sup> Loomans et al. also reported that the most common problems experienced by the general dental practitioners were achieving tight proximal contacts (82%) and postoperative sensitivity (POS) (61%).<sup>12</sup>

Several clinical studies indicated that nearly 30% of patients present POS after posterior composite fillings.<sup>7,15</sup> Mainly, class II restorations are associated with the POS.<sup>5</sup> POS may be contributed to several factors such as etching of dentin, incorrect adhesive procedure, bacterial microleakage, cuspal flexure, cavity depth, technique of composite placement, over-drying of dentin, cavity size, occlusal discrepancy, and trauma of cavity preparation.<sup>16,17</sup> The POS can be reduced if proper guidelines and techniques of patient selection and cavity preparations are followed for composite restorations.<sup>5,7</sup>

In the current study, most of the dentists applied incremental curing technique for composite filling (83.1%), which is in agreement with the results of previous studies.<sup>6,18</sup> The use of an incremental technique is commonly performed to overcome the effects of polymerization shrinkage. This method can increase the gel phase, thus improving the flowability of composite and, consequently, the marginal adaptation.<sup>7</sup>

In the current study, the main criteria for selecting composite by the participants were patient request (55.0%) and esthetic demands (53.1%). The result is similar to the findings of Gilmour et al., who found patient preference as the main criteria for choosing posterior composites.<sup>19</sup> Akbar reported that the most common factors for choosing posterior composite restoration were conservative cavity preparation followed by aesthetics and patient's preference.<sup>5</sup> The

ability of isolation (41.8%) was the main criteria reported by Judi and Abolghasemzade to select the composite as the material of posterior teeth.<sup>6</sup>

In the present study, most of the dentists preferred to restore the small or moderate class I cavities (67.5%) and after it, class V cavities (57.5%) with composite. Akbar reported that most of the dentists used composite in small cavities and class I restorations with light occlusal contact,<sup>5</sup> which is consistent with this study. It is noticeable that the use of resin composite in small cavities allows a great preservation of tooth structure.<sup>20</sup> It is estimated that, after 5 years, 10.1% of small-size composite restorations and 19.8% of large restorations have to be replaced; therefore, the use of composite in small cavities is reasonable.<sup>21</sup>

In this study, most of the dentists used packable composites (51.2%). "Packable" or "condensable" composites were introduced in the late 1990s with the expectation that they would condense like amalgam, thereby improving interproximal contacts. Many packable products were less sticky and stiffer than traditional composites. While their handling properties were useful for larger class I and class II restorations, packable composites did not help to achieve better proximal contacts.<sup>14</sup> Peumans et al. also reported that the packability of composites did not influence the tightness of the proximal contact.<sup>13</sup>

Fortunately, in the current study, most of the dentists checked light curing unit intensity (61.3%). It may be due to the higher knowledge of general dentists in Kerman about the importance of light curing unit intensity. Savadi Oskoei et al. evaluated the intensity output of curing lights in private dental offices and clinics of Tabriz, Iran, and reported that the intensities of light curing unit were inadequate for optimum curing, and 96.4% of dentists had never checked the light intensities of their unit.<sup>22</sup> Mirzaei and Moradimajd evaluated the light curing unit intensity of private dental offices and clinics



in Tehran, Iran, and reported that light intensities of about 46% of light curing units were inadequate.<sup>23</sup>

Complete polymerization is one of the main factors of success of composite restoration. Incomplete polymerization is related to more water uptake, lower hardness, more solubility, and lower bond strength.<sup>23</sup>

In the present study, secondary caries (58.1%) was the main reason for replacement of composite fillings, which is consistent with the results of previous studies.<sup>3,5,20</sup>

Asghar et al. reported that the common cause for replacing class I restorations was secondary caries, and for replacing class II restorations the main causes were secondary caries, improper proximal contacts, and gingival irritation.<sup>24</sup> Several studies reported that recurrent caries was the main reason for composite restoration failure.<sup>3,5,20</sup> The composite restoration-related secondary caries have been rated significantly more than amalgam restorations, which can be attributed to the higher amount of *Streptococcus mutans* in the margins of composite restorations and the polymerization shrinkage of composites.<sup>25</sup>

According to the findings of clinical trials, the annual failure rate of posterior direct composite restorations has been reported to

be 1%-3%, depending on different factors like tooth type and position, the age of patients, the knowledge and proper skills of the operator, socioeconomic and behavioral features (caries risk).<sup>4,5</sup>

Some studies suggested that the longevity of composite restorations is under the influence of the knowledge and enough skills of operator.<sup>26,27</sup> However, there are limited data about the direct effects of dentist performance on efficiency of composite fillings.<sup>6</sup>

Weak cooperation of general dentists was the limitation of this study; moreover, some of the dentists might not answer the questions precisely.

### Conclusion

The most frequent problem of dentists (achieving proper contact) and the most frequent complaint of patients (food impaction) are related to the use of traditional metal matrix systems.

### Conflict of Interests

Authors have no conflict of interest.

### Acknowledgments

This study was financially supported by the Oral and Dental Diseases Research Center of Kerman University of Medical Sciences.

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## What determines utilization of dental care services? The case of Iran

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### Original Article

#### Abstract

**BACKGROUND AND AIM:** Identifying the factors affecting utilization of dental services is one of the best ways to improve the health status. This study aimed to investigate the effective factors on utilization of dental services.

**METHODS:** In this cross-sectional study, 1185 household heads were selected randomly, and using a researcher-made questionnaire based on World Health Organization (WHO) Global Health Survey and Andersen behavioral model, and through multivariate logistic regression, the predictors of visiting a dentist during 1 year ago were investigated in 2017. The households' income inequality in utilization of dental services was analyzed using concentration indices (CIs) and Pearson chi<sup>2</sup> in STATA software.

**RESULTS:** The predictor of dental visit during 1 year ago for men was having decayed teeth [odds ratio (OR) = 1.3, P = 0.030], and the predictors for women were lower ages (OR = 0.8, P = 0.001 for 19-29 years old and so on), having 32 natural teeth (OR = 0.7, P = 0.020), and employment (OR = 1.3, P = 0.048). The common predictors were increase in education level (OR = 1.4, P = 0.001 for men, and OR = 1.7, P = 0.001 for women with university degree), brushing (OR = 1.9; P = 0.001 for women, and OR = 1.3; P = 0.040 for men), and having supplementary insurance (OR = 1.7, P = 0.001 for men, and OR = 1.9, P = 0.001 for women). Being burdensome of dental care costs during 3 years ago (CI: -0.074, P = 0.001), avoiding visiting a dentist during 1 (CI: -0.501, P = 0.001) and 3 (CI: -0.501, P = 0.001) years ago because of its costs, and failure to do all dentistry recommendations during 3 years ago (CI: -0.516, P = 0.001) happen more frequently among the poor. Moreover, the poor used all dental services such as scaling (CI: -0.638, P = 0.001), filling (CI: -0.458, P = 0.001), and root canal (CI: -0.524, P = 0.001) less than the rich.

**CONCLUSION:** Dental health status is negatively affected by population socio-economic situation; therefore, it is necessary to implement policies to improve access to dental services among the undeserved.

**KEYWORDS:** Utilization; Dental Care; Iran

**Citation:** Amiresmaili M, Amini S, Shahravan A, Goudarzi R, Saberi-Anari SH. **What determines utilization of dental care services? The case of Iran.** J Oral Health Oral Epidemiol 2018; 7(3): 139-47.

Dental diseases, although preventable, are the most chronic diseases in the world. So that, more than 3 billion people suffer from untreated dental decay. Periodontal diseases have a very negative impact on life quality.<sup>1</sup> Treatment of dental diseases is expensive and

considerable, so that the costs amount to US\$ 442 billion worldwide.<sup>2</sup> A high attention has been paid to socio-economic inequality in accessing and utilization of dental care services in different countries. For example, Borrell and Crawford reported difference in prevalence of periodontal diseases on the

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basis of income, education, and race in United States (US).<sup>3</sup> Sabbah et al. stated worse self-reporting of dental health among people with low education and income.<sup>4</sup> Wamala et al. indicated the correlation between poor socio-economic situation and decrease in using dental care and poor dental health status.<sup>5</sup>

A systematic review and meta-analysis study indicated that deteriorating socio-economic situation increased dental decay.<sup>6</sup> One of the main causes of this is poor access to dental care because of direct out of pocket for dental care.<sup>7</sup> However, out of pocket payment for dental care is usually higher than medical care, so that inequality in using dental care is higher than medical care.<sup>8</sup> Therefore, people are forced to spend their limited resources in food and shelter,<sup>9</sup> but if families spend catastrophically high proportion of their income in health care, high horizontal inequality happen.<sup>10</sup> Although different researchers in different countries have studied the relation between socio-economic situation and access to dental care,<sup>11-13</sup> there is not a thorough study in Iran.

On the basis of a national survey of dental health, administered by dental health office of Iran health ministry, in which educated dentists examined dental health situation of people all over the country, dental health indices of people of Kerman City-located in the south east of Iran- were in the mean of the country. For example, only about the adults who were the age group of this study, the percentage of edentulous in 35-44 years old age group in Kerman was 3.6% and in Iran was 4.0, the mean of decayed, missed and filled teeth (DMFT) index in 65-74 years old age group was 27.73% and in Iran was 25.71%, and the percent of population who needed dental care in 65-74 years old group in Kerman was 54.5 and in Iran was 45.9%. Other indices are similar, too.<sup>14</sup> So, Kerman is in the mean or near mean of the country in terms of many dental indices.

Moreover, the type of services provided by public centers is the same in different

provinces; also the private sector delivers same services along the country. The services tariff is the same along the country and is coordinated and determined by health ministry, and the services covered and administered by health insurances are the same all over the country.<sup>15</sup> Thus, because of these similarities between different cities of Iran, we selected Kerman as a representative of Iran population to investigate the effect of socioeconomic inequality on utilization of dental services.

## Methods

The data of this descriptive-analytical study were collected in 3 first months of 2017. Kerman city population was 534441 people on the basis of Iran 2012 census. The Cochran formula was used to estimate the needed samples. Since there was no previous study about utilization of dental care in Iran, we put P-value equal to 0.5 to obtain the most sample size. Therefore, the sample size was estimated 1065, and to increase the accuracy, 1158 people were entered to the study.

The questionnaires were completed by visiting house to house. The participants were head of households with every type of socio-economic status. If one household head did not respond to the trained interviewers, the next household head was entered to the study to obtain exactly 1158 completed questionnaires. The samples were selected through multi-stage random sampling. All of the households in Kerman are covered by 35 health centers. Therefore, proportional to the population covered by each center, the number of samples for each center was determined. For each health center, one house was selected randomly on the basis of municipality plaque. After completing the first questionnaire for the first house, by moving to the right of the first house door, other questionnaires were completed. This process was performed for other health centers. The interviewers were undergraduate students of Kerman University of Medical Sciences who were

trained before the onset of the study.

The researcher-made questionnaire was used for collecting data. This questionnaire was designed by the study researchers based on World Health Organization (WHO) questionnaire of "Global Health Survey, 2003" for assessment of health systems performance<sup>16</sup> and also Andersen behavioral model.<sup>17</sup> In Andersen behavioral model, using health services is a function of predisposing, enabling, and need factors. The predisposing factors were demographic variables (age and gender), social situation (education level and employment), and attitudes and beliefs (brushing). The enablers were supplementary insurance and income rate, and lastly the need factors were the number of natural teeth, decayed teeth, and using dentures. The effect of these factors on visiting a dentist during last year was measured using multiple logistic regression. The adjusted odds ratio (AOR) was obtained with 95% confidence interval (CI).

In the next step, the situation of dental services utilization among the rich and the poor households' heads was investigated using following questions:

Q1: How often do you visit a dentist for check-up? 1- Never 2- Only when necessary 3- Less than once a year 4- Once a year 5- More than once a year

Q2: When was the last time you visited a dentist? 1- Never 2- I do not remember 3- More than 5 years ago 4- 3-5 years ago 5- 1-3 years ago 6- Less than one year ago

Q3: If you used dental care during 3 years ago, has been its cost burdensome for you? 1- Yes 2- No

Q4: Have you avoided or postponed visiting a dentist during 3 years ago because of its costs? 1- Yes 2- No

Q5: Have you avoided doing all your dentist' recommendations because of their costs? 1- Yes 2- No

Q6: Have you avoided or postponed visiting a dentist during 1 year ago because of its costs? 1- Yes 2- No

Q7: If the response of Q6 is yes, for which

following services did you avoid visiting a dentist? 1- Examination and radiography 2- Scaling and preventive services 3- Filling 4- Prosthesis 5- Extracting 6- Dental surgery 7- Root canal 8- Tooth infection 9- Orthodontic 10- Other services.

Content validity, experts' opinions, and literature review were used to confirm the questionnaire validity. Test-retest method was used to confirm reliability, so that 10 participants were selected and the questionnaires were presented to them. After 15 days, the questionnaires were presented to them, again. The calculated Cronbach's alpha coefficient was 85%; so, the questionnaire reliability was confirmed. The level of difficulty, the degree of mismatch, ambiguity in the expressions, and shortcomings in the meaning of the words were assessed to confirm face validity of the questionnaire. For this, 20 questionnaires were completed by the target group under the supervision of the researchers.

Equivalent household income was categorized as follows: < 10, 10-30, 30-50, > 50 million Rials (Iran monetary unit). The exchange rate for the US dollars and Iranian Rial at the time of this study was one US dollar being equal to 37340 Iranian Rial. On the basis of age, the participants were classified into 6 categories: 19-29, 30-39, 40-49, 50-59, 60-69 and > 70 years old. Moreover, the family members were classified into 2, 3, 4, 5, 6, 7, 8 members.

Concentration index (CI) is one of the ways to measure inequality in health care.<sup>9</sup> The concentration curve depicts the cumulative percent of health against the cumulative percent of their economic situation. The amount of CI is in the range of -1 to +1. If the considered health situation distributes equally between persons with different socio-economic situation, the concentration curve coincides on the 45-degree line and its value becomes zero. When the concentration curve locates above the 45-degree line, the CI becomes negative which means the concentration of considered health index in the poor, and when it locates



below the line 45 degree, the CI becomes positive which means the concentration of considered health index in the rich. The least amount which concentration curve can take is -1 which means all of health is located in the hands of the poor, and the most amount which concentration curve can take is +1 which means all of health is located in the hands of the rich.<sup>18</sup>

CI is obtained from the following equation:

$$2\sigma_r^2 \left( \frac{y_i}{\mu} \right) = \alpha + \beta r_i + \varepsilon_i$$

$y_i$  is the considered health utilization index,  $\mu$  is its mean,  $r_i$  is the fractional rank of individual  $i = i/n$  in the living standard distribution.  $i = 1$  is for the poorest person in the distribution and  $i = n$  is for the richest person in the distribution.  $\sigma_r^2$  is the variance of the fractional rank and  $\beta$  as an estimation of CI obtained from the ordinary least squares estimation.<sup>9</sup>

The situation of dental utilization and its relation with predisposing and empowering variables were assessed using Pearson chi<sup>2</sup> and

CI. The CI method was used to quantify the degree of socioeconomic inequality in dental care use. P-values under 0.05 were considered as statistically significant. All analyses performed using STATA software (version 13.1, Stata Corp, College Station, TX, USA).

Before collecting the data, the written permission and ethical code were obtained from the Ethical Committee of Kerman University of Medical Sciences (Ethical code number: IR.KMU.REC.1395.363). Also, before completing the questionnaires, the consent of participants was obtained. This study was performed on the basis of Helsinki Declaration.

## Results

As table 1 indicates, dental visit has not been significantly higher or lower than the reference age group for men during 1 year ago, but dental visit has decreased significantly by increasing in women age during 1 year ago, so that the most dental visit occurred in 19-29 years old age group (OR = 0.8, P = 0.001). In both genders, dental visit increased by increase in education and income level during 1 year ago.

**Table 1.** The effect of predisposing, enabling, and need factors on visiting a dentist during 1 year ago

Variables		Men (n = 956)			Women (n = 202)		
		OR	95% CI	P	OR	95% CI	P
Age (year)	19-29		Ref			Ref	
	30-39	1.0	0.7-1.1	0.860	0.8	0.6-0.9	0.001
	40-49	1.2	0.9-1.3	0.210	0.8	0.6-1.0	0.010
	50-59	1.0	0.9-1.1	0.660	0.7	0.6-0.7	0.010
	60-69	1.1	0.9-1.3	0.190	0.5	0.3-0.7	0.001
	+70	1.2	0.9-1.3	0.300	0.6	0.5-0.7	0.001
Education	< High school		Ref			Ref	
	High school	1.3	1.1-1.5	0.040	1.4	1.3-1.5	0.001
	University	1.4	1.2-1.6	0.001	1.7	1.5-2.0	0.001
Income (US dollar)	267-803		Ref			Ref	
	803-1339	1.3	1.0-1.6	0.020	1.3	1.0-1.7	0.030
	> 1339	1.4	1.1-1.6	0.001	1.6	1.4-1.9	0.001
Employment	Not in employment		Ref			Ref	
	In employment	1.0	0.9-1.3	0.810	1.3	1.0-1.5	0.050
Brushing	Less often or never		Ref			Ref	
	Once a day or more	1.3	1.0-1.5	0.050	1.9	1.6-2.2	0.001
Dentition status	All 32 teeth		Ref			Ref	
	Some decayed	1.3	1.0-1.6	0.030	0.7	0.5-1.0	0.020
	Edentulous	0.8	0.7-1.0	0.030	0.8	0.6	> 0.999
Supplementary insurance	No		Ref			Ref	
	Yes	1.7	1.4-2.0	0.001	1.9	1.6-2.2	0.001

OR: Odds ratio; CI: Confidence interval



**Table 2.** Concentration index and Pearson chi<sup>2</sup> of income inequality in visiting a dentist

Variable	Estimate	SE	LB	UB	Pearson chi <sup>2</sup>	P
Question 1	0.107	0.006	0.094	0.118	664.938	0.001
Question 2	0.111	0.003	0.104	0.117	589.508	0.001
Question 3	-0.070	0.008	-0.090	-0.058	229.923	0.001
Question 4	-0.501	0.015	-0.531	-0.470	780.267	0.001
Question 5	-0.516	0.016	-0.548	-0.484	702.035	0.001
Question 6	-0.503	0.015	-0.533	-0.472	825.778	0.001

SE: Standard error; LB: Lower bound; UB: Upper bound

Q1: How often do you visit a dentist for check-up? Q2: When was the last time you visited a dentist? Q3: If you used dental care during 3 years ago, has been its cost burdensome for you? Q4: Have you avoided or postponed visiting a dentist during 3 years ago because of its costs? Q5: Have you avoided doing all your dentist' recommendations because of its costs? Q6: Have you avoided or postponed visiting a dentist during 1 year ago because of its costs?

P-values under 0.05 were considered as significant ( $P < 0.05$ ).

For example, the OR of dental visit in men and women with university education was 1.4 ( $P = 0.001$ ) and 1.7 ( $P = 0.001$ ), respectively, which was higher than the reference group during 1 year ago. Moreover, the OR of dental visit in household heads with income level higher than US\$1339 was 1.4 ( $P = 0.001$ ) and 1.6 ( $P = 0.001$ ) for men and women, respectively.

Dental visit in the employed men was not significantly different from the unemployed men during 1 year ago, but in employed women dental visit has been significantly higher than others (OR = 1.3,  $P = 0.048$ ). The persons with regular brushing visited a dentist significantly more than others in 1 year ago, which this ratio was higher among women (OR = 1.9,  $P = 0.001$ ) compared to men (OR = 1.3,  $P = 0.040$ ).

The persons with dentures visited a dentist significantly less than the persons with 32 natural teeth during 1 year ago. The men with decayed teeth visited a dentist significantly more than the men with 32 natural teeth (OR = 1.3,  $P = 0.030$ ), but the women with decayed teeth visited a dentist significantly less than the women with 32 natural teeth (OR = 0.7,  $P = 0.020$ ). The persons with supplementary insurance visited a dentist significantly more than others during 1 year ago, which this visit was higher in women (OR = 1.7,  $P = 0.001$ ) than men (OR = 1.9,  $P = 0.001$ ) (Table 1).

As table 2 and its concentration curve in figure 1 indicate, the concentration curve of question 1 "How often do you visit a dentist

for check-up?" and question 2 "When was the last time you visited a dentist?" have located below the 45-degree line and their CI are positive, which means the participants with higher income visit a dentist in shorter time periods than others.

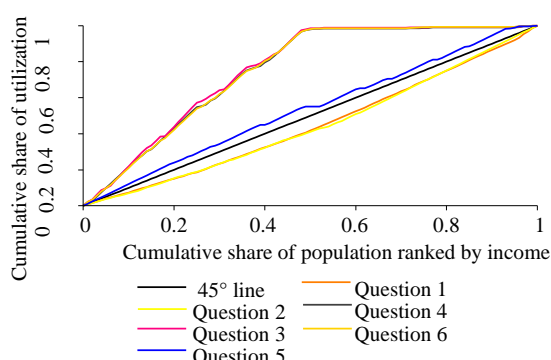
Furthermore, the curves of questions 3, 4, 5, and 6 have located above the 45-degree line (and their CI are negative), so that in question 3 "If you used dental care during 3 years ago, has been its cost burdensome for you?" the cost of dental services for the participants with lower income had been more burdensome than others. In question 4 "Have you avoided or postponed visiting a dentist during 3 years ago because of its costs?" the participants with lower income avoided visiting a dentist during 3 years ago more than others. In question 5 "Have you avoided doing all your dentist' recommendations because of its costs?" the participants with lower income avoided doing all of the dentist' recommendations because of its costs compared to others. And finally, in question 6 "Have you avoided or postponed visiting a dentist during 1 year ago because of its costs?" the participants with lower income avoided visiting a dentist during 1 year ago because of its costs more than others (Table 2, Figure 1).

As table 3 and its concentration curve in figure 2 indicate, the participants with lower income avoided utilization of all dental services including examination and radiography, scaling and preventive services, filling, prosthesis, extracting, dental surgery,

**Table 3.** Concentration index and Pearson chi<sup>2</sup> of inequality in utilization of dental care services

Variable	Estimate	SE	LB	UB	Pearson chi <sup>2</sup>	P
Examination	-0.7470	0.084	-0.912	-0.582	14.212	0.003
Scaling	-0.6380	0.074	-0.785	-0.492	19.484	0.001
Filling	-0.4580	0.042	-0.541	-0.374	76.650	0.001
Prosthesis	-0.4720	0.055	-0.580	-0.365	43.688	0.001
Extracting	-0.6067	0.090	-0.784	-0.429	18.381	0.001
Dental surgery	-0.4520	0.108	-0.665	-0.240	25.402	0.001
Root canal	-0.5240	0.022	-0.567	-0.481	30.698	0.001
Tooth infection	-0.7260	0.116	-0.953	-0.498	12.121	0.007
Orthodontic	-0.4820	0.044	-0.568	-0.396	49.135	0.001
Other services	-0.4880	0.075	-0.635	-0.341	15.071	0.002

SE: Standard error; LB: Lower bound; UB: Upper bound  
 P-values under 0.05 were considered as significant (P < 0.05).



**Figure 1.** Concentration curve of income inequality in visiting a dentist

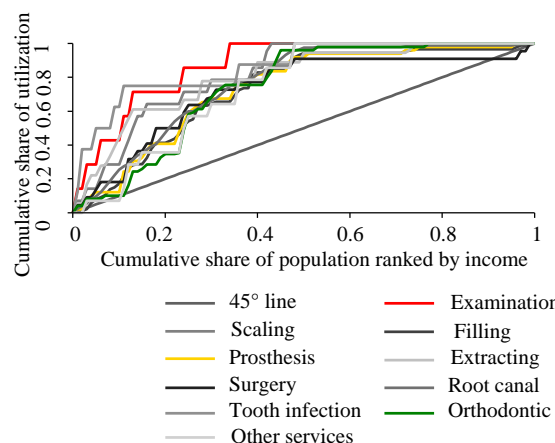
Q1: How often do you visit a dentist for check-up? Q2: When was the last time you visited a dentist? Q3: If you used dental care during 3 years ago, has been its cost burdensome for you? Q4: Have you avoided or postponed visiting a dentist during 3 years ago because of its costs? Q5: Have you avoided doing all your dentist' recommendations because of their costs? Q6: Have you avoided or postponed visiting a dentist during 1 year ago because of its costs  
 The curves of questions 3, 4, 5, and 6 have located above the 45-degree line and other curves have located under the 45-degree line.

root canal, tooth infection treatment, orthodontic, and other services more than the participants with higher income. In other words, there was inequality in utilization of dental care services in favor of the rich (Table 3 and Figure 2). P-value columns in table 2 and 3 indicate that the difference between the poor and the rich in visiting and utilization of dental care services is significant statistically.

### Discussion

This was the first study in Iran which

comprehensively investigated the relation between predisposing, enabling, and need factors in utilization of dental services among men and women, and also studied households' income inequality in utilization of dental services. As results indicated, the men' age had no significant effect on dental visit during 1 year ago, but in women by increasing age, dental visit decreased during 1 year ago. Suominen et al. studied the trend of dental utilization from 2000 to 2011. They resulted that women used dental services more than men, and also dental utilization decreased by increasing age in both genders.<sup>19</sup>



**Figure 2.** Concentration curve of inequality in utilization of dental care services

All curves have located above the 45-degree line.

This study indicated that dental visit increased by increasing in education level. A study by Ueno et al. on 1201 Japanese community residents aged 55-75 years who

completed a self-administered questionnaire in 2005 indicated that increasing in education level could enhance health literacy and decrease the inequalities in dental health.<sup>20</sup> On the basis of the results, there is high amount of socio-economic inequality in utilization of dental care services in Iran. Although based on 2014 Iran Health Evolution Plan, free basic health insurance coverage has been provided for all uninsured Iranians, in this package dental insurance has been neglected.<sup>21</sup> As results indicated, the persons with lower income visited a dentist for check-ups very less than the rich, passed more time period from their last visit, the cost of dental services was more burdensome for them, avoided dental care in 1 and 3 years ago more than others, and lastly utilized all dental care services very less than the rich. Real universal coverage can improve the utilization and access to dental care services. Matsuyama et al. examined the relationship between older Japanese' income and dental prosthesis utilization in 2013; they stated that providing free dental care was possibly an effective method to remove inequality in utilization of dental care.<sup>22</sup>

Health financing systems based on tax, and public and private insurances can protect people against health costs. These systems do this through sharing costs between persons with different needs and health status.<sup>23</sup> Because of long waiting lists, few covered services by insurances, and high co-payment, adults' access to dental care services is limited in Australia. These policies suppress demand for dental care and encourage people to visit a dentist only when they have severe dental problems which finally leads to poor dental indicators.<sup>24</sup> However, it is necessary to promote the dental health culture and literacy, improve life style, and use educational-preventive programs about brushing, flossing and regular dental examination.

The impact of socio-economic situation and dental health behaviors on dental health is inevitable. On the basis of Ghorbani and Peres study, the poorest population, those

with lower than 12 years education, those who brush less than 2 times a day, and lastly those who do not use dental floss daily are among those with high number of nonreplaced extracted teeth.<sup>25</sup> Therefore, in order to improve dental utilization, the authorities should consider different socio-economic and cultural variables when introduce different dental services and design public programs.<sup>26,27</sup>

The results indicated that when encountered with less income, men more than women avoided visiting a dentist. One of the reasons is that men in less income situations bear more stress and psychological pressure; so, they are more likely to seek family livelihood rather than receiving dental care. On the other hand, in general, women seek health care more than men.<sup>28</sup>

Current study's data were collected through self-reporting. Studies have indicated that self-reporting measures are a suitable alternative for clinical and administrative data in the field of health care utilization. In addition, there is little variation about conformity between self-reported measures and registered data on using services in different socio-economic groups.<sup>29</sup>

About the limitations of this study, we can say that firstly, although Kerman City -due to the circumstances described in the introduction section- can be a good representative of Iran population, it is better to extract the samples from all over the country in the future studies. In order to benchmarking, it is recommended that the characteristics of financing, insurance, and organizing dental care services in successful countries be studied.

Secondly, this study is survey-based and cannot interfere with cause and effect relationship. In other words, it is not possible to extract the exact causes of dental utilization using these types of studies. Thirdly, there may be some type of reporting bias about the services which have been used during 1 year ago, but regarding few number of dental visits during the last year, people usually do not

forget the last time they visited a dentist and they recall their expenditures on dental utilization. Therefore, there is no problem in this regard and if there was probably a recall bias, that would be for all respondents.

### Conclusion

In spite of different dental health programs in the country, there is high socio-economic inequality in utilization of dental health services in favor of deserved people. Thus, it seems necessary to revise dental health programs at the country level to decrease these differences. Dental health policies such as implementing effective programs which support low socio-economic groups and also

developing insurance coverage among undeserved people are important factors to increase the utilization of dental services.

### Conflict of Interests

Authors have no conflict of interest.

### Acknowledgments

This paper is retrieved from a doctoral thesis. The Deputy of Research of Kerman University of Medical Sciences supported the funding (Grant Number: 95000277). The authors would like to thank the Deputy of Research of Kerman University of Medical Sciences for the financial support.

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## Intramuscular hemangioma of masseter muscle: A report of unique case

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### Case Report

#### Abstract

**BACKGROUND AND AIM:** Even though hemangiomas are prevalent tumors in the region of head and neck, they are comparatively rare inside the mouth and less frequently detected by dental professionals. Therefore, the aim of this case report is to present such a rare variation of hemangioma manifested within the substance of the masseter muscle.

**CASE REPORT:** We report a unique case of intramuscular hemangioma of masseter muscle in a 26-year-old woman complained of growth and swelling in the right cheek since 6-8 months before. The growth was surgically excised and diagnosed histopathologically as intramuscular mixed capillary with cavernous hemangioma.

**CONCLUSION:** Hemangiomas are rarely seen intramuscularly. This case presents an intramuscular hemangioma occurring within the masseter muscle. Early detection and management is required in order to avoid the potential complications associated with it.

**KEYWORDS:** Capillary; Cavernous; Hemangioma; Vascular Malformation; Benign Tumor

**Citation:** ShettyUA, Shetty P, D'Cruz AM, Rao K, Bhandary S. **Intramuscular hemangioma of masseter muscle: A report of unique case.** J Oral Health Oral Epidemiol 2018; 7(3): 148-52.

**H**emangioma (Greek: Haima: blood, angeion: vessel, oma: tumor) is defined as "a benign tumor of dilated blood vessels". Hemangioma of head and neck usually occur following birth showing swift proliferative phase, and then resolves completely by involution. It is also named as "strawberry hemangioma", and "Salmon patch" based on its location. They are never encapsulated, usually manifested as hyperplasia of capillaries and veins in the connective tissue.<sup>1,2</sup> They may be cutaneous (at sites like skin, lips, and deeper structures), mucosal (lining of the oral cavity), intramuscular (within the masticator and perioral muscles), or intra-osseous (within the mandible and/or maxilla).<sup>3</sup> Oral hemangiomas are rarely seen on the gingiva and periodontium at

interdental gingival papilla, and spread laterally to involve adjacent teeth.<sup>4</sup> Even less frequently other sites like buccal and labial mucosa, lips, tongue, and palate are involved.<sup>5</sup>

Clinically, hemangiomas manifest as a soft mass of varying sizes; which may be smooth or lobulated, sessile or pedunculated. On visual examination, the lesion appears to be either red, pink, or purple, and it blanches on the application of external pressure. Hemorrhage may even occur spontaneously without external traumatic factor, or even after minimal trauma.<sup>4</sup> They are generally painless, but might functionally interfere with mastication.<sup>3,4</sup> While the superficial hemangiomas manifest as lobulated lesions showing blanching when finger pressure is applied, deeper lesions appear as dome-

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shaped with color ranging from normal to blue, and rarely blanch on pressure application.<sup>6</sup>

This report describes a unique case of intramuscular hemangioma of masseter muscle in an adult woman in the right cheek area.

### Case Report

A woman aged 26 years, reported to a private dental college with a chief complaint of a growth and swelling in the right cheek since 6-8 months before. The patient had mild pain and discomfort while eating due to obstruction of occlusal area by the growth during mastication. Medical history and family history was noncontributory. Extra-orally, no changes were noticed. A comprehensive intraoral examination revealed well circumscribed, non-fluctuant swelling on the right cheek. The surface of the buccal mucosa was bright red with no surface ulceration (Figure 1). A radiographic diagnosis of desmoid tumor was made following magnetic resonance imaging. The lesion was surgically excised, and sent for histopathological investigation. The surgeon encountered profuse bleeding while excising the lesion.



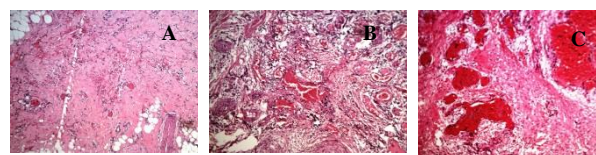
**Figure 1.** The preoperative clinical view showing a well circumscribed, non-fluctuant swelling on the right cheek

On gross examination, the biopsy specimen was brownish yellow in color measuring  $6 \times 4 \times 2$  cm, firm in consistency with adipose tissue attached to it. Sectioning of the gross specimen showed irregular areas of yellow and reddish brown discoloration (Figure 2).



**Figure 2.** Gross specimen measuring  $6 \times 4 \times 2$  cm, reddish brown in color with adipose tissue attached to it

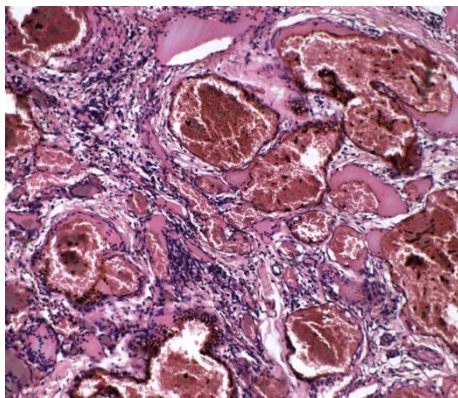
Histopathological examination using Hematoxylin and Eosin staining revealed the presence of numerous blood vessels of different sizes, with dense stroma along with longitudinal and transverse section of skeletal muscle fibers, areas of hemorrhage, and adipose tissue along with very mild inflammatory infiltrate (Figure 3).



**Figure 3.** Histopathologic examination using Hematoxylin and Eosin staining,  $\times 4$  (A),  $\times 10$  (B), and  $\times 10$  (C), showing both capillary and cavernous components with presence of numerous blood vessels of different sizes, dense stroma, longitudinal and transverse section of skeletal muscle fibres, areas of hemorrhage, and adipose tissue along with very mild inflammatory infiltration

Prominent endothelial cells were seen lining the capillaries of various sizes along with extravasated red blood cells (RBCs). Marked proliferation of endothelial cells were also observed. Very few plasma cells and lymphocytes could be seen scattered throughout stroma. Some of the medium sized vessels showed presence of organizing fibrin thrombi (Figure 4). The histopathologic diagnosis of intramuscular mixed capillary and cavernous hemangioma (venous hemangioma) was made. Further follow up through telephonic conversation with the

patient was done, and the healing was reported as uneventful.



**Figure 4.** Histopathologic examination using Hematoxylin and Eosin staining (× 40), showing capillaries with red blood cells (RBCs) along with sparse lymphocytes and plasma cells scattered throughout stroma

**Discussion**

Vascular lesions are usually classified as either hemangiomas or vascular malformations.<sup>7</sup> Difference between arteriovenous (AV) malformation and hemangioma is that, AV malformations are structural anomalies of blood vessels present at birth, and persist throughout life, showing normal endothelial cell growth which affects the capillaries, veins, or lymphatics. They are

more stable, fail to regress, and often shows signs of beating, and thrilling, and lastly do not involute. Whereas, hemangiomas are tumor-like malformations showing marked epithelial cell proliferation along with disorganized masses of endothelium-lined vessels that are filled with blood. They exhibit a rapid growth phase, followed by an involuting phase.<sup>4,8,9</sup>

Mulliken and Glowacki<sup>8</sup> elicited a most accepted classification scheme which divided the vasoformative tumors into 2 broad groups, hemangiomas and vascular malformations along with old and new nomenclatures (Table 1).

Hemangiomas involve the head and neck region in majority, and are frequently seen in whites than other racial groups.<sup>4</sup> Women are more affected than men,<sup>10,11</sup> as seen in our case. In younger children, the proliferative phase of hemangioma usually lasts for 6 to 10 months, after which the tumors slow in growth and begins to involute. By the age of 5 years, most of the red color disappears, and about 50% of all hemangiomas will show complete resolution by 5 years of age, with 90% resolving by age of 9 years.<sup>6</sup> Occasionally, older individuals are affected, as in our case.<sup>11,12</sup>

**Table 1.** Classification of vasoformative tumors by Mulliken and Glowacki<sup>8</sup>

Vasoformative tumor	New nomenclature	Old nomenclature
Hemangiomas	Capillary hemangioma	Strawberry hemangioma
	Cavernous hemangioma	Juvenile hemangioma
	Mixed hemangioma	Parotid hemangioma
Vascular malformations	Venous malformation	Cavernous hemangioma
		Hemangiomatosis
	Intramuscular venous malformation	Intramuscular hemangioma
	Capillary malformation	Capillary hemangioma
		Port-wine stain
	AV malformation	AV hemangioma
		Arterial angioma
		AV aneurysm
		Cirroidangioma
		Red angioma
	Serpentine aneurysm	
	Capillary lymphangioma	
	Cavernous lymphangioma	
	Lymphangioma	
	Cystic hygroma	

AV: Arteriovenous

Based on the histopathological appearance, hemangiomas are classified into two main type of cavernous and capillary.<sup>9,10</sup> Cavernous hemangiomas are comprised of thin-walled sinusoids or vessels which are large, along the uni-layered endothelium, and the thin septa of connective tissues separates them. On the other hand, capillary hemangiomas have numerous tiny capillaries lined by a uni-layered endothelial cells which is supported by a connective tissue stroma. Rarely, hemangiomas would show large as well as small capillaries, and are called as 'mixed hemangiomas'.<sup>4</sup>

A special type of hemangioma involving the skeletal muscle are noted in the region of head and neck, and are called intramuscular hemangioma which comprises only 0.8% of all hemangiomas. In the head and neck area, intramuscular hemangiomas are most frequently seen in the masseter muscle followed by the trapezius and sternocleidomastoid muscles. Histologically, they are seen as large and small proliferating vessels which are embedded within muscle tissue in the deep layer. They therefore have somewhat different characters from other types of hemangiomas. IHMs are usually seen in the first three decades of life, and not noticed until there is pain and enlargement. Etiological factors include hormonal change, infection, or trauma, as seen in this case.<sup>13-15</sup>

Differential diagnosis of intramuscular hemangioma should include masseteric hypertrophy, lymphangiomas, schwannomas, rhabdomyosarcomas, salivary

neoplasms, telangiectasia, angiosarcoma, and other vascular appearing lesions of face.<sup>14,3</sup>

No intervention is required in the management of true hemangioma as it resolves by itself. However, 10%-20% may require intervention because of functional compromise, behavior, stages of growth, or regeneration, and the most important factors are the size and location. Horizon of treatment includes intralesional injection of fibrosing agent, electrocoagulation, flash lamp pulsed laser, interferon alpha-2b, and surgery.<sup>2</sup> In our case, surgical approach was preferred considered on the basis of size, location, and difficulty in swallowing.

### Conclusion

Hemangioma of the oral cavity is of clinical importance, as they have a benign origin and behavior. Among the different types of hemangiomas, intramuscular hemangiomas seen in the buccal mucosa are relatively rare, and might mimic other lesions clinically and histologically. Dental surgeons must be aware of these kind of lesions and potential complication when excising such kind of lesions, as it may result in serious bleeding. Hence, the planning of the treatment modality should be done based on the diagnosis of the vascular lesions and their prognosis.

### Conflict of Interests

Authors have no conflict of interest.

### Acknowledgments

None.

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