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## Knowledge and clinical judgment of Iranian general dentists on vertical root fracture

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Mojdeh Akrami-Afshari<sup>3</sup>, Sohrab Tour-Savadkouhi DDS, MSc<sup>2</sup>

### Original Article

#### Abstract

**BACKGROUND AND AIM:** This study was conducted with the aim to investigate the knowledge and clinical judgment of Iranian general dentists and related factors on the diagnosis and treatment plan of vertical root fracture (VRF).

**METHODS:** A questionnaire was distributed among 300 general dentists who attended in Iranian General Dentists Association (IGDA) congress in 2015. The questionnaire comprised of demographic information and nine closed-end questions on the knowledge on VRFs and different treatment options and seven photographs for clinical judgment evaluation. The answers to all questions were assessed and data were analyzed by chi-square test.

**RESULTS:** 271 individuals (50.7% men and 49.3% women) participated in the study and responded the questions of the questionnaire correctively. Of the subjects, 88.3% and 76.3% had low to moderate clinical judgment and knowledge about vertically fractured teeth, respectively. The correlation between knowledge of participants attending in short endodontic courses was higher than that of those not attended in these courses; the difference between these two groups was statistically significant ( $P = 0.0005$ ). The correlation between clinical judgment, gender, past clinical activity, attendance in short endodontic courses, and field of clinical interest among participants was not significantly different ( $P = 0.1900$ ).

**CONCLUSION:** It seems that knowledge and clinical judgment are weak among general dentists requiring serious improvement. Fortunately, short endodontic courses may improve their knowledge of diagnosis and interventions related to teeth undergoing VRF.

**KEYWORDS:** Surveys and Questionnaires; Judgment; Dentists; Tooth Fractures; Tooth Root

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Vertically fractured teeth may cause post-endodontic complications, leading to immature tooth loss and many expensive alternative treatments. The vertical root fracture (VRF) may be a longitudinally or diagonally oriented root fracture.<sup>1</sup> A complete VRF extends from one external root surface to the other side and causes endodontic and periodontal communications.<sup>2,3</sup> The diagnosis of VRF is a challenge among general dentists and even endodontists, since its signs, symptoms and

radiographic features are not definitive or completely pathognomonic and may imitate periodontal disease or endodontic reinfection.<sup>4,5</sup> Two common causes of VRFs in root-filled teeth are improper post placement and excessive use of force during root canal filling procedures.<sup>6,7</sup> In addition, a vertically fractured tooth has been reported in non-endodontically treated teeth.<sup>8</sup>

Management of VRFs usually has a poor prognosis and the selection of a suitable treatment procedure can be confusing for

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most clinicians. Treatment of multi-rooted teeth compromised with VRF can be performed by resecting the involved root.<sup>9</sup> Conversely, single-rooted teeth usually are along with a poor prognosis, leading to tooth loss.<sup>10</sup> Furthermore, the time of VRF detection is also important since proper and early diagnosis may help prevent rapid bone loss and periodontal destruction, which has very negative impact on implant placement.<sup>11</sup> Appropriate and immediate diagnosis would prevent the waste of time and money for patients and dentists. Thus, one of the most important learning objectives in endodontics is training of general dental practitioners (GDPs) to detect and manage VRFs.<sup>12</sup> This study was undertaken to investigate the

Iranian GDPs' knowledge and clinical judgment and related factors on the diagnosis and treatment plan of the VRF.






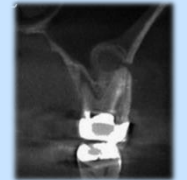
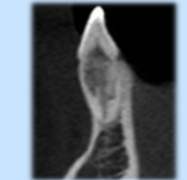
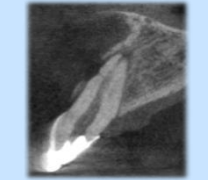
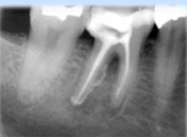

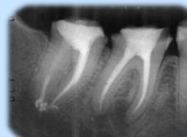
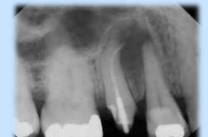
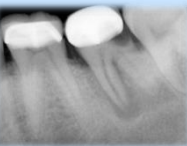

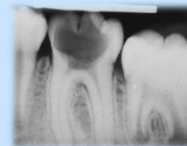








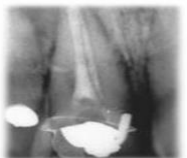
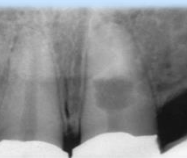
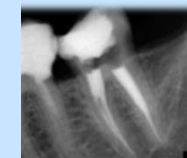

## Methods

In this descriptive cross-sectional study, 300 Iranian general dentists attending Iranian General Dentists Association (IGDA) congress in 2015 were assessed. A questionnaire was prepared and distributed among them in the 3-day period of the congress program. The questionnaire included demographic information and 9 closed-ended questions to check the knowledge of the subjects on the VRF and its treatment options and seven photograph-related questions for clinical judgment evaluation (Table 1).

**Table 1.** The questioner focusing on the knowledge and clinical judgment of general dental practitioners (GDPs) on vertical root fracture (VRF)

Which sentence can introduce the VRF better? Answer (A)	A) a vertically fracture which propagates from the root B) a vertically fracture which propagates from the crown C) a vertically fracture that always occurs in the endodontically treated teeth D) a vertically fracture which always seen in mesial-distal direction
Which one is the most important predisposing factor of VRF in endodontically treated teeth with full crowns? Answer (C)	A) Full ceramic bridges B) Cantilevers C) Teeth with intra-canal posts D) Single crown PFMs in incisors
Which one is the least important predisposing factor for VRF? Answer (C)	A) Root canal therapy B) Intra-canal post C) Age D) Para functional habits
What is the most prevalent symptom in VRF teeth? Answer (A)	A) Pain on chewing B) Rebound pain when the force is removed from the teeth C) Sensitivity to cold D) Sensitivity to percussion test
Which one is the definitive diagnostic method for VRF? Answer (C)	A) Periapical radiographs B) CBCT radiographic image C) Surgical flap removal and trans illumination D) Vitality, percussion and palpation tests
What is the treatment of choice in vertically fractured teeth? Answer (A)	A) Surgical removal the fractured teeth or root B) Wait and see C) Apicoectomy surgery D) Preventing the crack propagation by crown placement
Which direction of crack propagation is most prevalent in vertically fractured teeth? Answer (A)	A) Bucco-lingual direction B) Mesial-distal direction C) Both bucco-lingual and mesial-distal directions D) Depends on tooth position
Which one of the following teeth is more subjected to VRF? Answer (A)	A) Mandibular molars B) Maxillary molars C) Mandibular premolars D) Maxillary premolars

**Table 1.** The questioner focusing on the knowledge and clinical judgment of general dental practitioners (GDPs) on vertical root fracture (VRF) (continue)

<p>What is the first diagnostic step in a patient with pain on chewing over an endodontically treated tooth with perfect post and crown?</p>	<p>A) Bite wing radiograph                  B) CBCT radiograph                  C) Crown and post removal and direct detection for cracks visually                  D) Surgical flap removal and trans illumination</p>			
<p>Answer (A)                  Which one the figures can better show the VRFs feature?                  Answer (A)</p>	<p>A)  </p>	<p>B)  </p>	<p>C)  </p>	<p>D)  </p>
<p>Which one should be extracted secondary to VRF?                  Answer (B)</p>	<p>A)  </p>	<p>B)  </p>	<p>C)  </p>	<p>D)  </p>
<p>Which one the periapical radiographs can better show the VRFs feature?                  Answer (A)</p>	<p>A)  </p>	<p>B)  </p>	<p>C)  </p>	<p>D)  </p>
<p>Which one has the poor prognosis for endodontic treatment?                  Answer (A)</p>	<p>A)  </p>	<p>B)  </p>	<p>C)  </p>	<p>D)  </p>
<p>Which one has the poor prognosis for periodontal treatments?                  Answer (A)</p>	<p>A)  </p>	<p>B)  </p>	<p>C)  </p>	
<p>Which one is the pathognomonic feature of VRF?                  Answer (D)</p>	<p>A)  </p>	<p>B)  </p>	<p>C)  </p>	<p>D)  </p>
<p>Which one has the hopeless prognosis?                  Answer (A)</p>	<p>A)  </p>	<p>B)  </p>	<p>C)  </p>	<p>D)  </p>

VRF: Vertical root fracture; CBCT: Cone beam computed tomography; PFMs: Porcelain-fused-to-metals

The questions were designed in a multiple-choice format, in addition, the correct and incorrect answers were given a score of 1 and 0, respectively. The total scores of the knowledge or clinical judgment were obtained as percentage of correct answers to the whole questions. The volunteers who had not clinically practiced for the past two years or had not completely answered the questionnaire, were excluded from the study. The related variation factors like gender, clinical experience (before or after five years), field of interest and recent attendance in short endodontic courses were recorded. Moreover, 7 imaginary vertically fractured cases as photographic or radiographic images were used to determine the clinical judgment of the subjects. The questions were designed based on a review study on VRFs designed in the endodontic treatment, including: diagnostic signs and clinical management, pathogenesis, bone resorption patterns, incidence, clinical signs and symptoms, radiographic features, diagnosis, etiology and management discussed.<sup>13</sup>

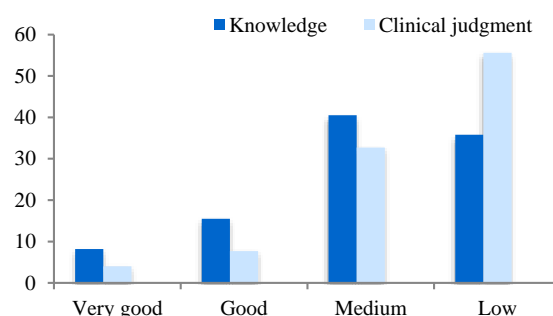
The closed-ended questions were related to the diagnostic tools, criteria and treatment plan to collect information on dentists' knowledge regarding the diagnosis and management of vertically fractured tooth. The reliability and validity of the questionnaire has been already pre-tested and modified in a population of Islamic Azad University academic teachers consisting of 20 general dentists, endodontists, oral surgeons and radiologists in an interval of 2 weeks and was calculated to be 83.8% level of reliability. The questionnaire was designed so that the participants could answer the questions in 20 minutes.

The degree of knowledge and clinical judgment of participants were defined to be very good, good, medium and low. The data were analyzed using the chi-square test in the SPSS software (version 20, IBM Corporation, Armonk, NY, USA).

## Results

A total of 300 individuals initially participated in the study. 16 individuals were excluded from the study due to the lack of clinical activity and 13 individuals had not completed the questionnaire. Therefore, 271 participants remained, on which the statistical analysis was performed. Of these 271 individuals, 50.7% and 49.3% were men and women, respectively. In addition, 35.0% and 65.0% of the individuals had lower and higher than 5 years of the clinical activity experience, respectively. Regarding the clinical interest of the general dentists, the highest and lowest incidence of attitude among them were endodontics and pediatric dentistry as 20.7% and 5.7%, respectively.

The attitude towards knowledge and clinical judgment with respectively 35.8% and 55.6% was weak among the general dentists. According to figure 1, there is a statistical difference between knowledge and clinical judgment ( $P = 0.0100$ ).



**Figure 1.** The difference between knowledge and clinical judgment of participants

The correlation between the knowledge, gender, past clinical activity and field of clinical interest of the participants was not significantly different ( $P = 0.1800$ ), however, participants with an experience of attending the short endodontic courses had higher knowledge on VRF than others ( $P = 0.0005$ ) (Table 2). It is noteworthy that, the correlation between the clinical judgment, gender, past clinical activity, attendance in short endodontic courses and field of clinical interest was not significantly different among the participants ( $P = 0.1900$ ) (Table 3).

**Table 2.** Correlation between knowledge and demographic properties of the participants

Demographic properties	Knowledge	Good and very good (%)	Medium and low (%)	P
Gender	Men	57.1	48.3	0.1800
	Women	42.9	51.7	
Clinical activity	More than 5 years	45.7	30.9	0.2000
	Under 5 years	54.3	69.1	
Attendance in short courses	Yes	68.6	56.6	0.0005
	No	31.4	43.4	
Field of clinical interest	Endodontics	37.1	18.5	0.1800
	Pediatrics	2.9	6.0	
	Restorative	11.4	14.3	
	Prosthodontics	8.6	12.8	
	Periodontics	20.0	11.3	
	OMF surgeries	5.7	11.7	
	Orthodontics	2.9	12.5	

OMF surgeries: Oral and maxillofacial surgeries

### Discussion

The main idea behind all the questions designed for knowledge assessment contained definition of VRF, predisposing factors, patients' signs and symptoms, radiographic features, other diagnosis tests and treatment options. Moreover, the photograph-related questions for assessing the clinical judgment were based on clinical features, periapical x-ray and cone beam computed tomography (CBCT) radiographs. According to the results of the present study, the level of the participants' knowledge and their clinical judgment on VRF was unacceptable.

Valenca et al. evaluated the knowledge on crown-root fractures among academic professors and their students of a school of

dentistry. They concluded that all professors and students who attended in any endodontic and surgery disciplines had a suitable degree of knowledge; however, students who had not attended any disciplines presented a poor knowledge.<sup>14</sup> Furthermore, the importance of short endodontic courses for improvement of dentists' knowledge on diagnosis and management of root fractures was remarked in this study compared with the present study.

In a clinical study on the evaluation of the endodontically treated vertically fractured teeth, it was found that only one-third of GDP could correctly diagnose the vertical fractured teeth. This study indicated a poor knowledge of GDP on diagnosis of vertically fractured teeth compared to our study.<sup>15</sup>

**Table 3.** Correlation between clinical judgment and demographic properties of participants

Demographic properties	Clinical judgment	Good and very good (%)	Medium and low (%)	P
Sex	Men	56.3	47.2	0.1900
	Women	43.7	52.8	
Clinical activity	More than 5 years	22.5	35.8	0.2000
	Under 5 years	77.4	46.2	
Attendance in short courses	Yes	78.9	51.5	0.1900
	No	21.1	48.5	
Field of clinical interest	Endodontics	28.2	18.3	0.1800
	Pediatrics	2.8	6.6	
	Restorative	15.5	13.5	
	Prosthodontics	11.3	12.7	
	Periodontics	16.9	10.9	
	OMF surgeries	7.0	12.2	
	Orthodontics	4.2	13.5	

OMF surgeries: Oral and maxillofacial surgeries



Re et al. evaluated the knowledge of Italian dentists on treatment of traumatic dental injuries. They concluded that the level of knowledge in the group of dentists working in hospitals and those who attended in post-graduate courses in traumatology was heterogeneous. In fact, the management of traumatic dental injuries was problematic based on the type of injuries.<sup>16</sup> This study shows the importance of post-graduate courses to increase GPD's knowledge on the diagnosis and management of dental traumatic injuries.

In an in-vitro study conducted by Hassan et al. on the detection of vertically fractured teeth endodontically treatments by a CBCT scan, it was demonstrated that the accuracy of CBCT (0.86) for detection of vertically fractured teeth was higher than the periapical radiographs (0.66).<sup>9</sup> Therefore, we considered both types of radiographs in our questions.

This type of study is required in any dental society to determine the status of knowledge and clinical judgment among general dentists who are in the first front in diagnosis and treatment of vertically fractured teeth. Definitely, the higher level of the related

knowledge and clinical judgment among the general dentists can improve the quality of dental treatment and prevent waste of time and money in the condition of improper diagnosis and management of VRFs.

Although the number of dentists participating in the study (n = 300) is relatively high, results cannot be generalized to the entire Iranian general dentists; moreover, further studies are required to evaluate the knowledge and clinical judgment of dentists who have followed different educational experiences in order to compare their effectiveness.

### Conclusion

It seems that the knowledge and clinical judgment of general dentists are in low levels needing serious improvement. Fortunately, short endodontic courses may improve their knowledge of diagnosis and management of vertically fractured teeth.

### Conflict of Interests

Authors have no conflict of interest.

### Acknowledgments

None.

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## Dental students' opinions on the challenges and research opportunities: A qualitative research

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### Original Article

#### Abstract

**BACKGROUND AND AIM:** The first step to improve research in a society is a true understanding of abilities, available possibilities, and also the strengths and weakness of research projects. The purpose of this study was to survey the students' ideas about research challenges and opportunities among dental students of Kerman, Iran.

**METHODS:** In this qualitative action research, personal and group depth interviews with students of 3<sup>rd</sup> to 6<sup>th</sup>-year of the study were performed. The data were collected by interview and focus group discussions, and oral explanations, and ideas of interviewees were recorded. In these interviews, the questions were about the quality of research performance, the procedure of completing the plans and thesis, and research challenges and opportunities. Performed interviews were depth, unstructured, and semi-structured interviews. After recording, the interviews were written by an undergraduate dental student, and participants' ideas were reviewed separately and coded by two researchers and continued to data saturation phase. Finally, data were analyzed and classified by content analyze, and the number of participants was specified.

**RESULTS:** Totally, in this study, the most of research challenges and opportunities were lack of teacher's tendency to research works, little motivation of students, not enough information and little knowledge of students about the value of research work and plans, not encouraging the students to search the subject, not training, incorrect projects about research work, lack of proper site in college, lack of research atmosphere in college, not emphasizing on research, and few number of researcher teachers. Also, no interviewee mentioned the factors such as research opportunities in dental university.

**CONCLUSION:** Various personal, intra-institutional, extra-institutional, modality and attitude factors are barriers to research, based on the opinions of students. It should be pointed out that in this research nobody mentioned the factors like research opportunities as the barrier of research.

**KEYWORDS:** Qualitative Research; Opportunities; Dental Students

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Currently, the importance and necessity of research studies are well-established. Research is the bedrock of sustainable development, construction and independence of all the countries.<sup>1</sup> In addition, one of the most important factors for the growth and development of each country is to nurture

research studies. Universities and higher educational institutes have three responsibilities including producing knowledge, training experts and providing technical services for the community. It is obvious that promotion of knowledge and progress in science depend on research results in universities and finding solutions

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for the problems in the community to pave the way for the promotion of research activities in future.<sup>1,2</sup> There is a high probability that students who are actively engaged in research will complete specialty educational courses and become the academic faculty members to teach and improve research in the future.<sup>2</sup>

In addition, it should be pointed out that production of science and knowledge is only possible through research and only knowledge and science-based development could be considered sustainable.

Production of scientific outcomes would increase the knowledge and pave the way for technology, which eventually results in the creation of jobs, wealth, social comfort, and security.<sup>3</sup> It is not possible to nurture creative talents to produce science and bring about participation in the countries' development without making the university students familiar with research in their lives and daily activities.<sup>4</sup>

Currently, all the industrialized and developing countries are trying to increase research investments. In this context, industrialized countries invest in research activities to maintain their position or promote their superiority in the global competition. Developing countries have also realized that they have no choice except for making investments in research activities in order to make real progress and achieve development and radically solve their social, health and economic problems.<sup>4</sup> Therefore, it can be claimed that there is a direct correlation between research and real progress in each country.<sup>5</sup>

The first step to organize research activities in the community is to reach a correct understanding of the existing abilities and facilities and to understand the weaknesses and strengths of research programs. Researchers believe that the most important barriers to research studies are deficiencies in facilities and equipment, complicated administrative regulations, lack of positive attitudes of executive managers toward the benefits of

research, lack of access to information sources, lack of adequate funding, low research wages, difficult and long procedures for receiving grants for research plans, and lack of research skill and motivation.<sup>5</sup>

Currently, the importance and necessity of research are well-established. Research is the foundation of independence and the overall development and reconstruction of all the countries all over the world. The chief gap between the industrialized and developing countries lies in differences between their research activities.<sup>5</sup> Production of science and knowledge is only possible through research, and science and knowledge-based development is the only development that can be considered sustainable. It is only possible through familiarizing of students with research in their lives and daily routines to nurture their creative talents and engage them in the production of science and make them participate in the country's development.<sup>6</sup>

Studies carried out on the attitudes prevailing in our universities toward scientific research have shown that attending the university for a short time (6 months) is adequate for students to realize the differences between their speculations and the realities of this educational system. This claim is substantiated by a decrease in students' tendency for participating in research activities and the difference between their speculation about research activities of university academic staff members and the realities.<sup>7</sup> Suggestions have been made that different strategies can increase the engagement of dental students in research activities. However, an important consideration in the dental education is to identify factors that facilitate the participation of students in research activities or prevent it.

The aim of this study was to determine the students' opinions on the challenges and research opportunities in the Faculty of Dentistry, Kerman University of Medical Sciences, Iran.

## Methods

In the present comprehensive action research,

in-depth interviews were carried out in the group and individual settings with a number of dental students (3<sup>rd</sup> to 6<sup>th</sup> year) in Faculty of Dentistry, Kerman University of Medical Sciences.

Data were collected through interviews and focus groups and the opinions and oral ideas of the interviewees were recorded. The interviewees were divided into 5 groups. There were 8 dental students in each group because the participants had many valuable experiences to explain.

Despite the fact that the study had been designed in a manner to eliminate the effect of sex on the participants' opinions, an attempt was made to include students from both sexes in each study group. In addition, an attempt was made to include students in the groups from different educational levels.

The students were asked to make appointments to be interviewed. Two researchers took part in all the interview sessions, as an interviewer and an observer (2 dental students). The first researcher was responsible for carrying out the interview and the second one recorded them. The two researchers reached an agreement before the interviews on how to carry them out.

Each interview lasted at least 45 minutes. Before the interview, an oral consent was obtained from the students and they participated in the study at their own will. During the interviews, questions were asked on how research is carried out, how the research plans and themes become operational, the barriers to research and research opportunities. In addition, the students' general ideas about research were questioned. The interviews were in-depth, open and semi-structured. At the beginning of each interview, the general questions were asked, followed by more specific questions in order to avoid a general discussion. An attempt was made to pose the questions simply without any prejudgments. In addition, at the beginning of each interview, the interviewer explained the aims of the study to the participants. In order to carry

out a better interview, each subject was given adequate time to express his/her opinions completely so that his/her experiences and attitudes could be evaluated in each field. During the interviews, the interviewer used prompters such as "could you please explain this further?" and "could you please give us an example?" for further expansion of the subject in each field.

At the end of each section of the interview, the results of the interview were summarized and summed up for the group members to make sure of the accuracy of the opinions expressed.<sup>8</sup> After recording the interviews, the interviews were written down by a last-year dental student and participants' ideas separately were reviewed and coded by two researchers and continued to data saturation phase. Finally, data were analyzed using the content analysis technique. The analyzed data were then classified and the number of respondents in each class was determined. In addition, in order to increase the scientific accuracy of the study and determine its validity, the codes of each interview were again submitted to the participants to make sure of the understanding of the researchers of the students' opinions. All steps of the study are illustrated in figure 1.

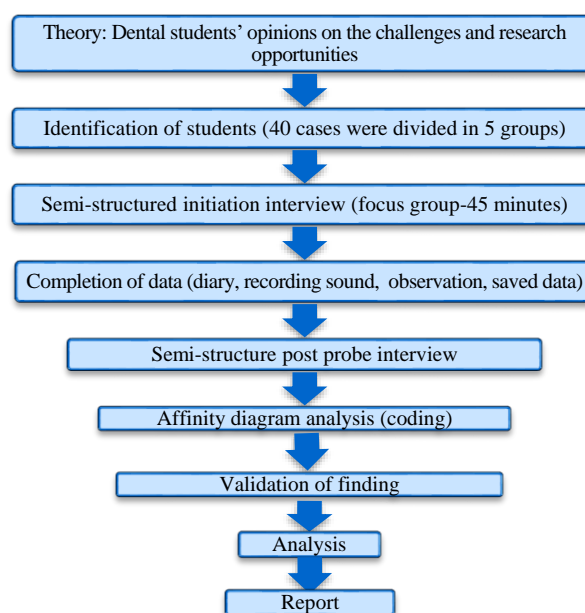


Figure 1. Steps of the qualitative study

**Table 1. Categories and subcategories in study**

Categories	Subcategories
Organizational problems	Financial restraints (7 students)
	Lack of access to the full texts of articles (4 students)
	Lack of faculty membership invalid websites (6 students)
	Lack of scoring of research works (4 students)
	Lack of acknowledgment of research works (3 students)
	Lack of an organized body for research in the faculty (4 students)
	Lack of an appropriate location for research in the faculty (7 students)
	Lack of attention to the aims of the students (4 students)
	Insufficient research opportunities during basic sciences courses (3 students)
	A long process of ratification of research plans (3 students)
	Absence of a research atmosphere in the faculty (8 students)
	Low-speed internet connections (5 students)
	Professors problems
Students' low motivation (5 students)	
Professor's disagreement with the students' research activities (6 students)	
Low appraisal of research works by professors (5 students)	
Professors not considering education and research as important (7 students)	
Student problem	A limited number of professors engaged in research activities (8 students)
	Inadequate information and students' low knowledge level in relation to the value of research plans and works (9 students)
	Lack of interest in easy jobs and high expectations of students (2 students)
	Lack of appraisal of students for searching for information (7 students)
	Lack of institutionalization of research in students (4 students)
	Low tendency of students toward research works due to a large volume of practical courses (4 students)
Educational problems	Lack of coordination between theoretical lessons and research works (3 students)
	Excessive attention to theoretical lessons (6 students)
	More research opportunities in other fields (5 students)
	Lack of education and correct programming in relation to research works (10 students)
	Interferences between research activities and studying (6 students)
	Poor information in relation to research (3 students)

## Results

The in-depth interviews were performed with 40 dental students. 13 subjects (32.5%) were men and 27 (67.5%) were women. The mean age of the subjects was  $20.8 \pm 1.6$  years, ranged from 21 to 45 years. The interviewees were divided into 5 groups. There were 8 dental students in each group because the participants had many valuable experiences to explain.

Data were coded and then the codes were categorized. The student-related codes and the number of students responding to each code listed in table 1.

In the present study, major themes were categorized into 4 key issues, including organizational, professors, student and educational problems.

Each of the remaining 6 codes acquired

from the students had been expressed by two students, the most important of which were assigning specialty research plans to students, taking part in the 6-year course for being engaged in research activities, time-consuming nature of research, poor English language knowledge of students, students not asking questions, differences in scoring and the students' tendency for preparation of educational materials.

In general, the carried out evaluations showed that the chief research challenges and barriers were lack of interest of professors to engage in research, low motivation of students, inadequate information and awareness of students in relation to the value of research works and plans, lack of student encouragement to search subjects, lack of correct education and programming related

to research works, lack of an appropriate location in the faculty for research activities, lack of a research atmosphere in the faculty, not considering research as an important plan from the point of view of professors, and a limited number of professors engaged in research activities.

It should be pointed out that none of the interviewees mentioned factors as research opportunities in the Faculty of Dentistry. In addition, the students suggested the following considerations to improve the research status of the faculty and the university: Professors should spend more time on the research work of students, promotion of research skills should begin at school, professors should discuss research work in classes, an appropriate location should be prepared by the faculty for research activities, workshops should be designed for research activities, notifications should be improved in relation to research works in the dental field, and research work should begin with easy subjects.

### Discussion

The present study evaluated the research barriers and opportunities based on the opinions of dental students in Kerman University of Medical Sciences.

Increase in the research activities in each country results in the development and progression, self-sufficiency and true independence. There is a direct relationship between research and the true progress of every country. No country is able to achieve sustainable and real social development unless the strategically applied research achievements of the country are used for improving the social, cultural, economic and educational programming. Otherwise, such a country will always need the outcomes and technology of other countries. In addition, it is very important to evaluate the barriers of research activities and it is the responsibility of researchers in each scientific field to describe the debility and distinguish that field based on their own and other researchers' experiences.

The present study showed that the greatest barriers to research, based on the students' opinions, were personal factors (low student motivation, low level of students' knowledge in relation to the value of research works and activities), organizational/administrative (lack of encouragement for students to search for subjects, insufficient information, lack of correct education and programming for research works), economic/financial (financial restraints), equipment/facilities (lack of a proper location for research activities in the faculty, lack of membership of the faculty in valid websites), and social/environmental (lack of a research atmosphere in the faculty, not considering research and education important from professors' point of view, an inadequate number of students engaged in research, lack of tendency on behalf of students for research works). It should be pointed out that in this study, none of the students mentioned factors as research opportunities.

Researchers have reported the following factors as barriers of research activities: inadequate equipment and facilities, complicated administrative regulations, lack of a positive attitudes on behalf of administrators toward the benefits of research, a high level of preoccupation, lack of access to data sources, lack of proper funding, low research wages, difficult and long process of receiving grants for research plans, and lack of research skills and motivation. A decrease in researchers' motivation is attributed to incorrect policies, not providing financial needs, mismanagement and an inappropriate atmosphere.<sup>5</sup>

Hamilton compared different studies on the subject and reported that the reasons for the academic staff members' lack of interest in carrying out research were factors such as lack of time, lack of adequate skills for carrying out research, lack of support for researchers, an excessive workload, financial restraints and lack of interest and motivation.<sup>8</sup>

Culpepper and Franks concluded that the

most important barriers to research in medical faculties consisted of lack of financial resources, lack of research skills, and lack of examples, respectively.<sup>9</sup> The study carried out by Culpepper and Franks showed that the majority of academic staff members believed that personal factors were unimportant and of all the other factors, organizational/administrative, economic/financial, facilities/equipment and social factors were the most important, respectively<sup>9</sup> that is similar to Kangai and Mapolisa study.<sup>10</sup>

Farmanbar and Asgari carried out a study to determine factors preventing research activities based on the opinion of the academic staff members of Guilan University of Medical Sciences, Iran, and reported that 71% of them believed that organizational/administrative factors were the most important factors in this respect.<sup>11</sup>

Azila-Gbette et al.<sup>12</sup> showed that inaccessibility to journal articles and textbooks, and lack of internet services are some of the main institutional factors that challenged dissertation writing. In addition, inadequate funding, lack of students' commitment and motivation to write and limited library skills, and poor time management are critical students-related factors which are similar to Kangai and Mapolisa,<sup>10</sup> Pakdaman et al.,<sup>13</sup> and Sadeghi et al.<sup>14</sup> studies.

This study represented that economic/financial deterring factors were reported by 7 students and they believed that such factors are very effective in deterring research activities, consistent with Shirahatti et al.<sup>15</sup> study. Students believed that factors such as allocation of inadequate budget for research plans, delays in paying the costs of the research plans, lack of grants for research plans with high costs, and paying the cost of the research plans by the students were the most important economic/financial factors that prevented research activities.

Yaghoubi reported that a lack of institutionalization of research in our country and allocating a very small portion of the

country's to research are the extra-institutional barriers to research activities.<sup>16</sup> Other similar studies have shown that academic staff members and students do not receive proper wages for their research activities.<sup>17-20</sup> Therefore, it is necessary for universities to pay more attention to such problems and allocate adequate budget to research activities and solve such a problem.

Factors such as equipment/facilities are very important for carrying out research based on the opinions of students. In this context, lack of access to facilities and equipment, lack of an appropriate location for carrying out research, the low internet speed and lack of access to journals were factors mentioned by students. Farmanbar and Asgari,<sup>11</sup> and Sabzevari et al.<sup>20</sup> believed that it is tiresome to prepare an independent and suitable location for research, consistent with the present study. In relation to sources and library facilities, the attitudes of more than 50% of students were inclined toward poor. The results of the present study were consistent with those of Zohor and Fekri.<sup>21</sup> The results of a study on 300 students in Yasuj, Iran,<sup>22</sup> also showed that an internet and computer center has a role in research activities and library sources meet the needs of students in relation to research, consistent with the results of studies carried out in Tabriz, Yasouj and Qazvin Universities of Medical Sciences, Iran.<sup>23</sup> Therefore, the adequate budget should be allocated to universities and research centers to provide the required equipment and facilities.

The absence of a research atmosphere in the faculty, the professors' opinion in relation to the insignificance of education and research, the limited number of professors who are engaged in research and lack of their interest in research activities were a barrier to research, based on the students' opinions. Hamilton reported that the long hours of teaching by the university academic staff members to satisfy their financial needs of their lives and their obligation to teach in different educational centers were obstacles



to research activities in higher education.<sup>9</sup> In addition, Talebi reported in the engineering field that usually the professors spend a lot of time on education and spend less time on research.<sup>24</sup> Ferdosi et al. reported that the most important barriers to the use of research results were management and administrative barriers,<sup>25</sup> consistent with the results of studies by Sabzevari et al.<sup>20</sup> Kadivar reported that the universities in Iran, in the first place, have become centers for education and evaluation of the regulations. In this respect, he showed that teaching wages are higher than research wages. In addition, the scores assigned to research are even less than those assigned to the translation of a small book and having administrative responsibilities such as the group manager, deputy dean and faculty dean provides greater scores for university professors. Therefore, individuals get involved in research under such conditions only based on their personal interest.<sup>26</sup> Such a decrease in research activity and a decrease in the number of students carrying out research have been reported in medical universities in the USA.<sup>27-30</sup> Therefore, it is possible to overcome such a problem by decreasing the number of teaching hours, preventing professors from being engaged in several activities and modifying the existing regulations.

Another factor which was mentioned by students as a barrier to research was a lack of institutionalization of research works (6 students). Hamilton believed that in order to institutionalize research activities individuals, an organization unit or a specific body should shoulder responsibility for research and constantly be responsible for this subject.<sup>8</sup>

In the developing countries, usually, the authorities try to immediately solve economic, social and political problems and pay less attention to research because the research results are used some years later. In this context, these countries will not achieve sustainable and social development as long as the authorities do not use the results of

research activities in decision-making processes and in social, economic and educational programming. Currently, there is a large gap between our country and many other countries in the production of science and knowledge. For example, in South Korea and the USA, one scientific article has been published per one thousand and 6 thousand of the population, respectively. But in Iran, this rate is one article for every 120000 of the population. In addition, studies have shown that the articles published by Iranian researchers have been of lower quality.<sup>20</sup>

The authors of the current study have suggestions to overcome the barriers to research, including strengthening the motivation of professors and students with regard to the facilities and privileges for faculty, strengthening the number of faculty members in order to reduce the number of units required to teach, strengthening management like increasing space and laboratory facilities, broadening access to information resources like high-impact papers, increasing research funding and expediting the payment, inspection at various stages of the project, and shortening the duration of approved research projects and theses.

### Conclusion

The major barricades to research, based on the students' opinions, were personal factors, organizational/administrative, equipment/facilities, and social/environmental. It should be pointed out that none of the students interviewed in the present study mentioned any factors as research opportunities.

### Conflict of Interests

Authors have no conflict of interest.

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## Evaluation of salivary glucose levels among children with early childhood caries compared to children with healthy teeth

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### Original Article

#### Abstract

**BACKGROUND AND AIM:** The present study was carried out with the aim to evaluate the salivary glucose levels among children with early childhood caries (ECC) compared to a group of healthy children without any caries and help control ECC.

**METHODS:** 55 children with an age range of 5-6 years were selected from some kindergartens. Then the subjects were divided into two groups of with ECC & without ECC as test and control groups, respectively, then they referred to the Pediatric Dentistry, School of Dentistry, Kerman University of Medical Sciences, Kerman, Iran. The salivary samples were collected from the subjects at 8 to 9 in the morning and sent to the laboratory to determine the salivary glucose levels. Data were analyzed using t-test with a significance level of  $P < 0.05$ .

**RESULTS:** The mean salivary glucose level among girls and boys with ECC were  $0.11 \pm 0.06$  and  $0.15 \pm 0.12$  mmol/l, respectively, with  $0.11 \pm 0.07$  for girls and  $0.13 \pm 0.05$  mmol/l for boys in the control group. There was no significant difference between ECC and control groups in terms of the salivary glucose levels ( $P = 0.61$ ).

**CONCLUSION:** The present study showed no significant difference in the salivary glucose levels among children with ECC and the control subjects.

**KEYWORDS:** Dental Caries; Saliva; Glucose; Children

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Primary teeth have an important role in feeding during childhood. Moreover, they have a great role in maintaining space for permanent teeth. Therefore, preventing caries in deciduous teeth during childhood is of great importance.<sup>1,2</sup>

An especial academy in America defined early childhood caries (ECC) as the presence of carious lesion(s) on a tooth or several teeth, with or without cavities, loss of teeth due to decay or restored teeth among children under the age of 6 years.<sup>3</sup> ECC is a chronic type of dental caries present among the very young children, with several etiologic factors.<sup>4</sup> The

incidence of ECC has been reported to be 6-90% at a global level<sup>5</sup>, inflicting heavy costs on families and health systems. Therefore, adopting beneficial measures both financially and from an individual health viewpoint, seems necessary to decrease the incidence and severity of ECC.

Dental caries is a multifactorial condition in which, the role of each etiologic agent might be independent of other factors or they might exert synergistic effects on each other. Quality and quantity of saliva is one of the most important factors affecting an individual's susceptibility to the caries

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development. It has been shown that the caries rate among patients with salivary gland disorders or with metabolic conditions, like diabetes, which result in changes in salivary composition, is significantly higher than individuals normal saliva quality and quantity levels.<sup>6,7</sup>

One of the most important ingredients of saliva is its sugar content which originates from the fermentation of simple sugars found in foodstuffs, or found in the oral cavities due to salivary secretions. The saliva sugar content has a very important role in preserving the equilibrium between microorganisms found in the oral cavity. Therefore, any change in the composition of saliva sugar content can cause increase in the activity caused by the cariogenic bacteria, increasing the rate of caries on various tooth surfaces.<sup>8-10</sup>

Some previous studies have evaluated the composition of saliva among patients with systemic conditions<sup>11-14</sup>; however, based on the best of our knowledge, no study to date has been conducted on the comparison of the salivary glucose levels among children with ECC and caries-free children, therefore, the present study was undertaken to conduct this comparison.

## Methods

This case-control study was approved by the Ethics Committee of Kerman University of Medical Sciences, Kerman, Iran, under the code REC.1394.589. The study population consisted of the children attending some kindergartens in Kerman and the children referring to the Department of Pediatric Dentistry, School of Dentistry, Kerman University of Medical Sciences. The sample size was calculated as 50 ( $n = 25$  in each group) based on similar previous studies and divided into two groups of case and control.<sup>15</sup>

The inclusion criteria consisted of ECC and lack of ECC among children and an age range of 5-6 years (due to lack of compliance in 4-year-old children, the age group of 5-6 years underwent a sampling procedure).

The parents or guardians of children attended the department of pediatric dentistry. Then the researchers explained the study for them and wanted them to sign the written informed consent.

The exclusion criteria consisted of suffering of systemic conditions (diabetes and any chronic condition), affliction with dental anomalies like enamel and dentin developmental anomalies.

The children under study were clinically examined in dental unit by the mirror and explorer and assigned to two groups: The case and control groups consisted of children with ECC and the caries-free children, respectively. ECC included presence of one or several carious surfaces on a tooth or several teeth, with or without cavities, loss of teeth due to caries or restored teeth among the children.<sup>3</sup>

On the test day, the children were taken to the test environment. Then, each child was first given a packet of milk (200 ml, produced by Mihan dairy Company) and a pack of cake (50 g, produced by tiny food products Company), all with the same size and shape. The milk and cake packets were sold in the kindergarten buffets. After 1 hour, during which the children did not eat or drink anything else, their stimulated salivary samples were collected. In order to collect the samples, a piece of odorless and inert paraffin (GC, Japan) was given to each child and asked him/her to chew and then evacuate his/her saliva into a sterile container provided by the laboratory. The salivary samples were collected and transferred to the laboratory to determine the salivary glucose concentrations. The samples were kept at  $-20^{\circ}\text{C}$  to be used in the study tests.<sup>16</sup> The total volume of saliva collected from each subject was 0.5-1 ml.

An enzymatic technique and a glucose kit (Diorax Fars, Iran) were used to determine salivary levels of glucose by a Technicon RA-100 AutoAnalyzer (Technicon, Germany).<sup>14</sup>

Data were analyzed with 21. In order to analyze data, the t-test was used to compare

the glucose salivary levels between the two groups and genders in the SPSS software (version 21, IBM Corporation, Armonk, NY, USA).

### Results

In this study, the glucose levels were evaluated and compared among children with ECC and caries-free children. In the ECC group, there was no significant difference in mean glucose levels between the two genders ( $P = 0.27$ ). In the control group, the difference in the mean salivary glucose between the two genders was not significant ( $P = 0.39$ ).

Statistical analyses showed no significant difference in the mean glucose levels between the ECC and control groups ( $P = 0.61$ ).

The results showed that the glucose level for girls in the test and control groups was 14 and 13 with mean and standard deviation of  $0.11 \pm 0.03$  and  $0.11 \pm 0.05$ , respectively ( $P = 0.17$ ). Moreover, this rate for boys was 14 in the test and control groups with mean and standard deviation of  $0.15 \pm 0.05$  and  $0.13 \pm 0.06$ , respectively ( $P = 0.37$ ). Based on these results, there was no significant difference between the two groups for both girls and boys.

### Discussion

According to the present study there was no significant difference in the mean salivary glucose concentrations between the two groups.

A few studies have been carried out on the possible relationship between salivary glucose concentration and dental caries. Vibhakar et al.<sup>16</sup> studied the possible relationship between salivary glucose levels and dental caries. The results showed an increase in the dental caries index with an increase in salivary glucose levels. In addition, there was an increase in dental caries rate with age. The present study is somehow different from the above study, which was carried out on permanent teeth, however, the present study was carried out on children with ECC and caries-free children

with an age range of 5-6 years. Therefore, evaluation of the relationship between age and dental caries was not possible in the present study. Furthermore, there was no significant difference in saliva glucose content among the two groups, which might be referred to the fact that the most the important etiologic factors for ECC among children are the mother's oral health and the child's nutrition rather than the salivary glucose levels at a particular period.<sup>4</sup>

Dental caries is a very complex process which is affected by internal protective factors like saliva, the tooth surface morphology, general health, and hormonal and nutritional statuses, and also external factors like diet, microbial flora, oral hygiene and fluoride. Saliva has various functions, including protection of the tooth surfaces and oral mucosa.<sup>17</sup> In addition, the composition of the saliva is affected by the gingival crevicular fluid, oral microbial flora, host-derived cells, cellular components and the dietary ingredients.<sup>16</sup> Some studies on the salivary composition have evaluated the secretory immunoglobulin A (SIgA) concentration in the saliva. The results of these studies have shown significantly higher salivary SIgA levels among children with ECC compared to healthy subjects.<sup>18</sup>

Some studies on the relationship between salivary and serum glucose levels among healthy and diabetic individuals have reported contradictory results.<sup>7,14,19</sup> Kakoe et al. compared the caries and the periodontal status and salivary glucose levels among diabetic and healthy subjects. The results of this study indicated that in both groups, the dental caries rate increased with an increase in salivary glucose levels, and there was no differences between the two groups. In addition, the dental caries rate increased with age. The salivary glucose level was only correlated with glycosylated hemoglobin.<sup>14</sup> Also in the present study, there was no significant difference in salivary glucose levels among the ECC and control groups. This might be justified by the cross-sectional

designs of these two studies, in which changes in salivary glucose levels were not evaluated in the longitudinal studies. A longitudinal study by Siudikiene et al. showed that the salivary glucose levels change over time by controlling the diabetic status of the individual and does not remain at a specific level. In addition, they reported that subjects with poor metabolic control were more susceptible to dental caries: in other words, the metabolic control of the disease had the greatest effect on the dental status among the diabetic subjects.<sup>11</sup>

In relation to the effect of glucose (from every source) on the formation of dental plaque and the effect of other sugars on dental caries, the results of a study by Cury et al. might be useful. They reported that the plaque formed in the presence of sucrose was much more cariogenic than the plaque formed in the presence of glucose and fructose; however, in this study, the capacity of sucrose and a combination of glucose and fructose to induce demineralization (acidogenicity) was the same. Therefore, it is necessary to conduct a study to investigate the relationship between other sugars found in saliva with the rate of dental caries among children with ECC.<sup>20</sup>

A wide range has been reported to the saliva organic contents among different individuals in various studies.<sup>16,21</sup> However, there is a mean value for each organic compound of saliva. In this context, the salivary level of glucose has been reported as 0.02-0.17 mmol/l<sup>21</sup>, which is the same as the

results of the present study. In this study, the levels of salivary glucose in the ECC and healthy groups were  $0.13 \pm 0.09$  and  $0.12 \pm 0.66$  mmol/l, respectively, with no significant differences between the two groups. In addition, there was no significant difference between boys and girls.

In relation to the etiology and progression of ECC, there are many facts that are still to be elucidated and although many studies have been carried out to identify all the factors responsible for the initiation and progression of the condition, there is a long way ahead until all these factors to be identified by scientific researches.<sup>15,18,22</sup>

### Conclusion

There was no significant difference in the glucose levels in saliva between children with ECC and the control subjects. The most important limitation in the way of performing this study was low ability of the children for evacuate their saliva into the containers which resulted in the small sample sizes. We strongly recommend another studies to be carried out with bigger sample sizes in future.

### Conflict of Interests

Authors have no conflict of interest.

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## Prevalence of the molar incisor hypomineralization in seven to twelve-year-old students of Kerman, Iran, in 2015-2016

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### Original Article

#### Abstract

**BACKGROUND AND AIM:** Regarding the prevalence of molar incisor hypomineralization (MIH) among students and different populations and continuation of related problems, it seems necessary to assess the prevalence among students in Kerman, Iran. The aim of this study was to review the prevalence of MIH and its relation to the sex of 7-12-year-old students in Kerman during 2015-2016.

**METHODS:** In this cross-sectional study, 779 students from different schools of Kerman were studied after examination. We used a checklist to keep the record of MIH cases, which was filled by an inspector. Discolored (milky white or yellow and brown) teeth were counted as defective. Diagnosis of the MIH was done on basis of similar studies. After extracting the results, the data were analyzed by SPSS software, considering the sex of participants. The confidence interval (CI) of 95% was considered.

**RESULTS:** The prevalence of MIH was 6.5% among the studied students (51 students were diagnosed). There was no significant relationship between MIH and the students' sex. Among the 169 obviously defective teeth, the most prevalence was for lower right molar (54.9%), upper right central (52.9%), and lower left molar (49.0%).

**CONCLUSION:** Although the prevalence of MIH among the students was relatively low, it seems that awareness among the students and their parents' needs to be enhanced so that they can take better actions for the treatment of the defective teeth.

**KEYWORDS:** Molar-Incisor; Hypomineralization; Molar Incisor Hypomineralization; Prevalence; Enamel Defects

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Molar Incisor hypomineralization (MIH) is a term used for the first time in 2007 to describe enamel defects in one or more than one molar with or without the involvement of incisors.<sup>1</sup> Another definition describes MIH as a situation in which one or more than one first permanent molar, and in the majority of cases, at least one incisor tooth is hypomineralized. The condition is an entity different from other disorders. This defect

has 3 grades of mild (white to yellow opacity), moderate (yellow to brown opacity), sever (fully hypomineralized enamel).<sup>1,2</sup>

It should be pointed out that a disturbance in the enamel matrix secretion phase of the tooth results in quantitative or morphological defects, i.e. hypoplasia. While a disturbance in the calcification process or maturation of enamel prisms leads to morphologically normal enamel with structural or qualitative defects, which is referred to as

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hypomineralization.<sup>3</sup> Such defects initiate at birth by affecting the enamel structure or when the enamel of the first permanent molars or incisors is forming. This condition might affect the quality of mineralization of one of the four permanent molars with or without the involvement of incisors. Although the mechanism of this disorder is not fully known, some of the factors involved might be asthma, pneumonia, respiratory infections, middle ear infections, tonsillitis, tonsillectomy and use of antibiotics.<sup>4</sup>

Prevalence rate of MIH in Iran as well as in other countries (India, Jordan, Lithuania, Spain, France, Germany, Australia, Hong Kong, Netherlands, Turkey, Bosnia, and Brazil) have been reported to vary from 3.6% to 52%.<sup>5-8</sup> Children who are at a risk of MIH lesions due to possible reasons and frequent medical conditions during the early years of life should be carefully evaluated and monitored regularly by a dentist. Several factors have been reported as etiologic factors for MIH that can be classified into 3 main categories of medical problems (before and after birth), environmental contaminants and genetic factors. Prenatal problems such as mother's frequent fever, problems during birth, such as cesarean sections, postnatal problems such as respiratory disturbances, convulsions, medications and immature infants could be the potential etiologic factors.<sup>6,7</sup>

In terms of fluoride, although further studies are necessary for this respect, studies carried out to date have shown no relationship between the prevalence of MIH and exposure to fluoride. Therefore, it is improbable that fluoride is a risk factor for MIH.<sup>9</sup> In addition, it has been suggested that in addition to exposure to environmental factors, predisposing genetic factors are also effective in the induction of MIH.<sup>3,6</sup>

Regarding MIH treatment, fluoridated children toothpaste and other local fluoride agents, such as fluoride varnishes, are useful.<sup>10</sup> Another product that might be useful for patients with MIH is casein phosphopeptide-

amorphous calcium phosphate (CPP-ACP); however, but further studies are necessary for this respect.<sup>9,11</sup> Composite resins and glass-ionomers can be used for one-surface and multi-surface restorations of molars affected by MIH.<sup>11</sup>

Considering the nature of MIH and since early diagnosis of MIH helps prevent destruction of tooth structures and also by considering the fact that MIH is relatively prevalent and no studies to date have evaluated the prevalence of MIH in Kerman, Iran, the present study was undertaken and aimed to determine the prevalence of MIH and its relation to sex in this area and provide recommendations for affected students. There is a paucity of research into MIH in Iran. Based on best of our knowledge, only two studies have been done in Shiraz and Zahedan, Iran, with MIH prevalence of 20.2% and 7.1% respectively.<sup>9</sup>

## Methods

In this cross-sectional study, the community consisted of selected schools in Kerman. A total of 779 students were examined in these schools.

Kerman is situated in the south-east of Iran, with a population of 800000. This city is divided into two educational districts. In early 2015, approximately 68000 were studying in 396 elementary schools of Kerman, with an age range of 7-12 years. The sample size was estimated similar to other studies<sup>9,12,13</sup> and by considering the number of students in elementary schools of Kerman. In this context, first, the student lists of all the elementary schools and consent forms were obtained from the Education Administration Organization of Kerman to include students in the present study. Then a multi-step random cluster sampling technique was used by tossing a dice. First 8 schools (4 for boys and 4 for girls) were randomly selected from each educational district (1 and 2). From each school, one class was randomly selected from the relevant educational level and half of the students in each class were randomly selected to be included in the study. An

informed consent form along with information about this study and its aims were provided for the parents.

The inclusion criteria<sup>9</sup> consisted of an age range of 7-12 years, with at least one-third of the occlusal surface of all the four first permanent molars visible, and with the partial or complete eruption of at least one permanent first molar.

The following cases were not evaluated in the present study:<sup>9</sup>

1- Amelogenesis imperfecta (affliction of the enamel of all the permanent teeth while MIH affects only the enamel of permanent incisors and first molars). 2- Children with a history of orthodontic treatment because orthodontic treatment might result in enamel discoloration and lesion that resemble hypomineralization on tooth surfaces. And 3- children who had permanent first molars with completely carious crowns because severe caries and loss of the crown of permanent first molars cannot certainly be attributed to MIH and it might be due to lack of oral hygiene.

The protocol of the study was approved by the Ethics Committee of Kerman University of Medical Sciences, Iran, under the code IR.KMU.REC.1394.582.

Before the study, the students were asked to brush their teeth or at least rinse and clean their teeth with water. Then, the students were examined clinically by one of the authors who was trained according to some patients as well as the pictures. The incisors and permanent first molars visualized with the use of an electric torch and a dental mirror. Then, the teeth that exhibited milky white, brown or yellow discolorations were considered defective.<sup>14</sup> A more accurate diagnosis of MIH lesions was reached based on the criteria of the European Academy of Pediatric Dentistry<sup>10,15</sup> and the checklist which had already been prepared for each child was completed. The checklist contained demographic data. Finally, a pamphlet on MIH was provided for the parents.

Descriptive data were used for qualitative

data at a confidence interval (CI) of 95% in order to estimate the prevalence of hypomineralization. In addition, chi-square test was used to evaluate the relationship between hypomineralization and the variable evaluated. SPSS software (version 21, IBM Corporation, Armonk, NY, USA) was used for statistical analyses. No important ethical considerations were involved because no therapeutic intervention was involved and no medications were used. However, a verbal informed consent was taken from the parents as well as the demographic data of the children were kept confidential and they will not be published anywhere.

## Results

In the present study, 779 elementary school students were evaluated in Kerman. Of all these, 51 (6.5%) were affected by hypomineralization. Table 1 presents hypomineralization of first permanent molars and incisors separately for each tooth. Of 51 affected children, 47.1% and 52.9% were girls and boys, respectively.

**Table 1.** Distribution of the teeth according to the jaw and the quadrant

Teeth	Teeth with MIH [n (%)]
Mandibular right permanent first molars	28 (16.5)
Maxillary right permanent central incisors	27 (15.9)
Mandibular left permanent first molars	25 (14.7)
Maxillary left permanent central incisors	23 (13.6)
Maxillary left permanent first molars	18 (10.6)
Maxillary right permanent lateral incisors	10 (5.9)
Maxillary right permanent first molars	10 (5.9)
Maxillary left permanent lateral incisors	10 (5.9)
Mandibular right permanent central incisors	6 (3.5)
Mandibular left permanent lateral incisors	5 (2.9)
Mandibular left permanent central incisors	5 (2.9)
Mandibular right permanent lateral incisors	2 (1.1)

MIH: Molar incisor hypomineralization

**Table 2.** Frequency of the affected first permanent molars according to sex

Sex (tooth)	Teeth with MIH [n (%)]	Total [n (%)]	P*
Boy (16 <sup>**</sup> )	7 (25.9)	27 (100)	0.56
Girl (16 <sup>**</sup> )	8 (3.3)	24 (100)	
Total	15 (29.4)	51 (100)	
Boy (26 <sup>***</sup> )	12 (44.4)	27 (100)	0.15
Girl (26 <sup>***</sup> )	6 (25.0)	24 (100)	
Total	18 (35.3)	51 (100)	
Boy (36 <sup>#</sup> )	13 (48.1)	27 (100)	0.90
Girl (36 <sup>#</sup> )	12 (50.0)	24 (100)	
Total	25(49.0)	51 (100)	
Boy (46 <sup>##</sup> )	15 (55.6)	27 (100)	0.92
Girl (46 <sup>##</sup> )	13 (54.2)	24 (100)	
Total	28 (54.9)	51 (100)	

\*Chi-square test, \*\*16, right upper first permanent molar; \*\*\*26, left upper first permanent molar; #36, left lower first permanent molar; ##46, right lower first permanent molar  
MIH: Molar incisor hypomineralization

Tables 2 to 4 present the frequencies of hypomineralization separately for each tooth and in both sexes. In addition, overall 36 subjects exhibited affliction of lower molars (left and right) (70.6%) and 31 subjects exhibited affliction of upper molars (left and right) (60.8%), with a significant difference, i.e. the rate of affliction was significantly higher in lower molars compared to upper molars.

### Discussion

In the present study, the prevalence of this lesion was estimated at 6.5%. Knowledge about the prevalence of MIH in each geographical location is a prerequisite for the diagnosis and preventive treatment planning.

The present study was carried out on 7-12-year-old children. This age range is ideal for the evaluation of MIH because in the

majority of children from 7 years onward all the permanent first molars and incisors have already erupted and some of these teeth will be treated after 12 years of age. As a result, this age range was selected in the present study. The results showed that 6.5% of students were affected by hypomineralization. Studies have reported very different prevalence rates for hypomineralization, which might be explained by differences in geographical location (different regions and countries), sample sizes, parameters, diagnostic criteria and opinions of observers.<sup>3,15</sup> In many cases, the presence of carious lesions might mask these lesions, making it difficult to determine the true prevalence of MIH. In older children, occlusal attrition and restorations, too, might mask these developmental defects as well.<sup>3,15</sup>

**Table 3.** Frequency of the affected lateral Incisors according to sex

Sex (tooth)	Teeth with MIH [n (%)]	Total [n (%)]	P*
Boy (12 <sup>**</sup> )	6 (22.2)	27 (100)	0.62
Girl (12 <sup>**</sup> )	4 (16.7)	24 (100)	
Total	10 (19.6)	51 (100)	
Boy (22 <sup>***</sup> )	6 (22.2)	27 (100)	0.62
Girl (22 <sup>***</sup> )	4 (16.7)	24 (100)	
Total	10 (19.6)	51 (100)	
Boy (32 <sup>#</sup> )	2 (7.4)	27 (100)	0.65
Girl (32 <sup>#</sup> )	3 (12.5)	24 (100)	
Total	5 (9.8)	51 (100)	
Boy (42 <sup>##</sup> )	1 (3.7)	27 (100)	> 0.99
Girl (42 <sup>##</sup> )	2 (3.9)	25 (100)	
Total	2 (3.9)	51 (100)	

\*Chi-square test, \*\*12, right upper lateral Incisor; \*\*\*22, left upper lateral incisor; #32, left lower lateral incisor; ##42, right lower lateral Incisor  
MIH: Molar incisor hypomineralization

**Table 4.** Frequency of the affected central incisors according to sex

Sex (tooth)	Teeth with MIH [n (%)]	Total [n (%)]	P*
Boy (11 <sup>**</sup> )	14 (51.9)	27 (100)	0.87
Girl (11 <sup>**</sup> )	13 (54.2)	24 (100)	
Total	27 (52.9)	51 (100)	
Boy (21 <sup>***</sup> )	10 (37.0)	27 (100)	0.22
Girl (21 <sup>***</sup> )	13 (54.2)	24 (100)	
Total	23 (54.1)	51 (100)	
Boy (31 <sup>#</sup> )	3 (11.1)	27 (100)	> 0.99
Girl (31 <sup>#</sup> )	2 (8.3)	24 (100)	
Total	5 (9.8)	51 (100)	
Boy (41 <sup>##</sup> )	3 (11.1)	27 (100)	> 0.99
Girl (41 <sup>##</sup> )	3 (12.5)	24 (100)	
Total	6 (11.8)	51 (100)	

\*Chi-square test, \*\*11, right upper central incisor; \*\*\*21, left upper central incisor; #31, left lower central incisor; ##41, right lower central incisor  
MIH: Molar incisor hypomineralization

As discussed above, the prevalence of MIH in the present study was 6.5%, which is similar to the results of a study by Mittal et al. in India (6.13%).<sup>16</sup> However, other studies in India by Bhaskar and Hegde<sup>15</sup> and Mittal et al.<sup>16</sup> have shown a prevalence rate of 9.5% and 9.2%, respectively, for MIH. Other studies in other countries in Asia have reported the prevalence rates of 2.8% in Hong Kong,<sup>17</sup> 17.6% in Jordan,<sup>18</sup> 18.6% in Iraq,<sup>4</sup> 20.2% in Iran<sup>9</sup> and 12.5% in Singapore.<sup>19</sup> In addition, the prevalence rates have been reported in non-Asian countries including 10.2% in Greece, 9.7% in Lithuania, 9.2% in Turkey and 12.3% in Bosnia and Herzegovina.<sup>20,21</sup> Therefore, there is a wide range of prevalence rate for hypomineralization in different countries and regions, with wide variations in the prevalence rates of MIH among different ethnic groups.

In the present study, the highest relative frequency was detected in mandibular right first molars (54.9%), with the lowest prevalence rate in the right (3.9%) and left (9.8%) mandibular lateral incisors.

Affliction of permanent molars in all the cases in the present study was associated with the affliction of incisors. A study in India showed that 50% of the subjects had concomitant involvement of molars and incisors and 50% had involvement of molars alone.<sup>16</sup> However, studies all over the world<sup>16,20,21</sup> have shown a lower prevalence

rate for molars only and in the majority of cases molars and incisors were affected simultaneously. In the present study, mandibular molars were affected at a significantly higher rate compared to maxillary molars. In a study in India<sup>16</sup>, too, mandible molars were affected at a higher rate.

In addition, studies in western India,<sup>16</sup> Jordan<sup>18</sup> and Lithuania,<sup>20</sup> also have shown a higher prevalence rate of MIH in mandibular molars; however, in studies in Spain,<sup>22</sup> France,<sup>23</sup> Germany<sup>24</sup> and Australia<sup>25</sup> maxillary molars were affected at a higher rate.

Studies in Hong Kong<sup>17</sup> and the Netherlands<sup>26</sup> have shown that maxillary and mandibular molars were equally affected. The discrepancies in the results of studies in different communities might be explained by geographical locations and genetic and ethnic differences.

In the present study, girls were affected by MIH at a higher rate compared to boys; however, the difference was not significant. Results of a similar study in India showed MIH was more prevalent in boys, but the difference was not significant. In a different study in India,<sup>8</sup> there were no significant differences in the prevalence of MIH between the two sexes.

However, in a study in Shiraz,<sup>9</sup> contrary to the results of the present study, the prevalence of MIH was significantly higher in girls, which might be explained by the age

range of the subjects, which was more limited (9-11 years) compared to that in the present study (7-12 years). A lack of significant difference between boy and girl subjects in the present study might be explained by the etiology of MIH, which is not related to sex. In addition, in a study in Jordan, the prevalence of MIH was significantly higher in girl subjects compared to boys. In that study, similar to the study in Shiraz, the age range was more limited (7-9 years).<sup>18</sup>

A large number of studies have evaluated the role of early onset diseases and pre- and post-natal factors in the initiation of MIH as well as the prevalence of it. The results have shown a significant relationship between early-onset diseases and the infants' medical problems during birth and MIH.<sup>7</sup> However, in the present study, the prevalence of MIH was evaluated in addition to its relationship with sex only. Therefore, it is suggested that further studies should be carried out to evaluate the role of these factors and socioeconomic factors and other factors affecting MIH.

Suga et al. carried out a study to evaluate the prevalence of MIH in elementary schoolchildren in Lithuania. The results showed a higher prevalence rate of MIH in 7-9-year-old children; in addition, the prevalence of MIH was higher in mandible molars,<sup>20</sup> consistent with the results of the present study. In addition, in a study by Ahmadi et al, the prevalence of hypomineralization of molars and incisors was evaluated in elementary schoolchildren in Zahedan. The results showed a prevalence rate of 7.1% for MIH.<sup>27</sup> The consistency

between the results of these two studies might be explained by the socioeconomic and culturally similarities. In a study by Garcia-Margarit et al, the epidemiology of MIH was evaluated in 840 children aged 8 years. The results showed a 9.7% prevalence rate for MIH. In addition, inconsistent with our outcomes, the results indicated that the prevalence of MIH was higher in maxillary molars compared to incisors.<sup>22</sup> In the present study, the prevalence of MIH in mandibular molars was higher than that in other teeth. The differences in the results of these two studies might be explained by differences in geographical location and the effect of personal opinions on diagnosis.

### Conclusion

In the present study, the prevalence of MIH was estimated at 6.5% in a group of students aged 7-12 years. Mandibular molars were affected at a higher rate than other teeth. In all the cases, the affliction of mandibular molars was associated with the affliction of incisors. There was no relationship between sex and MIH. Further studies are recommended in other regions of Iran to further evaluate the prevalence of MIH.

### Conflict of Interests

Authors have no conflict of interest.

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## Evaluation of mothers' awareness about the presence of first permanent molar teeth among the 6-8 year old children in Yasuj, Iran, 2016

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### Original Article

#### Abstract

**BACKGROUND AND AIM:** First permanent molar teeth (FPMT) erupt slowly and without any side effects among the 6-8 year old children. Sweet snacks consumption, parents' unawareness about existence of these teeth and lack of attention to oral health care cause early caries among children in these ages. First permanent molars (FPMs) have a very important role in oral cavity among children. Therefore, missing of these teeth causes serious mastication and dental problems. In the present study, mothers' knowledge on the presence of FPMs in their children's mouth and its effect on health of these teeth were evaluated.

**METHODS:** In this cross sectional study, 350 elementary school students of the 1<sup>st</sup> and 2<sup>nd</sup> grades and their mothers from Yasuj, Iran, were evaluated in 2015-2016. After sampling, questionnaires were used for data collection and were filled out by mothers. Then, each student was visited separately and the decayed, missing, and filled teeth (DMFT) index of FPMs was registered. Data were analyzed statistically using independent samples t-test, Mann-Whitney test and Spearman's rank correlation coefficient.

**RESULTS:** The results showed that the difference between mothers' knowledge score about the presence of FPMs in their children's mouth was not significant regarding their education level, occupation and age. The same result was obtained after evaluation of DMFT index of children's FPMT.

**CONCLUSION:** Mothers' education about methods of dental caries prevention and protective oral health care is essential.

**KEYWORDS:** Decayed, Missing, and Filled Teeth Index; Permanent Molar; Tooth Eruption

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First permanent molar teeth (FPMT) erupt slowly without any important complication at the ages of 6-8.

These teeth are located normally posterior to the second deciduous molar teeth. First permanent molars (FPMs) have the largest size among the teeth in the oral cavity and also play the most important role in mastication, occlusion, correct positioning of other teeth, esthetics and preservation of vertical orientation.<sup>1,2</sup>

Decayed, missing, and filled teeth (DMFT) index of FPMs among individuals above 12 years old consists about 29% of DMFT index

of all teeth in oral cavity. It shows that caries of FPMT and its complications include the largest part of total DMFT index in mouth.<sup>3</sup>

FPM tooth is an appropriate place for retention of food and sweet snacks due to the fissures and deep pits on its surface. This makes the tooth predisposed to early caries very soon after eruption and reserves the larger proportion of caries in oral cavity. Other factors that make this tooth prone to caries and early extraction include use of sweet snacks and sticky candies, lack of skill and attention to oral health care among children of this age.<sup>4,5</sup>

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Some parents believe that permanent teeth start eruption after exfoliation of all deciduous teeth, however, in fact FPMs erupt when deciduous teeth are present in the oral cavity. Unawareness of existence of permanent teeth is one of the most common reasons for early extraction of them. Unfortunately, extensive caries and pulp exposure happen in early years of eruption due to the parents' unawareness of the permanent nature of these teeth. Decayed FPMT may not be restorable or may have poor prognosis if their dental treatment is postponed.<sup>6</sup>

One of the goals of World Health Organization (WHO) was achieving DMFT index lower than 1 for 12 year old children by the year 2010, however, studies performed in different cities of Iran show that the fact is far from this goal.<sup>7</sup>

According to the key role of FPMs in children's mouth, it is necessary for parents to be aware of the existence of these teeth in order for more care on them. Therefore, the researchers decided to evaluate the mothers' awareness about the presence of these teeth in their children's oral cavity.

## Methods

This cross-sectional study has been performed on 350 students of 1<sup>st</sup> and 2<sup>nd</sup> grades of 17 elementary schools and their mothers in Yasuj and the suburbs, Iran, in 2016. The study protocol was approved by the Ethics Committee of Yasuj University of Medical Sciences with the code number 93.12.25.57. The sample size was estimated according to a similar study conducted in Mashhad, Iran ( $P = 0.35$ ,  $d = 0.05$ ) using the formula  $N = z^2 \cdot p(1-p)/d^2$ .<sup>8</sup> Then, a list of public and private elementary schools for both girls and boys was obtained from Yasuj department of training and education.

The sample size was accounted considering the ratio of students in state and private schools and also according to the girl to boy ratio. 17 schools were selected by simple randomization, then the researchers attended the schools and performed

sampling systematically according to the lists of students' names. Every student included in the study was given a questionnaire. The questionnaires consisted of questions about eruption process of FPMs, mothers' knowledge about existence of these teeth in their children's mouth and mothers' demographic characteristics. The validity and reliability of the questionnaire were confirmed according to the study by Sadat-Sajadi et al.<sup>9</sup> The validity and reliability of questions were 91% and 82%, respectively.<sup>9</sup> Questionnaires were filled by mothers at home and returned to school. Students who did not take the questionnaire back were excluded. The questionnaires were collected, then, the students' oral cavities were examined for presence of FPMT and DMFT index of these teeth.

Questionnaires included 8 questions related to mothers' knowledge on FPMT eruption process including location, timing and replacement. Mothers' awareness about presence of FPMT in their children oral cavity was another question of the questionnaire. Correct and incorrect answers were given a score of 2 and 0, respectively, in addition, if parents did not know the answer of a question, it was scored 1.

After collecting the questionnaires and scoring them, data were entered in SPSS software (version 21, IBM Corporation, Armonk, NY, USA) and statistically analyzed using Independent Samples t-test, Mann-Whitney test and Spearman's rank correlation coefficient. The significance level ( $\alpha$ ) was considered as 0.05 in this study.

## Results

In this study, 350 students and their mothers were studied. Children were within the age range of 6-8 years with the mean and standard deviation (SD) of  $7.25 \pm 0.69$  years. The mean and SD of mothers' age was  $34.08 \pm 5.44$  years. Minimum and maximum ages of mothers were 22 and 49 years, respectively. Demographic characteristics of children and mothers are listed in table 1.



**Table 1.** Demographic indices of children and their mothers

Variant	n (%)
Sex	
Boy	179 (51.1)
Girl	171 (48.9)
Mothers' occupation	
Unemployed	285 (81.4)
Employed	65 (18.6)
Number of children in family	
2 and less	184 (52.6)
3 and more	166 (47.4)
Mothers' education	
Diploma and lower	251 (71.7)
Higher than diploma	99 (28.3)

The mean and SD of score of parents' awareness related to existence of FPMT in their children's mouth was  $8.28 \pm 3.03$ . The minimum and maximum scores were 3 and 17, respectively.

Table 2 shows the rate of children with or without FPMs in their mouth and their mothers' awareness of it.

According to the results, mothers' knowledge score about the presence of FPMT in their children's mouth did not differ statistically regarding their education level ( $P = 0.21$ ), occupation ( $P = 0.06$ ) and age ( $P = 0.20$ ).

The mean and SD of DMFT index of FPMT was  $1.35 \pm 1.34$ . The results indicated that the difference between DMFT index of FPMT in children's mouth was not significant regarding their mothers' education level ( $P = 0.63$ ), occupation ( $P = 0.60$ ) and age ( $P = 0.12$ ).

## Discussion

According to the results of this study, DMFT index of FPMT is estimated to be  $1.35 \pm 1.34$ . Unfortunately, there was not significant

correlation between DMFT index of FPMs among 6-8 year old children and their mothers' demographic characteristics like age, occupation and education level. The study by Vejdani and Simaei also showed that the level of parents' education has no positive effect on prevention of FPMT caries.<sup>10</sup> A similar study by Vanobbergen et al. showed that none of the parents' demographic and behavioral indices cannot predict susceptibility of their children to dental caries.<sup>11</sup> This may be due to the mothers' unawareness of importance of these teeth, their permanent nature, caries preventive methods like fissure sealant and dental protective methods. Therefore, enhancing the knowledge of mothers on the importance of FPMT in their children's mouth and education about caries preventive methods are urgent needs.

In the present study, only 30.0% of mothers knew that eruption time of FPMT in children's mouth is 6-7 years of age, 30.6% of them did not have any information and 39.4% gave wrong answers, respectively. Luca et al. studied 215 mothers of pre-school children in 2013; 20.9%, 26.5%, and 47.9% of the mothers knew the precise time of FPMT eruption, gave wrong answers to the question, and did not have any information, respectively.<sup>12</sup> Another study by Jaradat et al. showed that 82.0% of parents were not aware of the exact time of the FPMT eruption.<sup>13</sup> Compared to similar studies, mothers participating in the present study had slightly more information about the time of FPMT eruption, however generally, their knowledge was not significant in this regard.

**Table 2.** Rate of children with or without first permanent molar teeth (FPMT) in their mouth and their mothers' awareness about it

	Rate of children whose mothers indicated the lack of FPMT in their children's mouth	Rate of children whose mothers indicated the presence of FPMT in their children's mouth
Rate of children with FPMT in clinical examination	295	1
Rate of children without FPMT in clinical examination	45	9

FPMT: First permanent molar teeth

In the present study, 40.0% of mothers knew the correct position of FPMT in their children's mouth (exactly posterior to second deciduous molar teeth), and 20.9% and 39.1% gave wrong answers and did not have any information about it, respectively. Only 20.9% of mothers knew that FPMT erupt approximately at the same time of anterior permanent teeth eruption. In the study by Luca et al., only 21.39% of mothers gave the correct answer to the question regarding the position of FPMT eruption.<sup>12</sup> This indicates that the level of awareness about the location of FPMT was higher among participants in the present study compared to the study by Luca et al.<sup>12</sup>

In the present study, more than half as 53.1%, 26.0%, and only 20.3% of mothers did not know whether FPMT in their children's mouth would be replaced, believed that it would be replaced, and knew that it would not be replaced after extraction, respectively. In the study by Luca et al., 24.7% of mothers stated that FPMT replaced in their children's mouth after extraction.<sup>12</sup> Hence, the results of this study are similar to those in the present study. The importance of FPMT may remain unknown for most of mothers due their incorrect information about replacement of these teeth in their children's mouth after extraction.

The mean score of mothers' knowledge about eruption process of FPMT in areas including existence, timing, positioning and replacement after extraction in their children's mouth was  $8.28 \pm 3.03$  with a total score of 18. There was not significant correlation between score of mothers' knowledge and their demographic characteristics like age ( $P = 0.20$ ), occupation ( $P = 0.06$ ) and education ( $P = 0.21$ ). The study by Luca et al. in Romania showed that the mothers' education had positive effect on their knowledge about eruption process of FPMT, however, their occupation was not effective.<sup>12</sup> Another study by Jaradat et al. showed that the level of parents' education do not affect their knowledge about FPMT

eruption.<sup>13</sup> This indicates that even educated parents need to learn more about eruption process of FPMT.

In the present study, 16.2% of mothers were exactly aware of the presence or lack of FPMT in their children's mouth, i.e., 11.7% of children had FPMT in their mouth and their mothers could find it out and 4.5% of mothers were aware of the lack of FPMT in their children's mouth. A study by Zouashkiani and Mirzakhan showed that 34.7% of parents were aware of the presence of FPMT in their children's mouth.<sup>8</sup> In a study carried out in Kerman, Iran, 82.5% of parents were aware of eruption of the FPM tooth in their children's mouth.<sup>9</sup> The higher level of knowledge among parents in this study may be due to the oral health education during the study.

Mothers' knowledge about the existence of FPMT in their children's mouth did not have significant correlation with DMFT index of these teeth. In other words, DMFT index of FPMs were equal for both children whose mothers were and were not aware of eruption of these teeth in their children's mouth. This is similar to the results of the studies by Sadat-Sajadi et al.<sup>9</sup> and in contrast with Zouashkiani and Mirzakhan,<sup>8</sup> which indicated that the DMFT index was lower for children whose mothers were aware of the presence of FPMT in their children's mouth.<sup>8,9</sup>

## Conclusion

According to this study, mothers' awareness about the existence of FPMT in their children's mouth and also DMFT index of these teeth are not affected by their education, occupation and age. Therefore, training mothers about the presence of these teeth in mouths of the 6-8 year old children is essential. In order to reduce caries level and DMFT index in children oral cavity, mothers' should be trained about methods of protective oral health care.

## Conflict of Interests

Authors have no conflict of interest.

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## Evaluation of health status of first permanent molar teeth among 12-year-old students in rural areas of south of Kerman, Iran, 2016

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### Original Article

#### Abstract

**BACKGROUND AND AIM:** First permanent molar (FPM) has an important role in occlusion and biting. FPM is susceptible to dental caries due to early growth. The objective of this study was an evaluation of oral health status of FPM in terms of decayed/missing/filled teeth 6 (DMFT6) among 12-year-old children in rural areas of southern cities in Kerman, Iran.

**METHODS:** This analytical/cross-sectional study was performed in 2016 on 564, 12-year-old students (281 girls and 283 boys). Students were randomly selected from 32 different villages of southern cities of Kerman. The DMFT index was determined using the standard method suggested by World Health Organization (WHO). The trained dentist recorded data of DMFT index and oral health status in checklist form. Data were analyzed using SPSS software.  $P < 0.05$  was considered as significant.

**RESULTS:** The frequency of FPM dental caries of students was 53.12-66.04%. There was no significant difference in mean of DMFT6 among students in rural areas of 7 cities in the south of Kerman, but it was greatest in Ghaleganj (2.60) and lowest in Jiroft (1.97), respectively. Girls had more carries than boys (DMFT6 2.43 vs. 2.13) but it was not significant ( $P = 0.08$ ). There was a little amount of sealant or filled FPM (0.58%). 26.24% of students had a toothbrush. 19.14% of them brushed their teeth equal or more than once daily and 37.41% of them knew that the first molar is a permanent tooth.

**CONCLUSION:** Study showed a high rate of caries in FPMs in 12-year-old children and poor knowledge and performance in relation to these teeth. Therefore, it is absolutely necessary to provide health, educational and dental treatment services for villages in the south of Kerman province, Iran.

**KEYWORDS:** Students; Oral Health; Decayed/Missing/Filled Teeth Index; Molar; Permanent

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The first permanent molar (FPM) is undoubtedly the most important tooth in the oral cavity and has an important role in the development of a favorable occlusal relationship and the physical growth in children.<sup>1</sup> It has an important role in the mastication of food because it has a larger occlusal surface area than other teeth and its loss in the lower jaw

decreases the masticatory efficacy up to 50%.<sup>1,2</sup> Since this tooth is one of the FPM to erupt into the oral cavity in children and its eruption does not need exfoliation of any deciduous tooth, the majority of parents are not aware of its presence in the children's oral cavity and make no attempts to preserve its health, believing that it is a deciduous tooth.<sup>3</sup> On the other hand, the occlusal

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surface anatomy of these teeth favors the adhesion of foodstuffs and their fermentation in that area due to the presence of various deep fissures, making this tooth susceptible to caries.<sup>4</sup> Therefore, despite the importance of preservation of FPMs in a children's oral cavity, due to the reasons above, it is rapidly lost due to widespread caries and its complications. The literature has reported a high prevalence of caries in FPMs (80%) among children.<sup>3</sup> Early loss of these teeth results in various complications, heavy costs of treatment, and needs for time and expert manpower.<sup>5</sup>

Jiroft, Kahnuj, Anbarabad, Rudbar, Ghaleganj, Menojan and Faryab are seven cities in the south of Kerman province in Iran, which are considered deprived areas in this province. The total surface area of these regions is approximately 49000 Km<sup>2</sup> (more than three times that of Kohgiluyeh and Boyer-Ahmad province in Iran and more than twice that of Slovenia and 70 times than Qatar), with a population of over one million people, and consisting of a large number of villages that harbor more than half of the population of these areas.

The villagers are engaged in agriculture and the population of some of the villages is more than 10000. These villages do not receive proper healthcare services and almost 60 dentists are working in these areas, with over half of them in Jiroft and the rest work in the six remaining cities. However, based on the World Health Organization (WHO) guidelines, one dentist should provide services to every 10000 individuals, which is far from the norm in these cities, i.e. currently 100 dentists should be working in the south of the province. However, the more worrying problem is the fact that this limited numbers of dentists are distributed unevenly and in some cities with a better social status there are more dentists and have only been concentrated centrally. They even are not present in big villages temporarily. It should be pointed out that in rural areas of these cities the provision of

oral healthcare is even worse (based on unpublished data provided by the Oral Health Office of Jiroft University of Medical Sciences). Considering the importance of FPMs in the oral cavity and since no study has evaluated this tooth in children in the deprived areas of 7 cities in the south of Kerman Province in Iran, the present study was undertaken to evaluate the status of this tooth in these areas.

## Methods

In this analytical/cross-sectional study, the health status of FPMs of 12-year-old children was evaluated in rural areas of 7 cities in the south of Kerman province (Ethical Code: IR.KMU.REC.1395.336).

Based on the prevalence rate of caries in FPMs in other regions of the country and by considering similar studies in Babol, Iran, and Kerman, the sample size was calculated at 80 in each city, totally 560 subjects. First, the cities were considered as layers and within each layer, the list of the villages was taken from the Governor's Office of that city. Then, 4-6 villages were selected randomly for each city. Overall, 32 villages were selected. Then the schools of each village were visited and the 12-year-old children were examined during school hours.

Inclusion criterion was the 12-year-old students that present on the day of study and their parents signed an informed consent form. The study objectives were then explained to them.

The FPM in 12-year-old children was examined under the direct light of a 100-W bulb light with the use of a flat dental mirror and a dental explorer by a trained dentist. Data were recorded in the checklists. WHO guidelines and criteria were used for the diagnosis of caries.<sup>1,6</sup> Then, some data related to the oral health status of these students were collected in another checklist.

At the end of the examination, the children were instructed in oral hygiene, and the importance of maintaining the health of the FPMs was explained to them.

**Table 1.** Distribution of health status of first permanent molars (FPM) based on rural areas of the cities

Rural areas	Healthy [n (%)]	Decayed [n (%)]	Filled or sealant [n (%)]	Extracted [n (%)]	Total [n (%)]
Rudbar	132 (40.24)	190 (57.92)	0 (0)	6 (1.82)	328 (14.53)
Ghaleganj	103 (31.79)	214 (66.04)	0 (0)	7 (2.16)	324 (14.36)
Menojan	128 (40.50)	183 (57.91)	2 (0.62)	3 (0.94)	316 (14.00)
Faryab	116 (36.25)	194 (60.62)	7 (8.75)	3 (3.75)	320 (14.18)
Anbarabad	133 (41.56)	179 (55.93)	2 (0.62)	6 (1.82)	320 (14.18)
Kahnuj	127 (38.71)	193 (58.84)	0 (0)	8 (2.43)	328 (14.53)
Jiroft	146 (45.62)	170 (53.12)	2 (0.62)	2 (0.62)	320 (14.18)
Total	885 (39.23)	1323 (58.64)	13 (0.58)	35 (1.55)	2256 (100)

Descriptive statistics were performed for assessing the mean, frequency and percentages. Student's independent t-test and ANOVA were recruited to compare 2 groups and more than 2 independent groups, respectively, using SPSS software (version 18, SPSS Inc., Chicago, IL, USA).  $P < 0.05$  was considered as significant.

### Results

In the present study, 564 subjects (283 boys, 281 girls), were examined in the rural areas of 7 cities in Kerman province. There was a mean of 40 subjects from each sex in each city. The highest frequency of caries in FPMs was reported in the rural area of Ghaleganj (214 teeth, 66.04%) and the lowest frequency was reported in the rural areas of Jiroft (170 teeth, 53.12%) (Table 1).

The highest mean of DMFT6 in boys was reported in the rural areas of Menojan (2.44) and the lowest was reported in the rural areas of Jiroft (1.7%). The highest and lowest mean values of DMFT6 in girls were in the rural areas of Ghaleganj (2.95%) and Anbarabad (2.00%), respectively. There was no significant difference between girls and boys in the mean of DMFT6 ( $P = 0.08$ ). Also, there was no significant difference in mean of DMFT6 among 7 cities in the south of

Kerman ( $P = 0.09$ ) (Table 2).

**Table 2.** The mean of decayed/missing/filled teeth 6 (DMFT6) index of first permanent molar (FPM) in the rural areas according to sex and city

City	DMFT6		
	Rural areas	Sex	
		Boy	Girl
Rudbar	2.34	2.08	2.60
Ghaleganj	2.60	2.26	2.95
Menojan	2.27	2.44	2.11
Faryab	2.41	2.04	2.79
Anbarabad	2.07	2.15	2.00
Kahnuj	2.30	2.25	2.36
Jiroft	1.97	1.70	2.25
P*	0.09	0.08	

\*t-test, DMFT6: Decayed/missing/filled teeth 6

The children in the rural areas of Ghaleganj (14.62%) had the least and in Faryab (43.75%) had the highest number of toothbrushes. Also, the rural areas of Menojan (13.92%) and Ghaleganj (13.49%) exhibited the least frequency of tooth brushing. The highest level of knowledge in relation to the permanent nature of tooth 6 was reported in children in the rural areas of Anbarabad (43.75%) and Faryab (45.00%). 37.41% of them knew that this tooth is a permanent tooth. Only 30 children out of all the evaluated 564 children had 4 healthy and intact FPMs (Table 3).

**Table 3.** The frequency of some characteristics related to oral health status of students in rural areas of south cities in Kerman

Rural areas	Have toothbrush [n (%)]	Have daily tooth brushing [n (%)]	Caries free [n (%)]	Considering tooth 6 as a permanent one [n (%)]
Rudbar	20 (24.69)	16 (19.50)	6 (7.30)	28 (34.14)
Ghaleganj	12 (14.62)	11 (13.49)	2 (2.46)	26 (32.90)
Menojan	15 (18.98)	11 (13.92)	2 (2.53)	26 (31.87)
Faryab	35 (43.75)	26 (32.50)	5 (6.25)	36 (45.00)
Anbarabad	28 (35.00)	17 (21.25)	6 (7.50)	35 (43.75)
Kahnuj	19 (23.16)	12 (14.62)	5 (6.08)	29 (35.36)
Jiroft	19 (23.75)	15 (18.75)	4 (5.00)	31 (38.75)
Total	148 (26.24)	108 (19.14)	30 (5.31)	211 (37.41)

## Discussion

The present study was undertaken to evaluate the health status of FPMs in a group of 12-year-old students in the south of Kerman province, 2016. Unfortunately, the prevalence of caries in the FPMs among 11-12-year old students is high in all countries. It seems 80% of children in these ages need restoration and/or extraction of this tooth. It is not done fissure sealant therapy for FPM, its pit and fissures decayed 7.5 times more than other teeth. There are antithetical results about the prevalence of caries in the FPMs according to the sex.<sup>5,6</sup> In 2002, a descriptive study was undertaken in Kerman to evaluate the health status of FPMs in 12-year-old children.<sup>2</sup> The results of that study showed the caries was more frequent in girls compared to boys (19.9% vs. 16.0%). The results of the present study were consistent with those of the study in Kerman, indicating a generally higher prevalence rate of carious lesions in FPMs in girls compared to boys. A difference between boys and girls might be attributed to the earlier eruption of these teeth in girls compared to boys, a possible anatomic difference in these teeth, differences in dietary and oral hygiene habits and also possible quantitative and qualitative changes in saliva and changes in preferences with the earlier puberty in girls compared to boys.

Studies on the prevalence of caries in 12-year-old children in Mashhad<sup>6</sup> and Neyshabour,<sup>7</sup> Iran, have yielded similar results. Studies in Mashhad, and in other countries, including Poland<sup>8</sup> and India<sup>9</sup> have shown a higher rate of caries in lower first molars compared to upper first molars. In this study, we did not evaluate the difference in caries prevalence between upper and lower jaws.

In the present study, out of 2256 FPMs only 13 teeth had received fissure sealants, restorations (6 teeth had received fissure sealants and 7 had been restored). In the study of Kerman, none of the FPMs had received fissures sealants. However, in the present study, a small number of teeth had

received fissure sealants, indicating an increase in attention to teeth 6. However, it is far from the global goals of 2010 indicating that 50% of FPMs should undergo fissure sealant therapy.<sup>10</sup>

The present study showed that out of 2256 FPMs, 1323 teeth were carious (greater than 50%), which is far from the global aim that by 2010 the carious PFMs should have decreased to 11%. Also, DMFT6 of the subjects was 2.28, which is almost similar to that in 12-year-old children in Hamadan (2.17), Iran.<sup>11</sup> However, in Babol, this index was 1.59 in 12-year-old children.<sup>12</sup> Such a discrepancy might be attributed to better oral hygiene status in children in the urban areas in the north of the country due to improvements in the socioeconomic status. This index in 12-year-old children in Rafsanjan, Iran, was 1.9<sup>13</sup> and again the difference might be explained by the possibly better socioeconomic status of students in urban areas of Rafsanjan compared to the children in the deprived rural areas in the south of Kerman province. In the study of Kerman, this index was 0.71, and the difference might be attributed to the following reasons: The subjects were selected from schools in the city center with better socioeconomic status. Moreover, it was carried out 15 years ago and it appears during these years the population's economic status has deteriorated in villages, along with an increase in the intake of carbohydrates, aggravating the oral hygiene status and increasing the caries rate.

Furthermore, in the Kerman study, out of 2400 FPMs evaluated, 16 teeth had been extracted and out of 240 evaluated teeth only 321 teeth were carious (13%), and 93 teeth had been restored. However, in this study, 35 teeth had been extracted out of 2256 evaluated teeth, which is an unfavorable finding in relation to the necessity of preserving the FPM. Greater than 50% of the teeth evaluated were carious, which can be attributed to the very poor oral health of the children in the rural areas in the south of Kerman province.

In a study in Karachi, Pakistan,<sup>14</sup> out of 1808 FPMs evaluated in 8-12-year-old children, 1240 teeth were sound and 180 FPMs had been extracted or had not erupted yet and 568 teeth were carious, indicating a better health status of these teeth in Karachi. The differences might be attributed to cultural, nutritional, hygienic and age differences between two regions.

In the present study, comparison of DMFT6 between 7 cities revealed that the overall DMFT6 status of students in villages of Jiroft was the best and it was the worst in Ghaleganj; however, the difference between these two areas was not significant. DMFT6 in the other cities was somewhere between of these two areas. The reason for these minor differences is the unfavorable oral health status and socioeconomic poverty in the villages of the south of Kerman province.

The results of present study showed that out of 564 evaluated students, only 108 students, almost one-fifth, brushed their teeth at least once in 24 hours. There are many studies on caries prevalence of FPM but we did not find any study about FPM in young students, in which the caries status of these teeth and tooth brushing habits of the subjects have been evaluated at the same time. However, the results of present study are far from the recommendations of the health authorities all over the world that all the students should brush their teeth at least once in 24 hours.

In this study, only 148 had a toothbrush and of the rest 416 individuals, more than two-thirds, did not have a toothbrush, which is tantamount to disaster in relation to oral hygiene. In addition, the results of the present study showed that 211 students were aware that the FPM is a permanent tooth and the rest believed that the tooth was a deciduous tooth and will exfoliate later to be replaced by another tooth. In a study in Mashhad,<sup>15</sup> the parents of the students in the first grade of elementary schools were evaluated. One-third of the parents were aware that the tooth 6 was a permanent tooth

that had erupted or was erupting in the oral cavity of their children. The study of Mashhad showed the necessity of increasing the awareness of students and their parents of the permanent nature of the tooth 6 and its eruption at 6 years of age.

In a study by Rasouli Tabar<sup>16</sup> in Kermanshah, Iran, DMFT6 was 1.64, and 37.3% of 12-year-old children had no caries in their FPMs. Barati Nejad in Kashan, Iran,<sup>17</sup> reported that DMFT6 was 2.09, with 18.2% of the subjects being caries-free. However, the results of the present study showed that only 5.31% of all the evaluated students were caries-free in all the four FPMs. A study by Ali et al. in Karachi, Pakistan, showed that 69.4% of the 8-12-year-old children had caries-free in FPMs.<sup>14</sup> In a Massom et al. study in Hamadan, this value was 18.8% for 12-year-old children.<sup>11</sup> In a study by Sadeghi in Rafsanjan, 31.4% of 12-year-old children were caries-free.<sup>13</sup> The differences, as discussed previously, might be attributed to differences in the amount of fluoride in drinking water, the nutritional habits, oral hygiene habits and also cultural, socioeconomic factors in different cities that directly and indirectly affect caries in FPMs.

The limitation of this study was the absence of some students on the day of assessing the DMFT6. Also, lack of measurement of other factors like level of parents' education that could effect on student's oral health was a drawback.

## Conclusion

The results of the present study showed a high rate of caries in FPMs in 12-year-old children and poor knowledge and performance in relation to these teeth. Therefore, it is absolutely necessary to provide health, educational and dental treatment services for villages in the south of Kerman province, Iran.

## Conflict of Interests

Authors have no conflict of interest.



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## Avoidance dental visit, the impact of predictor factors: A cross-sectional study in Kerman, Iran

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### Original Article

#### Abstract

**BACKGROUND AND AIM:** In spite of different reforms and programs, the evidence indicates that Iran dental health sector has not been able to improve the dental situation and decrease the unmet needs. This study assessed the factors which affect the avoiding dental visit during one year ago because of its costs.

**METHODS:** This cross-sectional study was performed on 1158 household heads which were selected through multi-stage sampling in Kerman, Iran, and questioned house by house using trained interviewers. The association of dichotomous outcome variables of “have you avoided or postponed dental visit during 1 years ago in spite of need because of its costs?” with 3 types of predictor variables of household heads including sex as binary predictor, age as continuous predictor, and income and education as categorical variables studied using regression logistics.

**RESULTS:** The odds ratio (OR) of avoiding dental visit because of its costs in men was 1.4 times more than women ( $P = 0.035$ ). The OR decreased by 0.01 with each year increase in age ( $P = 0.017$ ). Furthermore, the OR is people with incomes 267-803, 803-1339 and  $> 1339$  USD in comparison with the heads incomes under 267 USD was 0.31, 0.02, 0.01, respectively ( $P = 0.001$ ), and in people with educational level  $<$  diploma, diploma, Bachelor of Science (BSc), Master of Science (MSc) and Doctor of Medicine (MD)/Doctor of Philosophy (PhD) in comparison with illiterate/elementary decreased by 0.51, 0.13, 0.04, 0.01 and 0.02, respectively ( $P < 0.001$ ).

**CONCLUSION:** The factors of older ages, being a woman, increasing education and income level decrease the rate of avoiding a dental visit. In the absence of strong dental health insurance, these factors determine the utilization of the services which lead to horizontal inequality.

**KEYWORDS:** Odds Ratio; Utilization; Dental Care

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Twenty-five percent of the difference in health situation of the poor and the rich is because of access to the healthcare system.<sup>1</sup> Access to dental care services may be more important than many other health services, because it leads

to immediate recovery of pain, restore the people functions and prevent other diseases. Wamala et al. have stated that the access to dental care is the cause of 60% difference in people health, while their health style determines only 29% of it.<sup>2</sup>

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On the basis of a national dental health survey, there was a high level of unmet dental needs in Iran, so that mean decayed, missing, and filled teeth (DMFT) score for 18 and 35-44-year old people was 4.3 and 11.0, respectively. Also, more than half of 35-44-year old people had periodontal pockets.<sup>3</sup> Based on countries ranking by the World Health Organization (WHO), Iran is in a low DMFT situation in 12-year old children, but this index is in a medium situation at 35-year old people.<sup>4</sup> This indicates that DMFT index getting worse by increasing age. On the other hand, some unofficial estimates indicate that people pay more than 90% of dental costs directly through out-of-pocket and the share of other resources (mostly health insurances) is lower than 10%. Moreover, the share of dental payments of 2 main basic health insurances of Iran (Iran Health Insurance Organization and Social Security Organization), which cover more 80% of Iran population, is lower than 1%.<sup>5</sup>

The World Health Report 2000, which is a turning point about the financial goals and performance of health systems, has determined equitable financial protection against financial costs, meeting the non-therapeutic needs of people and improving health as the 3 goals of health systems.<sup>6</sup> On the basis of above paragraph and matching it with the World Health Report 2000, it can be inferred that Iran health system has not achieved the goals of health improvement and financial protection in the field of dental care.

To counter with the problems of health system performance, the Iran 11<sup>th</sup> government has started reforms Health Sector Evolution Plan (HSEP) in 2014. One of the main objectives of the HSEP was providing universal health coverage to all Iranians.<sup>7</sup> Unfortunately, HSEP has neglected the coverage of dental services and people still pay the entire dental costs through out-of-pocket. So, HSEP has not any effect on access to dental services. In one hand, public dental centers usually present preventive care, not specialized and restorative services. On

the other hand, there are too many private dental offices and clinics which present all dental services but because of their costs, access to them is very low. These problems have had negative effects on the regular visit of dentists and receiving dental care.<sup>8</sup>

There is no new study in Iran to explore the situation of avoidance dental visit because of its costs among households' heads. We do not know how the sex, age, income and education of households' heads have effects on visiting and utilization of dental services. To answer these questions, Kerman, Iran, was selected. Dental indices of adults in Kerman such as dental decay, edentulous and unmet dental needs have the mean frequency among different cities of Iran,<sup>9</sup> so its results can be generalized to the country. Moreover, the dental health system, in both the private and public sectors, has a similar structure throughout Iran in terms of administrative, regulatory, tariffs and out-of-pocket issues.<sup>10</sup>

## Methods

The data of this population-based, cross-sectional survey were collected in the first quarter of 2017. The participants were head of households with each type of socio-economic situation in Kerman. In the last national census performed, the total population of this city was 534441 people.<sup>11</sup> Through Cochran's sample size formula and by adding 20% for design effect and 15% for peoples who present incomplete or imperfect information, the sample size was estimated 1158 people. If one household head did not respond to the interviewer, the next household head was entered into 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. So, 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, the other questionnaires were completed. This process was performed for other health centers. Households' heads were questioned by trained interviewers, house by house.

Logistic regression was used to model dichotomous outcome variables. In the logit model, the log odds of the outcome was modeled as a linear combination of the predictor variables. The dichotomous outcome variable of this study is as follows: Have you avoided or postponed dental visit during 1 year ago in spite of need because of its costs? (yes/no). Households incomes were categorized as < 267, 267-803, 803-1339 and > 1339 USA dollars (USD).

There are 3 types of predictor variables in this study including binary predictors, continuous predictors, and factor (categorical) predictors. In this study, the variable of household head sex was binary (man and woman), the variable of household head age was continuous, and household head income and education were factors (or categorical) variables. We used the logit command in STATA 13.1 (StataCorp, College Station, TX, USA) to estimate a logistic regression model. In the following, in order to better understanding the logistic model, we calculated predicted probabilities using margins command. In other words, we calculated the predicted probabilities of avoiding dental visit at different levels of income and education using the margins command (holding all other variables in the model at their means). All analyses were performed using STATA 13.1.

This study is part of the corresponding author Doctor of Philosophy (PhD) thesis. Thus, the full questionnaire content validity was confirmed by a panel of faculty members of the Department of Health Management, Policy and Economic. Also, a sample of 10 household heads was asked to complete the questionnaire on two separate occasions to confirm test-retest instrument reliability.

Before collecting the data, the written permission was obtained from Ethical

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

## Results

Descriptive characteristics of the participants are presented in table 1. Accordingly, 82.56% of household heads were men. The most number of household heads were from 40-49 age-groups (26.94%). In terms of income level, 25.04% of the household heads had under 267, 24.18% between 267-803, 46.80% between 803-1339 and 3.97% higher than 1339 USD income. On the basis of household heads education, 20.21% were illiterate/elementary, 15.54% under diploma, 29.88% Bachelor of Science (BSc), 19.34% Master of Science (MSc), and 1.55% Doctor of Medicine (MD)/PhD (Table 1).

**Table 1.** Descriptive characteristics of the study sample

Variable		n (%)
Age (year)	19-29	292 (25.22)
	30-39	186 (16.06)
	40-49	312 (26.94)
	50-59	238 (20.55)
	60-69	96 (8.29)
	> 70	34 (2.94)
Sex	Woman	202 (17.44)
	Man	956 (82.56)
Income (USD)	< 267	290 (25.04)
	267-803	280 (24.18)
	803-1339	542 (46.80)
	> 1339	46 (3.97)
Education	Illiterate/elementary	234 (20.21)
	Under diploma	180 (15.54)
	Diploma	156 (13.47)
	BSc	346 (29.88)
	MSc	224 (19.34)
	MD/PhD	18 (1.55)

USD: USA dollar; BSc: Bachelor of Science; MSc: Master of Science; MD: Doctor of Medicine; PhD: Doctor of Philosophy

According to table 2, the likelihood ratio chi-square of 612.99 with  $P = 0.001$  indicates that the model was significant and was better than a model with no predictor.

**Table 2.** Odds ratio (OR) of avoiding dental visit because of its costs during 1 year ago in relation to demographic characteristics of the household heads

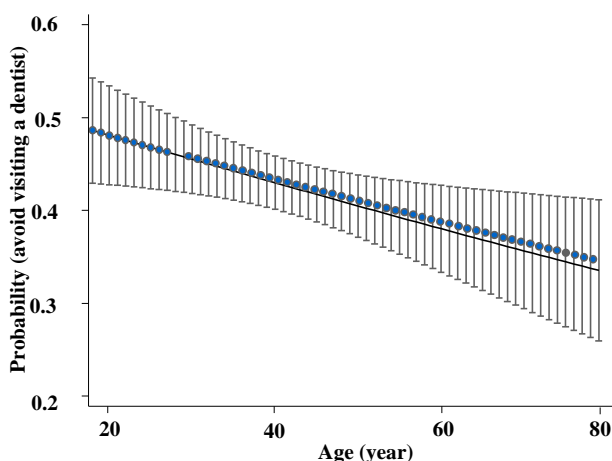
Avoid dental visit		OR	SE	Z	P* >  z	95% CI
Sex	Woman				Reference	
	Man	1.388967	0.216072	20.11	0.035	1.023945-1.884114
Age		0.989737	0.004278	-20.39	0.017	0.981387-0.998158
Income (USD)	< 267				Reference	
	267-803	0.313094	0.077878	-40.67	0.001	0.192287-0.509799
	803-1339	0.026817	0.006186	-150.69	0.001	0.017063-0.042148
	> 1339	0.017677	0.008115	-80.79	0.001	0.007188-0.043468
Education	Illiterate/elementary				Reference	
	Under diploma	0.507343	0.157983	-20.18	0.029	0.275577-0.934030
	Diploma	0.134346	0.038270	-70.05	0.001	0.076863-0.234818
	BSc	0.040718	0.010640	-120.24	0.001	0.024393-0.067970
	MSc	0.016147	0.004850	-130.74	0.001	0.008963-0.029091
	MD/PhD	0.026702	0.016376	-50.91	0.001	0.008027-0.088831

Woman sex, incomes < 267 USD and education level of illiterate/elementary considered as the reference; \*Logistic regression; number of observations = 1158; likelihood ratio chi-square = 612.99; probability > chi2 = 0.001; log likelihood = -495.40955; pseudo R<sup>2</sup> = 0.3822

OR: Odds ratio; SE: Standard error; CI: Confidence interval; USD: USA dollar; BSc: Bachelor of Science; MSc: Master of Science; MD: Doctor of Medicine; PhD: Doctor of Philosophy

The odds ratio (OR) of avoiding dental visit because of dental care costs in men was 1.4 times more than women, this association was significant statistically (P = 0.035).

For every unit increase in age, the OR of avoiding dental visit because of its costs decreased by 0.01 (P = 0.017). Figure 1 indicates adjusted predictions for avoiding dental visit because of its costs with an increase in age.



**Figure 1.** Adjusted predictions of avoiding dental visit because of its costs during 1 year ago in different age groups with 95% confident intervals (95% CI)

About the association between household

income and avoiding dental visit during 1 year ago, the income under 267 USD considered as the reference and the OR of avoiding dental visit in participants with incomes 267-803, 803-1339 and higher than 1339 USD was compared with it. As table 2 indicates, by increasing in income, the OR of avoiding dental visit because of its costs has decreased. In this way, the OR of avoiding dental visit in household heads with incomes 267-803, 803-1339 and higher than 1339 USD in comparison with the household heads with incomes under 267 USD were 0.31, 0.02, 0.01, respectively (P = 0.001).

Regarding the association between the educational levels of household heads with avoiding dental visit during 1 year ago, illiterate/elementary level of education was considered as reference and other levels were compared with it. Accordingly, increasing education level decreased the OR of avoiding a dental visit. In this way, the OR of avoiding dental visit in participants with education level lower than under diploma, diploma, BSc, MSc and MD/PhD in comparison with participants with illiterate/elementary education level decreased 0.51, 0.13, 0.04, 0.01 and 0.02, respectively (P < 0.001).

Table 3 indicates the predicted probabilities of avoiding dental visit because

**Table 3.** Predicted probabilities of avoiding dental visit because of its costs during 1 year ago in relation to income and education of the household heads

Avoid dental visit	Margin	Delta-method SE	Z	P* >  z	95% CI	
Income (USD)	< 267	0.910345	0.016776	54.26	< 0.001	0.877464-0.943225
	267-803	0.760714	0.025497	29.84	< 0.001	0.710741-0.810688
	803-1339	0.214022	0.017617	12.15	< 0.001	0.179493-0.248551
	> 1339	0.152174	0.052960	2.87	0.004	0.048375-0.255973
Education	Illiterate/elementary	0.914530	0.018277	50.04	< 0.001	0.878708-0.950352
	> High school	0.844444	0.027014	31.26	< 0.001	0.791498-0.897391
	High school	0.589744	0.039382	14.97	< 0.001	0.512557-0.666931
	BSc	0.303468	0.024717	12.28	< 0.001	0.255024-0.351912
	MSc	0.147321	0.023681	6.22	< 0.001	0.100907-0.193735
	> Doctoral	0.222222	0.097991	2.27	0.023	0.030164-0.414281

\*Logistic regression

SE: Standard error; CI: Confidence interval; USD: USA dollar; BSc: Bachelor of Science; MSc: Master of Science

of its costs during 1 year ago in participants with different incomes and education groups. Accordingly, the predicted probability of avoiding dental visit because of its costs during 1 year ago for incomes under 267, 267-803, 803-1339 and higher than 1339 was 0.91, 0.76, 0.21 and 0.15, respectively. In other words, the predicted probabilities of avoiding dental visit because of its costs during 1 year ago in participants with lower incomes were more than the higher incomes.

The predicted probability of avoiding dental visit because of its costs during 1 year ago for education levels of under diploma, diploma, BSc, MSc and MD/PhD was 0.84, 0.59, 0.30, 0.15, 0.22, respectively. In other words, the predicted probabilities of avoiding dental visit because of its costs during 1 year ago in participants with lower education levels were more than the higher education levels.

## Discussion

According to the results, the OR of avoiding dental visit because of its costs in men was more than women and decreased with each year increase in age. A study on university students of 5 Association of Southeast Asian Nations (ASEAN) countries indicated that men in comparison with women rarely or never have visited a dentist.<sup>12</sup> The association between income and utilization of dental services in men is more severe than women. The reason would be the more sensitivity and stress to income decrease in men and more

interest and follow-up among women in seeking dental care.<sup>13,14</sup> Other studies have indicated that women have higher information seeking behavior than men. The probable cause is more satisfactory levels of respect from their physicians.<sup>15,16</sup>

According to the results, the OR of avoiding dental visit because of its costs was decreased with each year increase in age. One of the reasons that younger people less likely seek healthcare may be in lack of coverage by insurance benefits.<sup>15</sup> Also, suffering from dental problems is low in lower age groups of household heads. By attention to cumulative nature of dental diseases, these problems increase with aging.

According to the results, the OR of avoiding dental visit because of its costs decreased with increase in income and education level, and the predicted probabilities of avoiding dental visit because of its costs during 1 year ago in participants with lower incomes and education levels were higher than the participants with lower income and education levels.

The results confirmed that the lower income groups use less dental services because of paying directly through out-of-pocket. A study in Canada showed that two-thirds of low-income groups pay the cost of services through out-of-pocket. Despite the underprivileged citizens are covered by public programs, these programs cover only emergency services; therefore, they cannot improve their dental health. In contrast, the

rich people have private insurance and usually do not pay the costs through out-of-pocket.<sup>17</sup> Likewise in Iran, public health insurances are not powerful adequately and do not cover dental services which prevent the access of poor people to the services. This is called inverse care law which means higher access to the services among people who need lower need to them.<sup>18</sup> There is no doubt about the necessity of insurance coverage in the low-income families. Two different studies in Canada indicated that dental coverage significantly increased dental visits and utilization, especially in the lowest income groups.<sup>19,20</sup>

Such as current study, other studies also have confirmed the positive relationship between educational level and utilization of dental care.<sup>21-25</sup> According to the researchers, people with high education level seek health services more than others, because of better recognition of health needs and more knowledge about the deteriorating effects of dental problems on health. Also, they can register for dental programs better than illiterate people and better diagnose the services they need.

There is no problem about the ratio of the dentists to the population in Iran. Indeed, the number of dentists in Iran is about or more than most developed countries. In 2014, Iran had more than 28000 active dentists in private and public sectors (1 dentist to each 3000 population).<sup>8</sup> This ratio was 1 dentist to 1408 population in European countries in 2014.<sup>26</sup> Annually more than 1300 dentist students are accepted to Iran universities.<sup>27</sup> So, in the near future, Iran can take the first rank of dentist/population ratio in the world. In spite of the quantitative growth of the dentists' numbers, the qualitative growth in the field of dental care has not a good situation. DMFT index in different age groups is high, there are high unmet dental needs and other dental health problems.<sup>4,28</sup>

There are only 150 dental health workers (other than dentist) in Iran public health centers who are allowed only to present

limited predictive services such as scaling, radiography, dental health education and extracting (Ministry of Health and Medical Education, personal communication, September 2012). That is while people need dentistry services which impose a large cost on them. An unofficial report estimated that about 90% of the dental costs are paid through out-of-pocket, while other sources especially insurance funds pay lower than 10% of the costs.<sup>5</sup> Supportive financial mechanisms such as insurance can improve utilization of dentistry services by lower and middle-income groups which need more than others to the services.<sup>29</sup> Finally, because of failure in determination of a basic package of dental health services on the basis of credible evidences such as cost-effectiveness, the effect analysis of economic burden of the services on families, situation of demand rate for the services in the health market and socio-economic situation of the potential population of the services, the current package of services has no legitimacy and need redefinition.

This study has some limitations. Although Kerman has the mean frequency of dental indices among different cities of Iran, using data from only one city and also performing a cross-sectional study make it difficult to generalize the results to the country. Also, future studies should consider a broader range of predicting variables. Cross-sectional studies are prone to non-response bias and are unable to determine causality. To deal with this problem, the sample size was increased. The most important strength point of the study is large sample size which allowed adjustment for numerous social, demographic, biological, and nutritional variables. We also used family-level reported income as a measure of socioeconomic position.

## Conclusion

The public sector of dental care in Iran has scarce resources and by attention to the unsuitable situation of dental diseases, it is necessary to more strengthen preventive and restorative dental programs. The formation of

health policies to reduce disparities in access and utilization of dental care services is necessary. These policies should pay an especial attention to the horizontal equity in order to improve the access of different income groups to the dental services.

### Conflict of Interests

Authors have no conflict of interest.

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## Surgical replacement of huge rate of root end amalgam filling with mineral trioxide aggregate angelus: A case report

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### Case Report

#### Abstract

**BACKGROUND AND AIM:** Surgical endodontics may sometimes fail despite using root-end filling materials (REFMs). In this case report, a symptomatic right maxillary first premolar underwent periradicular surgery (PS) for replacing huge rate of amalgam with mineral trioxide aggregate (MTA).

**CASE REPORT:** A thirty-year-old healthy woman attended with the chief complaint of recurrent swelling and abscess in the periradicular region of maxillary premolar tooth and sensitivity to percussion. She had a history of PS in the past year. Periapical radiographic images showed a huge rate of amalgam used as REF. The PS was performed again and the amalgam was replaced with MTA. Postoperative clinical and radiographic evaluation after 2 years showed no sign of abscess and no sensitivity to percussion and periapical pathosis.

**CONCLUSION:** In this case report, replacing amalgam with MTA provided reasonable outcome up to 2 years after the treatment.

**KEYWORDS:** Dental Amalgam; Failure; Mineral Trioxide Aggregate; Root Canal Filling Materials; Root-end Filling

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Endodontic periradicular surgery (PS) may be indicated after root canal treatment or retreatment when the orthograde nonsurgical treatment is not possible.<sup>1</sup> In addition to the elimination of pathological tissues, PS consists of resecting apical part of the root (apicoectomy), root-end cavity preparation and placing the root-end filling material (REFM).<sup>2</sup> A major factor affecting success of PS is using appropriate REF to create an effective and long term seal and to prevent the spread of root canal infection to surrounding tissues.<sup>3,4</sup>

Many dental and medical materials have been used as REF; among which, silver amalgam has been the most frequently used material for many years.<sup>5</sup> Although many

researchers have questioned safety and long term successful outcome of amalgam as a material for root-end filling (REF) in recent years due to the numerous drawbacks of the material like mercury toxicity, corrosion and electrolysis, delayed expansion and developing of tattoos in tissues.<sup>6</sup>

Mineral trioxide aggregate (MTA) has been introduced in 1993 by Torabinejad et al. This material has excellent sealing ability, with the capability of promoting osteoblast activity and lowering toxicity compared with amalgam.<sup>7</sup> MTA is the most biocompatible REF and has an appropriate outcome without any inflammation and mutagenic effect, therefore it can be used for REF.<sup>8,9</sup> In addition, REF has antibacterial and antifungal effect.<sup>10,11</sup> One of the very

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important reasons that make MTA a very popular material for REF is formation of cementum on the material.<sup>4,6,12,13</sup>

In this case report, a symptomatic maxillary premolar in which a huge rate of amalgam was used as the REF in the previous surgery, rate was surgically retreated by replacing amalgam with MTA.

### Case Report

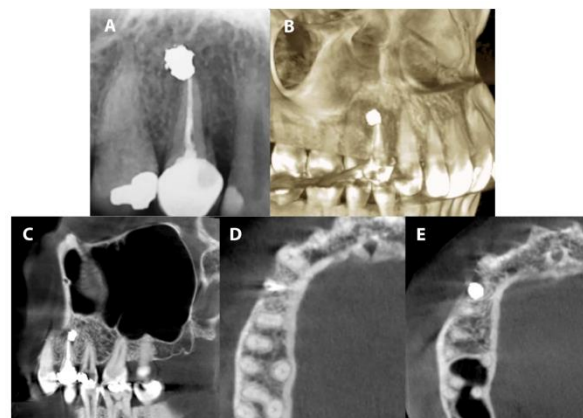
A 30-year-old healthy woman referred with a chief complaint of recurrent swelling and abscess in the periradicular region of right maxillary first premolar tooth and sensitivity to percussion (Figure 1).



**Figure 1.** The maxillary right first premolar: Crown on the tooth and periapical abscess

The patient had the opportunity to choose the option of receiving another endodontic surgical treatment or the tooth extraction and single tooth implant placement. The patient had a history of PS in the past year and amalgam was used as a root-end material based on radiographic findings. A cone beam computed tomography (CBCT) was ordered for better evaluation. CBCT images showed a small radiolucency that could be interpreted as a metallic artifact (Figure 2, A-E). Axial view of CBCT did not show presence of a missed root canal (Figure 2, D and E). Furthermore, there were some favorable factors including: normal mobility (maximum grade 1), healthy and compliant patient with no systemic disease. No

periodontal pocket could be observed around the tooth when walking probe was performed. The patients would not like to receive orthograde treatment due to potential of further failure and also need to penetrate through crown for the procedure. The diagnosis of acute apical abscess was made. Therefore, we suggested to repeat the PS and replace the amalgam with MTA.



**Figure 2.** Periapical and cone beam computed tomography (CBCT) images: (A) Periapical radiograph: excess rate of amalgam, (B) 3 dimensional view of CBCT, (C) sagittal view of CBCT (D, E) axial views of CBCT

The PS was started after achieving appropriate anesthesia by 2% lidocaine and 80000 epinephrine (Persocaine, DaruPakhsh, Tehran, Iran). A sulcular full mucoperiosteal flap with one vertical releasing incision in the mesial was used. No buccal plate was present at the apical part of the tooth. In order to remove amalgam without splashing surrounding area, the bone was removed with low speed round bur to access the apical area of the tooth. Amalgam was removed by a curette and a low speed hand piece using copious rate of sterile normal saline (Samen Co., Mashhad, Iran). The root-end was resected as 3 mm due to the potential of crack and accumulation of bacteria at the apical region. A new root-end cavity was prepared by an ultrasonic device (Piezon master surgery, EMS, Nyon, Switzerland) with 3 mm depth MTA Angelus (Angelus, Lorandria, Brazil) and was mixed based on the

manufacturer instruction and placed in root-end cavity. The patient was instructed to use 500 mg amoxicillin every 8 hours for 5 days. The flap then repositioned and sutured carefully. The patient was followed up for 2 years both clinically and radiographically (Figure 3).



**Figure 3.** The tooth after replacing amalgam with the mineral trioxide aggregate (MTA) after the 2-year follow up period

The patient's signs and symptoms resolved after one week. The tooth remained asymptomatic until the end of the 2-year follow-up period. There was no sign of abscess or sensitivity to percussion which were the reasons of the patient's first attendance.

### Discussion

In this case report, both unsuitable treatment procedure and the bulk of amalgam caused failure of the REF procedure and successful outcome of replacing huge the rate of amalgam with MTA as REF have been presented.

Nonsurgical root canal therapy is a highly predictable option in most cases; dental practitioners may have to perform surgery for teeth with persistent periradicular pathosis despite nonsurgical treatment. PS consists of removing the diseased tissue associated with the root apex, resecting the apical part of the root, cavity preparation in the apical root-end and placing the REFM. The REFMs should seal the root-end cavity and prevent microleakage which is crucial for

endodontic surgery success.<sup>2</sup>

An ideal material for REF should be biocompatible, osteoinductive, with antibacterial activity, insolubility in tissue fluids, radiopaque, non-toxic, non-corrosive and with suitable handling properties.<sup>14</sup> MTA included most of these specifications.

In the present case, the patient had been offered for two options including either keeping her own tooth by surgical retreatment or extraction and replacing with single tooth implant. The patient decided on keeping her own tooth due to the lower cost, faster function, and the tooth returned aesthetics.<sup>15</sup> The option of retreatment was rejected since the patient was reluctant to receive orthograde treatment.

Amalgam has been used as a REFM for a long time due to the radiopaque, easy to use and non-resorbable characteristics. However, there are many concerns about mercury release from amalgam to bloodstream. Mercury is the most harmful material among the heavy metals with the capability to alternate the distribution and retention of other heavy metals. Mercury is a very reactive metal with numerous toxicity characteristics in high doses including, cerebral ataxia, paresthesia, dysarthria and constriction of the visual fields. According to the results of a study, placing the amalgam as REFM caused high level of blood mercury one week after the treatment, although the mercury levels still was very lower than the toxic level.<sup>14</sup> Drawbacks of amalgam have been discussed in this study and it has been shown that amalgam failures could be healed by replacing amalgam with another bioactive endodontic cement in the apical region.<sup>5</sup> Today, promising results of bioactive endodontic cements have made them suitable materials for REF.<sup>16</sup>

In the present case report, MTA was chosen as the REFM instead of amalgam.

CBCT was ordered to evaluate the causes of symptoms following the previous endodontic surgical treatment. Both American Association of Endodontists (AAE)

and the American Academy of Oral and Maxillofacial Radiology (AAOMR) position statement have recommended to use CBCT for evaluating non-healing teeth that received endodontic treatment.<sup>17</sup> In the present case, according to the CBCT images, the excess rate of amalgam present at the apical part of the treated tooth and possible unsuitable apical seal by the REFM were the causes for failure of the REF treatment rate. Therefore, microleakage and lack of a suitable root-end cavity preparation and filling were assumed to be the causes of the treatment failure.

Recent articles on the advanced endodontic surgery emphasize on using ultrasonic device for root-end cavity preparation and MTA as REFM.<sup>18</sup> The depth of preparation is very important to prevent further communication between the root canal and the periapical tissues. It has been recommended the depth of preparation to be

at least 3 mm.

In this case report, it has been shown that using MTA as REFM could significantly improve the outcome of the endodontic surgery compared to amalgam.

### Conclusion

Unsuccessful treatment of periapical surgery can be retreated through performing a second surgery and a suitable root-end cavity preparation hence, REFM could improve the outcome of the treatment.

### Conflict of Interests

Authors have no conflict of interest.

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