Kerman Oral and Dental diseases research center

Kerman University of Medical Sciences and Health Services

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Original Articles

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Delineation and analysis of co-authorship network among the academics of School of Dentistry in Kerman University of Medical Sciences in 2013 using network analysis method

Fariba Tohidinasab MD[1], Diba Ghonchepour MSc[2], Mohammad Azami PhD[3], Sirous Farvahari MD[4], Farzaneh Zolala PhD[5]

Original Article

Abstract

BACKGROUND AND AIM: This study aims to explore the co-authorship in School of Dentistry at Kerman University of Medical Sciences, Iran, in three levels; individuals, other schools of KUU, and beyond the university.

METHODS: This is a cross-sectional study which is a part of a larger study conducted from September 2014 to December 2014. A comprehensive search in Scopus was conducted to find related articles published in 2013 by following these steps; first of all, a complete list of all faculties, based on the school and the department they worked in, was obtained. Second, all articles indexed with the affiliation of KMU were retrieved, using both keywords of "Kerman Medical University" and KUM Sciences." The data were analyzed using Social Network Analysis and Visone software.

RESULTS: The results showed an inadequate collaboration within departments; only two of them had collaboration. Co-authorship among departments illustrated a more satisfactory picture: although, it still has more rooms for improvement. Regarding collaboration between the Dentistry School and other schools of the university, the School of Dentistry is in a middle position, though it could have had more potential relationships. The School of Dentistry formed a few relationships with the organizations outside of the university.

CONCLUSION: Our study suggests that there are more rooms for improvement in the field of collaboration and co-authoring papers, which could consequently not only lead to a higher rate of publication and visibility but also affect the citation rates for authors.

KEYWORDS: Authorship Collaboration; Dentistry; Network Analysis; Social Networks; Co-Authorship

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Scientific collaboration is described as complex social phenomena[1] which could be defined from the exchange of views to working together in a laboratory.[2] This sort of collaboration occurs at three levels of between; countries (macro level), organizations, and departments (meso-level), and individuals (micro level).[3] In today's world, due to the existence of problems inquiring interdisciplinary solutions, and a growing demand for making scientific-based decisions, it is very essential to create such partnerships.[3,4] With regard to the area of health, many often complex issues are addressed, and many stakeholders are involved, therefore collaborations with

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different discipline are highly crucial.[4] For instance, oral health care is discussed to be related with general health, and also to provide the oral health care it is vital to have effective collaboration and use interprofessional approaches.[5]

Scientific collaboration could be gained through two main routes: First, team working with enormous funding, and second, increasing communications among scientists.[1] Since scientific collaboration is becoming more and more important as an effective approach to enhance productivity, quality and research effects,[6] it is more appealing than the first route because of increasing limitations of resource availability among nations.[1] Co-authorship, as the second route, is an indicator of scientific collaboration. Noteworthy, the relation between authors in academic world can be observed as co-authorship network.[7] And to measure the level of co-authorship networks, three main research methods have been suggested including qualitative (interviews), bibliography (counting), and networks.[8]

Social networks analysis (SNA) is a graphical method to examine the relationship between actors who create the network. The pattern of relationship and the structure of the network shed light on the type of behaviors and connections among individuals.[6] Co-author network is a type of social network, in which authors are the main actors, and their collaboration with each other in writing a paper is explored.[6] Moreover, co-authorship analysis can be conducted at three stages including individuals, organizations, and countries or region.[9] This sort of analysis can enhance our understanding on science production in a certain field. Furthermore, the authors with greater influence and more level of connectivity will be recognized.[3]

The current evidence indicates an increased rate of collaboration in publication of papers. However, this does not occur uniformly across different disciplines and domains.[5,10-12]

Iran, a Middle East country, has shown a very dramatic growth in scientific publication over the past year.[13] Iranian's co-authorship has been examined in a few studies, on different areas of social networks such examining the networks among the faculties of medical universities,[14] medical engineering,[15] medical emergency,[16] and research on three centers at Tehran University of Medical Sciences, Iran.[17]

To the best of our knowledge, in the area of dentistry, there is very limited literature on the co-authorship; only one document, conducted in Brazil. This study examined the network of co-authorship based on the information extracted from the Scopus on different levels of collaboration.[18] This study aims to explore the co-authorship in Dentistry School at the Kerman University of Medical (KUM) Sciences, Iran, in three levels; individuals, other schools in the universities, and beyond the university.

Methods

This is a cross-sectional study which is a part of a larger study conducted from September 2014 to December 2014. The primary aim of this study was to know the co-authorship networks among faculties in Kerman Medical University (KMU) in the year 2013. This study presents results, which was related to the Dentistry School. In this study, a librarian conducted a comprehensive search in Scopus to find related articles by following these steps; first of all, a complete list of all faculties, based on the school and the department they worked in, was obtained. Second, all articles indexed with the affiliation of KMU were retrieved, using both keywords of "Kerman Medical University" and "KUM Sciences." Next, we excluded the articles without faculty authors; if the author was a student or a staff of the university, we did not include that for analysis. In total, 673 articles were examined; 237 were eligible out of which 26 were related to the School of Dentistry.

This was followed by retrieval of information related to the authors including

name, family name, affiliation, departments, and schools. Finally, the data were weighed based on the number of faculties in each department, then entered in Excel matrices and finally, exported into Visone program (version 7.3.4) for network analysis. The data related to the School of Dentistry were excluded from other information before they were exported to the Visone.

The data were analyzed at four levels; within departments, among departments and schools, and between departments and institutions outside the university; via SNA. In this study, authors, departments, schools, and institutions outside the university were defined as nodes and their collaboration as edges (networks were described by a series of nodes and edges; nodes were actors and edges are their relations).[19] We used properties to describe the networks in this study. A network can be defined and illustrated with different methods; however, there are a number of properties which are commonly used to describe networks. The following is a brief overview of these approaches: Overall, network structure can be assessed by property such as density which in general means, how connected a network is;[19] the more connected, the more collaboration exists. Furthermore, it is possible to find each node attribute such as the betweenness centrality, the centrality degree, and the cut points. These all shows the importance of a node in the network. To make it more clear we present the results from collaboration at micro level (individuals) to macro one (beyond the university) in figures. Therefore, in each figure a node illustrates different entities; in figures 1 and 2 individuals, in figure 3 departments, in figure 4 schools, and in figure 5 connections beyond KMU. The centrality degree shows the number of connections that a node possesses;[20] this implies the importance of the node in the network. Betweennees centrality shows whether a node can play a role in building relationships between two other nodes.[7] Cut points are those important nodes to form a bigger network that relates components of a network, so if they are removed the components will be separated.[19]

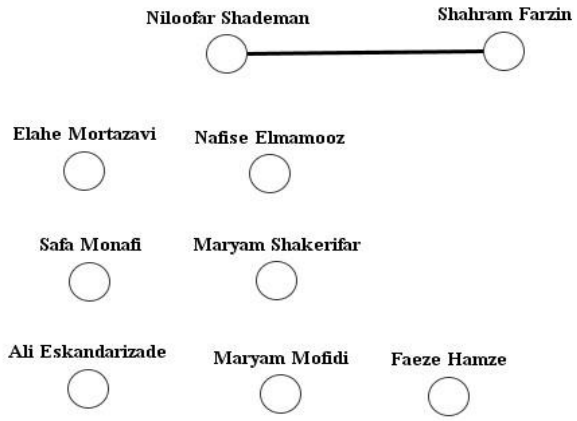


Figure 1. Co-authorship network among school of restorative dentistry in Kerman University of Medical Sciences, 2013

Results

As mentioned in the section of method, the results are presented in a hierarchical order from micro to macro level.

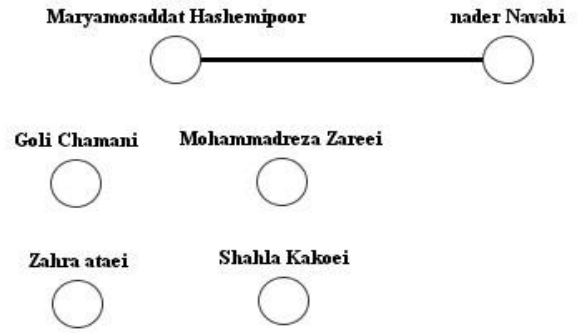


Figure 2. Co-authorship network among school of oral disease in Kerman University of Medical Sciences, 2013

Co-authorship within departments of the Dentistry School of KMU: Among the 10 departments of the School of Dentistry, the Departments of Dental Public Health and Restorative Dentistry had collaboration, and the relationship was formed only between two faculties in each of these two groups, figures 1 and 2, respectively. However, it is needed to have more than 2 relationships to

calculate network indices, since there was no such condition, we failed to calculate network indices. In figures 1 and 2, circles are nodes, showing the names of authors, while the lines between them show edges or relationships. Those authors with no lines had no collaboration with other faculties in the same department.

Co-authorship between departments of the Dentistry School: Among departments in the School of Dentistry, there was no collaboration between orthodontics, fixed prosthesis, denture, and restorative dentistry and other departments of the school. However restorative dentistry formed collaboration within its members. Other departments had collaborations and formed a network with a density of 1.16% (Figure 3). Dental public health and endodontics are cut points in this network with a higher score of betweenness 0.1 and 0.08, respectively. In addition, the Department of Endodontics had the most centrality among departments (Table 1).

Co-authorship among the schools of KMU: Different schools at the university could form a network of co-authorship. The school of dentistry had relationship with the school of medicine, health, and pharmacy. While, there was no direct relationship between the school of dentistry and other schools such as nursing and management (Figure 4).

Table 1. Co-authorship among schools at the Kerman University of Medical (KUM) Sciences

Department	Central degree (%)
Endodontic	36.79
Oral disease	34.57
Pediatric dentistry	7.381
Restorative dentistry	6.10
Oral and maxillofacial surgery	5.54
Oral and maxillofacial pathology	4.90
Oral and maxillofacial radiology	4.60

The centrality of the School of Dentistry was 31.15%; which had the fifth centrality degree among the 7 schools of the current study. The most centrality belonged to the School of Medicine and Health, 31.15%, 27.22%, respectively. Based on the results of computation of Cut Points in NetDraw (version 6.0) software, the two schools of Medicine and Health Schools are the cut points of the network. Finally, the highest amounts of degree and betweenness centralities are related to Medicine and Health Schools, respectively.

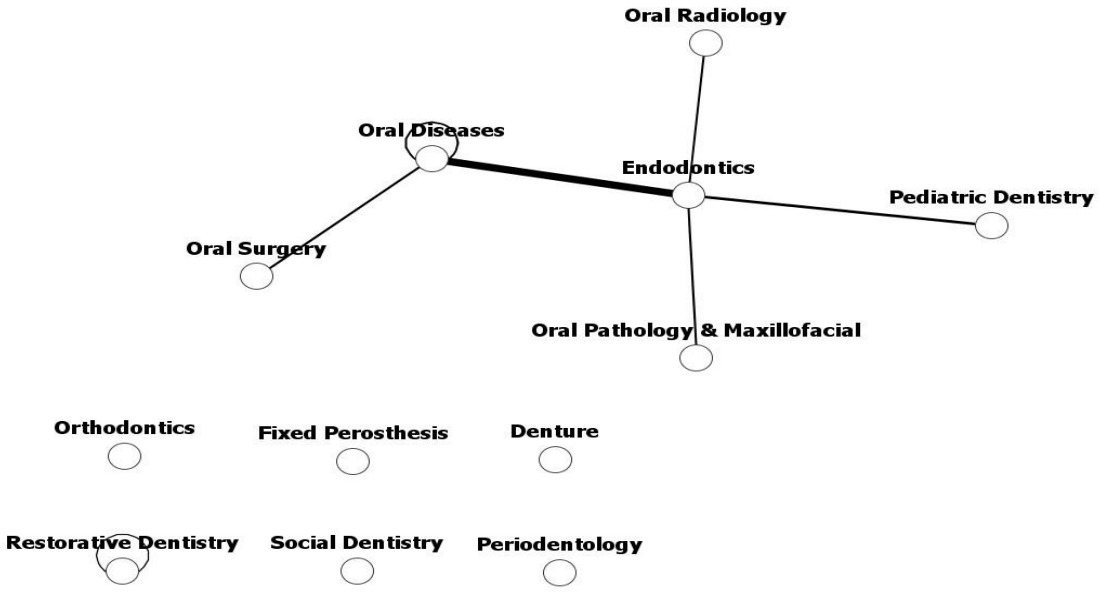


Figure 3. Co-authorship network among departments of the School Dentistry in Kerman University of Medical Sciences, 2013

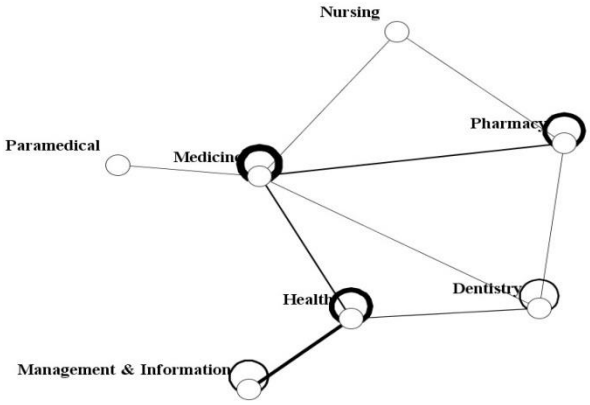


Figure 4. Co-authorship network among the schools in Kerman University of Medical Sciences

Co-authorship between schools at KMU and institution outside the university: The amount of density for schools and other universities network was 0.195. Based on figure 5, there was no isolated node in the network. Cut point index was calculated and based on the result, no cut point was observed in this network. Figure 5 shows "Medical Sciences of Iran" category had the highest degree centrality in this network. "Health" school had the highest amount of this index among the schools of KMU (12.95%), in comparison with the Dentistry School with the lowest degree of centrality among the schools, 2.64%.

Discussion

Considering all together, this study shows that co-authorship networks embodying papers, indexed in Scopus in the year 2013 from the Dentistry School, depicts a somewhat satisfactory picture. However, the level of collaboration fluctuates between different levels. For example, there is inadequate collaboration within departments; only two of them had collaboration. Co-authorship among the departments illustrated a more satisfactory picture although it had more rooms for improvement. Regarding the collaboration between the schools of the university, the dentistry school is in the middle position, though it could have more potential relationships. Two departments of the school of dentistry formed a few relationships with the organizations outside of the university.

Over recent years desirability of scientific publication enhancement has been emerged considerably. This led many countries compete with each other for producing more scientific documents. A publication called "lifeblood" of academic world[21] as it could bring financial and prestige motivations for faculties.[21] Scientific collaboration is discussed to be an effective way to increase knowledge and productivity. The collaboration is achieved not only through conducting research but also through co-authoring the papers.[6] The current evidence indicated a rising attention on such collaboration, for example in the field of evolutionary biology there has been a rapid growth in collaboration in Brazil,[3] also the same pattern has been observed in the field of physics in Malaysia.[22]

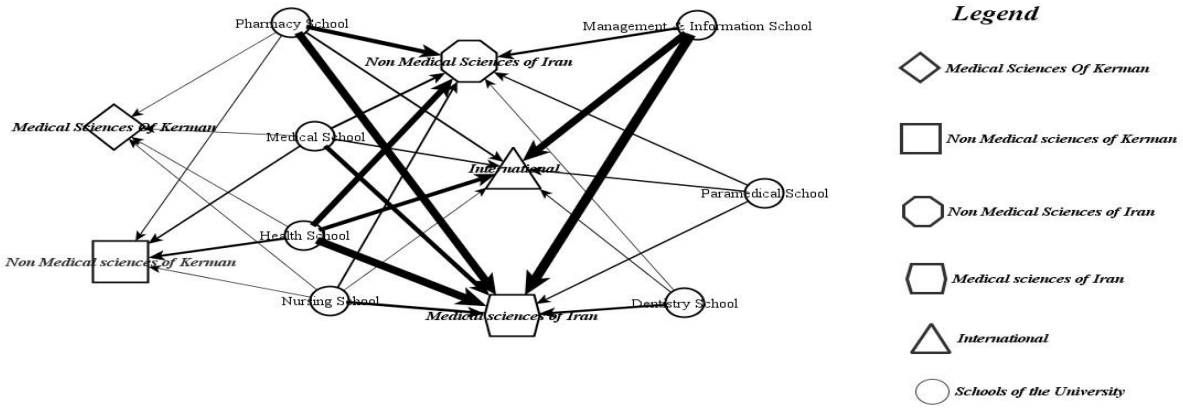


Figure 5. Co-authorship network among the schools of Kerman University of Medical Sciences and the other universities

In addition to deep understanding of the process of knowledge production in any scientific institution, the network of collaboration knowledge is necessary to know.[23]

SNA which has been widely used at the social literature has received growing attention in other disciplines including studying co-authorship networks. Examples of such studies are the following studies.[6,18,24,25] These studies, according to their own specific aims, analyzed the networks at different levels. For example in one study, conducted in Brazil, the networks of collaborations in the field of dentistry among universities across Brazil and beyond that were examined. Based on this study, the universities of Brazil were rather well connected with a density of 63.7%, which means 63.7 out of 100% of possible connections were created.[18] However, in one study conducted in Brazil in the field of evolutionary biology, the results found that the centrality degree in different universities ranged from 29.6% to 7.6%.[3] In our study, the degree of centrality was low among the faculties of the dentistry school, and there was no node between two other nodes. These indices show the impact and importance of a person on scientific collaborations.[25]

Iran is a developing country with a growing speed at scientific publication.[13] However, there are limit evidence about co-authorship network in Iran and some of them did not address the network structure straight forward.[26] One study suggested the existence of low connections networks among Iranian Medical Universities.[14] However, one study suggested acceptable levels of collaboration among the medical engineering students; 48% collaboration with international organization and 38% with national ones.

We found a low international collaboration among scholars at the Dentistry School, while in one study conducted in China on the management field about half of the published papers came through international collaboration.[27]

Conclusion

Our study suggests that there are more rooms for improvement in the field of collaboration and co-authoring papers, which could consequently not only lead to a higher rate of publication and visibility but also affect the citation rates for authors.

Conflict of Interests

Authors have no conflict of interest.

Acknowledgments

We acknowledge that to know a deep understating of the pattern it is better to have more data on several years; however, this study is among very few evidence on co-authorship network among the dentistry schools in Iran. Our study suggests that there are more rooms for improvement in the field of collaboration and co-authoring papers. This could not only lead to a higher rate of publication and visibility but also affect the citation rates for authors.[28]

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Assessment of knowledge and practice of pharmacists regarding oral health in Kerman, Iran

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Original Article

Abstract

BACKGROUND AND AIM: Oral health is an integral part of general health. Between the different medical professions, pharmacists are one of the groups who encounter patients seeking consultation in the oral health field a lot. Therefore, this study aimed to assess the knowledge and practice of pharmacists in Kerman, Iran, toward oral health.

METHODS: All pharmacists were invited to participate in the study after being informed about the aims of the study. A validated questionnaire with six sections including demographic data, oral hygiene behavior of the participants, the pharmacies' specifications and products related to oral health, questions related to knowledge, questions related to practice, and questions related to the participants' assessment were filled out by the participants. The collected data were analyzed using SPSS software, and descriptive results were presented in tables and charts. The chi-square statistical tests were used to explore any association between variables.

RESULTS: Data were analyzed for 81 participants. Most of the participants were male and the mean age was 38 ± 10. The pharmacists' mean knowledge of oral health was 6.5 out of 10 which places them in the medium knowledge range. The performance of pharmacists when encountering oral problems was prescribing analgesics in 79% of cases for tooth aches. There was no statistically significant difference in the knowledge score between different age and gender groups (P = 0.500).

CONCLUSION: The results show a medium knowledge of pharmacists on oral health topics. Considering their own desire plans to train and educate in oral health fields to promote oral health seem necessary.

KEYWORDS: Knowledge and Practice; Pharmacists; Oral Health

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All around the world, pharmacists are a part of the medical team who the public consult about health and hygiene and other matters related to them. They also consult other medical professions.[1] In dentistry references, pharmacists are mentioned as a partner who can help to promote oral health levels and standards.[2]

Many oral health products are sold in most pharmacies without prescription such as toothbrush, toothpaste, mouthwash, whitening agents, breath fresheners, and painkillers. Therefore, in many cases, pharmacists are the first who encounter those seeking advice in dental and oral matters and can play an important role in preventing the occurrence or progress of illnesses.[3] Because pharmacies are accessible by public they are constantly encountering a high demand for

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consultation in health subjects by them; therefore, they are a suitable location to target with health promotion programs. Studies show that 94% of people visit a pharmacy at least once a year and around 1.8 million visits are made to pharmacies daily most of which are to seek consultation.[4] In some countries, there are even laws obliging pharmacies to promote health in society and they have been modified in ways to do so.[5] Because of the importance of pharmacists in general health and oral health promotion, many researchers have conducted many studies on this matter.[6-10] Unfortunately, this role has been neglected in Iran. Considering the importance of pharmacists in promoting oral health and the fact that they have been overlooked in this country, this study aimed to provide the necessary basis required for cooperation between different sectors to promote dental public health by analyzing the knowledge and practice of pharmacists regarding oral health in Kerman, Iran.

Methods

This was a cross-sectional descriptive study based on the pharmacist population of Kerman city and sampling was conducted as a census. The aims of the study were explained to every pharmacist (110 people) by visiting their pharmacy or another place of work and they were invited to voluntarily participate in the study after informed consent had been acquired. The data collection tool was a questionnaire with several sections which validity 85% for Cronbach's alpha test. The different parts are as follows, demographic data, the pharmacy's specifications, products related to dental and oral health, analyzing the knowledge of pharmacist regarding oral health, analyzing the practice of pharmacists in the field of oral health and the pharmacists' evaluation of their own knowledge, and practice in relation to oral health. The collected data were analyzed in SPSS software (version 20, IBM Corporation, Armonk, NY) software. The statistical analysis was performed using chi-square test and calculating the Pearson coefficient. The statistically significant level was considered 0.05 in the study.

Results

A total of 81 (response rate = 74%) participants including 51 men and 30 women took part in the study. The mean age of the participants was 38 ± 10 years with a minimum of 22 and maximum of 65-year-old. The mean years after graduation were 12.24 ± 8.5-year-old and the maximum was 30 years. The majority of the participants were general pharmacists and only 6.5% were specialists. Most (77.8%) of the participants worked in private pharmacies and a 17.3% worked in both private and non-private pharmacies. 45 people equal to 56.8%, meaning the majority brushed their teeth twice daily or more and only 38.0% flossed once or more a day. Most of the participants, 61.0% had received dental treatment. The most common number of pharmacists in one pharmacy was one and two (74.0%). The highest number of attendance in a pharmacy was 200 people, which was reported by 17 pharmacies. Over 90.0% of the pharmacies had various kinds of foreign and Iranian made toothbrushes available, whereas brushes used for prosthetics were only available in 35.0% of the pharmacies. Fluoride containing toothpaste was available in 96.0% of pharmacies. Approximately 97.0% of the floss available in pharmacies was non-waxed. 65 of the pharmacies had fluoride containing mouthwashes. Denture cleaning tablets were available in 47.2% of the pharmacies. Super floss could be found in 78.9% of the pharmacies. Tooth whitening agents were available in almost 50.0% of the pharmacies.

In the section analyzing, the knowledge of pharmacists in regards to oral health only 2.5% answered all of the questions correctly. 50.0% of the pharmacists knew that teeth have to be brushed three times a day and 85.2% answered that medium toothbrushes

are best to use. The plaque was identified as the main cause of oral disease by 85% and 96% answered correctly that the most important way to clean the mouth is by brushing. 65 people answered correctly that the method of brushing is more important compared to the type of brush (manual or electric). About 56.8% knew that every 3-4 months the toothbrush should be changed. Daily flossing frequency was reported by 86.4%. 60.0% knew about super floss, and its use and over 90.0% had knowledge about fluorides properties in caries resistance. The different aspects of dental health in which pharmacists gave consultation were toothache with 80%, type of mouthwash with 71.0% and type of toothpaste with 85.3% (Figure 1).

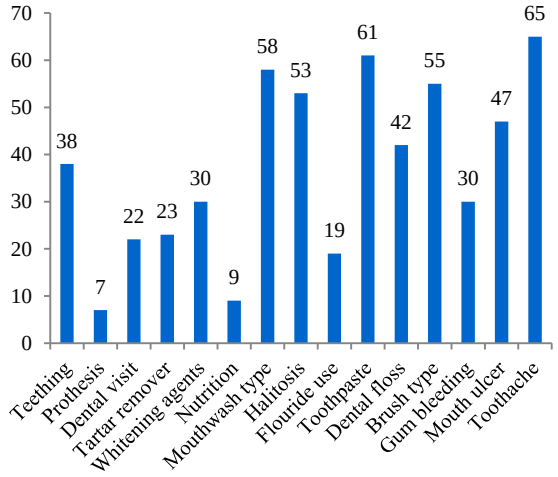


Figure 1. Frequency distribution of oral health advices by pharmacists

The most common response from the participants toward those seeking guidance in oral and dental health matters was prescribing painkillers for toothaches with a frequency of 79% (Figure 2).

Only 27% of the pharmacists stated certainty regarding the information they were giving to the patients (Figure 3).

The majority of the pharmacists (90%) referred the patients who had toothache to dentists and 84% also prescribed painkillers (Figure 4).

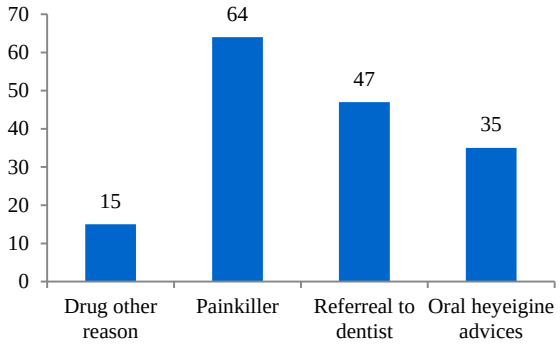


Figure 2. Frequency distribution of pharmacists action encountering dental problems

Most of the pharmacists (51.9%) evaluated their own knowledge in the oral and dental health as good, also 85.0% of were eager to take part in courses in this field especially to learn more about oral hygiene products.

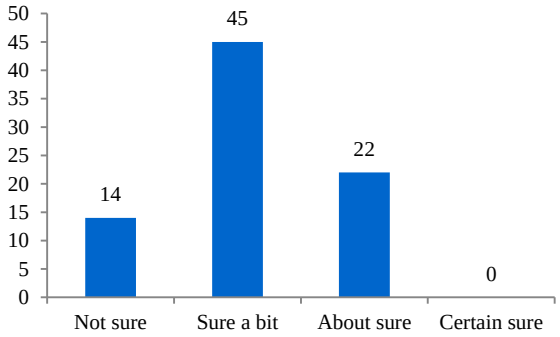


Figure 3. Levels of certainty of pharmacist for their giving advices in oral health

The mean score of knowledge of pharmacists had no statistically significant relationship with their age and number of years after graduation (P = 0.100). The mean score of knowledge of pharmacists also had no statistically significant relationship with the type of pharmacy (P = 0.500). The consultation given and referrals in the field of oral health had a statistically significant relationship with the age of the pharmacist such that those aged under 35 referred patients more often (P = 0.002). The practice of pharmacists in giving information about oral health had statistically significant difference based on the type of pharmacy, such that private pharmacies performed this

more often (P = 0.020). Furthermore, private pharmacies claimed they prescribed painkillers more often with a statistically significant difference (P = 0.001).

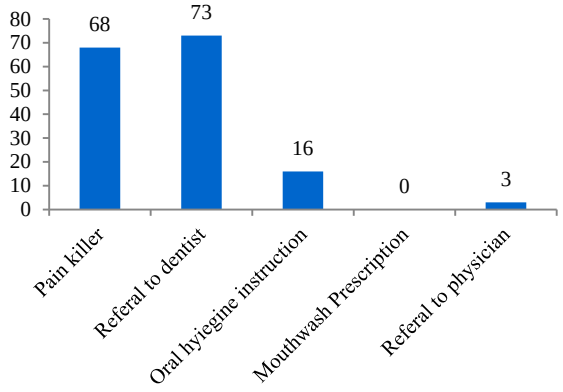


Figure 4. Practice of pharmacists with dental pain patients

Discussion

Pharmacies are a place for the public to seek guidance and consultation regarding their health.[11] Therefore, pharmacists are one of the main references for people to get answers for the questions they have regarding their health which includes questions about their oral and dental health.

The results of the study showed that the knowledge of pharmacists in relation to oral health is at a medium level and a few number answered to all questions correctly. Most of the participants knew about fluorides role in strengthening teeth against caries which was higher than the result of Priya et al.'s study[6] in India which only showed a 50% awareness of this topic. This result was also higher than a study conducted in Malaysia.[12] The knowledge of pharmacists regarding fluorides role in preventing caries is important as they can advise people to use products which contain fluoride to prevent caries.

The awareness of pharmacists regarding the oral diseases etiologic factors of the mouth and methods of eliminating them could be very useful as they can help disseminate awareness of the benefits of brushing and flossing teeth. Most pharmacists, especially younger ones stated referral to the dentist when encountering someone with pain, also many of them reported prescription of painkillers to help with the pain and in comparison with Priya et al.'s study[6] in India the results of this study was higher. However, in Maunder and Landes' study[3] 100% of pharmacists' prescribed painkillers but the referral to dentists was similar to that of this study. A study conducted in Riyadh in Saudi Arabia reported a lower amount of painkiller prescriptions and referrals.[9]

Prescribing painkillers are the most common and after that is antibiotics which are prescribed the most by pharmacists without the dentist's prescription, and the same thing was also reported by most of the other studies. However, this was reported to be less in Priya et al.[6] and Bawazir's studies (22.4% and 13%)[9] compared to this study.

In relation to the pharmacists' own oral hygiene behavior, less than half brushed twice or more a day, and only 27% used dental floss once a day. The majority of pharmacists (80%) only visited the dentist when they had problem with their teeth, and no checkup visits were made. The results from Priya et al.'s study[6] were similar to this study regarding dental visits. The results of Rajiah and Ving's study[12] showed that 96% brushed twice a day which was higher than this study but only 21% used dental floss during the week which was lower than this study.

Only one-third of the pharmacists were certain about their knowledge in the field of oral and dental health, whereas in a study in Riyadh 98% were certain about their information. Furthermore, in this study, 51.9% of the pharmacists evaluated their level of awareness in oral and dental health as good, but in similar studies this figure was 70-90%.[3,9] 85% of the participants were eager to take courses to learn more about oral and dental health and their related products. These results are in line with similar studies.[3,6,13] One of the main reasons people visits pharmacies is to purchase health and hygiene products such as toothbrush and

dental floss and it is estimated that pharmacies encounter more people with oral and dental concerns than dentists daily.[7,14] Therefore, it seems that pharmacies are involved in society's health needs assessment in an informal and experimental way which could affect the kind of intervention suitable for each region.[3]

Unfortunately, currently role of pharmacists is limited to the distribution of drugs which are prescribed by dentists and physicians, but studies emphasize their important role in the field of oral health[5] and that they can be part of the primary health-care teams in general and oral health. Even though prescribing painkillers by pharmacists to those in pain is a positive action, by increasing the pharmacists' knowledge the referral can prescriptions can be more efficient.

One of the important points and limitations of this study was the busy work hours that pharmacies could be visited which ultimately led to over five visits to some of the pharmacies to acquire the questionnaires handed out before, and sometimes even after multiple visits some of the pharmacists did not cooperate completely in answering the questions.

Considering the results of the study and the importance of the pharmacists' role in promoting oral health and the fact that many people visits pharmacies seeking consultation in this field, organizing meetings with pharmacists and dentists together and other related organizations, setting up educational programs related to the target group in relation to oral dental health and fitting in oral health courses into students' curriculums is suggested. Emphasizing the pharmacists' role in promoting oral health with increased payment from insurance services for those who provide service to people in this field to encourage pharmacists in giving consultation in relation to oral health subjects.

Conclusion

This study showed that pharmacists in Kerman city do not have enough knowledge in oral health to be able to play an efficient role in promoting oral health. It seems that their role has been overlooked in oral health and also in many other fields of health and hygiene and it is necessary to give them the required training to be able to intervene in these matters more efficiently. Continuing education program and distribution of information sheet could be useful.

Conflict of Interests

Authors have no conflict of interest.

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Assessment of correlation between chronological age and modified Demirjian estimated dental age

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Original Article

Abstract

BACKGROUND AND AIM: This study was designed to assess the correlation between chronological age and modified Demirjian estimated dental age.

METHODS: Panoramic radiographs of 183 Patients between 13.5 and 20.5 years old were assessed for the developmental stage of lower right third molars. Student's t-test was used to measure the same hypothesis of the chronological age and estimated modified Demirjian dental age described above and Pearson's correlation coefficient was used to measure the linear correlation between them.

RESULTS: The result of the test at a significance level of 95% led to the hypothesis. There was no significant difference between chronological age and estimated dental age measured by modified Demirjian method (P = 0.81). Pearson correlation coefficient between dental age in modified Demirjian's method and chronological age was calculated 40%.

CONCLUSION: The mean dental age in both male and female, was calculated 0.33 years less than chronological age.

KEYWORDS: Chronological Age; Demirjian's Method; Dental Age; Mandibular Third Molar

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Estimating children's age plays a critical role in forensic medicine, endocrinology, pediatrics and clinical dentistry. Dental age is of critical importance particularly in diagnosis and planning of pediatric and orthodontic treatment procedures. Dental age of children may be assessed based on development of teeth in radiographic images. Assessment of dental developmental stages is more valuable than dental formation because the formation time is short and begins as soon as teeth begin to appear inside the mouth and can change by factors that may be local, like lack of space or systematic, like nutrition status.[1-4]

Several methods are suggested to determine dental evolution in radiography.[5,6] Among methods using dental calcification to determine dental age, the most common method in the world is Demirjian's technique.[6] It is based on calcification of permanent teeth in panoramic radiographic images. The method however has some limitations and weaknesses, such as requiring much time and accuracy in calculations, and using curves and diagrams, and the fact that it was originally developed for people of Canadian decent.[6-11] Moreover, the method resulted in overestimation in research works undertaken in various countries. Since the

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publication of reports on dental age determination by the technique of Demirjian et al., other methods have been developed by Nolla,[12] Galic et al.,[13] Willems et al.,[14] and Cameriere et al.[15] The problem with dental age determination through Demirjian method emerges when nearly all roots of the patient's permanent teeth have already evolved and the technique has to focus on the patient's wisdom teeth (third molar). Based on previous studies, modified Demirjian's method has the best accuracy, reliability and inter- and intra-observer agreement.[16,17]

Modified Demirjian technique is a perfect technique to estimate dental age radiologically. Radiographic analysis of third molar development allows to estimate age in a range of 9-23 years, because crown and root development can be studied regardless of eruption. The third molar is of particular interest because (a) it is the last and most variable tooth to form and (b) it is the only tooth to be completely formed after puberty, which has made it attractive in forensic and legal circles as an estimator of adulthood.[18]

The modified Demirjian method was studied in various populations and its application resulted in differences between various races.[8,19,20] As similar studies were already undertaken in other countries, this study was focused on evolutional stages of modified Demirjian technique on third molar teeth.

Methods

Ethical approval of this study was granted by the Shahid Sadoughi University of Medical Sciences, Yazd, Iran (IR.SSU.REC.1395.81). The present study was a retrospective review of 284 panoramic radiographs of orthodontics patients referring to a state-run dentistry clinic (Khatam al-Anbia dental clinic, Yazd, in 2016). Radiographs showing developmental/evolutionary problems, lacking third molars or those with invisible third molars were totally eliminated from the study. Dental age was estimated by modified Demirjian method using right third molars. Panoramic radiographs of acceptable quality and clarity which were showing at least the lower-right third molars were chosen. Estimation of dental age was also performed on all existing third molars of patients.

Chronological age of patients was collected from their medical files, taking into account their month of birth and by subtracting the radiography date from the birth date. Dental age was calculated by modified Demirjian method for lower-right third molars (Figure 1).[21]

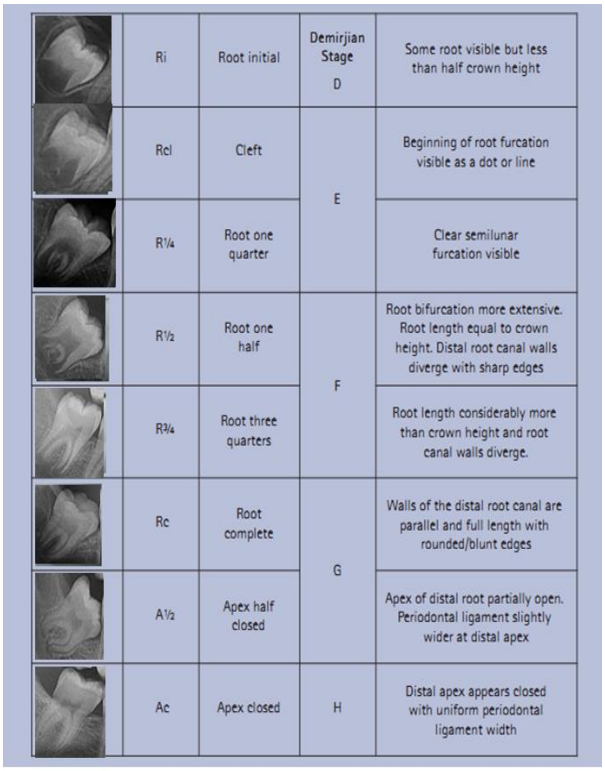


Figure 1. Developmental stages of third molar roots based on modified Demirjian's method

SPSS (version 18, SPSS Inc., Chicago, IL, USA) was used for statistical analysis. Kolmogorov-Smirnov test was used to verify data normality hypothesis. Average difference between dental and chronological ages was calculated for all ages. T-test was used for comparison between groups. A reliability level of 95% was considered for all of the tests used in this study.

To verify the repeatability of the analyses, 83 of the panoramic radiographs were

Table 1. Descriptive data on estimated dental age by modified Demirjian method and chronological age of studied population

	Number	Chronological age	Dental age	Chronological age	Dental age	Chronological age	Dental age
		Minimum		Maximum		Mean ± SD	
Total	183	13.5	13.75	20.58	19.5	17.21 ± 1.17	16.88 ±1.08
Female	126	13.5	13.75	20.58	19.5	17.20 ± 1.18	16.90 ± 1.14
Male	57	13.5	13.95	19.50	18.4	17.24 ± 1.13	16.80 ± 0.95

SD: Standard deviation

randomly chosen and examined 1 month later by oral and maxillofacial radiology experts. Kappa agreement coefficient was employed to test the agreement of old and new dental ages.

Results

A number of 183 panoramic radiographs belonging to legible Iranian young adults met the inclusion criteria. Kappa agreement coefficient of this study was 0.82 showing a good level. In other words, reliability of the first round of estimation was confirmed by the second analysis of the samples.

Distribution of sex and mean/minimum/maximum chronological age of studied patients and dental age by modified Demirjian method are presented in table 1.

Mean estimated dental age by modified Demirjian method was 0.33 year (about 4 months) less than the chronological age. Table 2 presents data on difference of chronological and estimated dental age by modified Demirjian method.

T-tests were used to examine the significant difference between chronological age and estimated dental age by modified Demirjian method. T-tests were also used to study the effect of sex on age estimation, and no difference was observed between the two sexes in estimated dental ages, showing that sex did not affect age estimation by modified Demirjian method (P = 0.95).

Pearson's correlation coefficient test was used to look for a linear correlation between estimated dental age by modified Demirjian method on lower and upper third molars and the chronological age of the patients. The calculated value was 40%. The ratio between estimated dental age and chronological age was 29% for male and 32% for female patients. Figure 2 provides a comparison between chronological and estimated dental age by modified Demirjian method based on sex of patients.

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Table 2. Difference of mean, minimum and maximum of chronological and estimated dental age by modified Demirjian method

	Number	Minimum	Maximum	Mean ± SD	P
Difference of chronological and dental age	183	-0.25	1.08	0.33 ± 1.7	0.81

SD: Standard deviation

Table 3. Pearson correlation coefficients between 4 studied teeth

	LR	LL	UL	UR
LR Pearson correlation (n = 183)	1	0.880*	0.753*	0.706*
N	183			176
P	< 0.001	< 0.001	< 0.001	< 0.001
LL Pearson correlation	0.880*	1	0.760*	0.750*
N	178	178	171	173
P	< 0.001	< 0.001	< 0.001	< 0.001
UL Pearson correlation	0.753*	0.760*	1	0.909*
N	174	171	175	174
P	< 0.001	< 0.001	< 0.001	< 0.001
UR Pearson correlation	0.706*	0.750*	0.909*	1
N	176	173	174	177
P	< 0.001	< 0.001	< 0.001	< 0.001

LR: Lower-right; LL: Lower-left; UL: Upper-left; UR: Upper-right
*Correlation is significant at the 0.01 level (2-tailed)

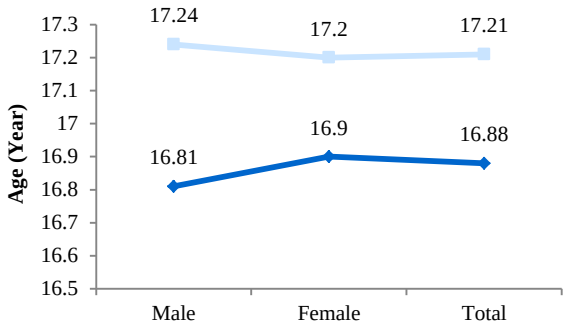


Figure 2. Sex-based comparison between chronological and modified Demirjian method estimated dental age

Figure 2 shows that the modified Demirjian estimated dental age provided a lower age average in comparison to chronological age.

Correlation coefficient of estimated dental age for lower-left (LL), lower-right (LR), upper-left (UL), and upper-right (UR) third molars are provided in table 3. Maximum correlation was reported for upper-left and upper-right third molars. Minimum value was calculated for upper-right and lower-right third molars, which was 0.706. Value of P for all variables in table 3 was < 0.001 at a significance level of 90%, indicating an acceptable correlation assumptions between the two variables.

Based on the present study using linear regression, the formula for calculating chronological age from estimated dental age is as follows:

Table 4 is regression model for Sex-Free.

Sex-free linear regression model: y = 10.384 + 0.39x

Table 5 is Regression model for female.

Female linear regression model: y = 9.611 + 0.433x

Table 6 is Regression model for male.

Male linear regression model: y = 8.033 + 0.53x

Using regression models to predict the exact chronological age, we can use this model to predict Dmirjian method based on the estimated age.

Discussion

The highest level of reliability in dental age determination will be achieved when the evolving teeth are used for the process. Teeth

Table 4. Sex-free linear regression model

Model		Coefficients*			t	P
		Unstandardized coefficients		Standardized coefficients		
		B	Standard error	Beta		
1	Constant	10.384	1.696	-	6.124	< 0.001
	Mean	0.391	0.100	0.395	3.891	< 0.001

*Dependent variable: age

Table 5. Female linear regression model

Coefficients*						
Model		Unstandardized coefficients		Standardized coefficients	t	P
		B	Standard error	Beta		
1	Constant	9.611	1.979	-	4.857	< 0.001
	Mean	0.433	0.117	0.445	3.714	< 0.001

*Dependent variable: age

are the most resistant parts of human body with the lowest turn-over rate. Also, teeth are less sensitive to nutritional, hormonal and pathological factors.[22] In comparison to other teeth, third molars are the most used ones in forensic dentistry because they evolve slower and at later ages.[23] In terms of dental maturity, third molars are the only teeth that allow accurate dental determination after the age of 16 years.[24] On the other hand, panoramic radiography is one of the best tools for evaluation of dental calcification due to its potential in showing a wide range of facial and dental bones.[25] Thus, this paper is focused on determining chronological age and dental evolution phases of third molars by modified Demirjian technique on panoramic radiography images.

We found a significant linear correlation between chronological age and dental age of all four third molar teeth (based on Demirjian), a finding that is in line with other studies.[26-33]

In our study, the highest correlation coefficient was between UR and UL and also between LR and LL with rates of 91 and 88 percent. The correlation coefficient for UL/UR was 98% for men and the same for LL/LR in women was 85.8%.

Based on different studies, the highest correlation coefficient between dental and chronological age was reported between UR/UL and LR/LL.[29,34-36]

Moreover, in the work of Bagherpour et al. on an Iranian population using Gleiser and Hunt method modified by Kohler, dental age of UR/UL showed the highest correlation, similar to the present study.[37] But studies of Rai et al. with modified Demirjian method on an Iranian population of 10-27 years found the highest correlation between LL/UL teeth which was 94%.[26] The difference may be related to the differences in the age range of the studied population, as in the present study a range of 13-21 years was used.

In our study, the highest correlation between dental and chronological age was found for UR, LR, LL and UL teeth at rates of 40.2, 39.2, 37.3 and 35.2 percent. In the study by Ezoddini et al. the highest rate of correlation between dental and chronological age was found for LR, LL and UR at rates of 23.9, 24.5 and 39.4 percent, similar to ours.[38] But in the study by Monirifard et al. the highest correlation between dental and chronological age was in LL for men and LR for women.[25]

We found a significant linear correlation between ages of left and right third molars which means that the ages estimated separately by these teeth were approximately the same.

In the works of Lopez et al.,[39] Orhan et al.,[29] Meinl et al.,[35] and Darji et al.,[33] there was no significant difference in the age of linear correlation between the third molars of both jaws. The coefficient was acceptable although not so large (32.9%).

Table 6. Male linear regression model

Coefficients*						
Model		Unstandardized coefficients		Standardized coefficients	t	P
		B	Standard error	Beta		
1	Constant	8.033	3.514	-	2.286	< 0.032
	Mean	0.530	0.208	0.476	2.540	< 0.019

*Dependent variable: age

According to Olze et al.[40] and Li et al.,[41] there was no significant difference in the evolution of higher and lower third molars, but according to Gunst et al.[36] and Darji et al.,[33] maxillary third molar evolved a little quicker than the mandibular.

In the present study, the average estimated age by Demirjian method was underestimated compared to the average chronological age by a factor of 0.33 years, which is in line with several other studies,[24,30,38,42] while some other studies reported overestimation of age by Demirjian method.[1,43,44] The differences may be related to racial diversities among studied populations.

According to the present study using Demirjian method, no significant difference was observed in age estimation of the two sexes, a finding in line with that of several other studies.[27,29,33,44,45] However, there are many studies reporting significant differences in evolution of third molars between the two sexes.[23,32,35,36,38,39,46]

Effectiveness of age estimation is usually measured with mean absolute error (MAE), calculated by deducting the chronological age from the dental age. A positive result indicates overestimation, while a negative result points to underestimation.[28] In this study, the average MAE was -0.33 for all participants: -0.43 for men, and -0.3 for women. In the study by Khorate et al.,[28] the average MAEs for all participants, men and women by Demirjian method were 2.32, 2.25 and 2.29 respectively. His works also reported the lowest MAE for women. The difference in MAE between the present study and that of Khorate et al. may be due to differences in race and age range of studied population in the latter study (4-22 years).[28]

Conclusion

There was a significant linear correlation between the chronological age and dental age of all four third molar teeth, and also between ages of left and right third molars in our study.

Using modified Demirjian method, we did not observe any significant difference in age estimation of the two sexes. The average estimated age by modified Demirjian method was underestimated compared to the average chronological age by a factor of 0.33 years.

Conflict of Interests

Authors have no conflict of interest.

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Evaluation of the effect of various types of fluoride varnishes on color stability of a composite resin

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Original Article

Abstract

BACKGROUND AND AIM: Fluoride varnish as an extrinsic factor may cause discoloration in tooth-colored restorative materials. This research compared the impact of different fluoride varnishes on color change of a composite restorative material.

METHODS: This laboratory experimental study was conducted on 40 specimens of flowable composite resin were divided into four groups based on the brand of applied varnishes (Durashield, Nupro, Fluorilaque, and Profluoride varnishes) (n = 10). Color measuring (ΔE) was performed using the easy shade device and according to Commission Internationale de l'Eclairage (CIE) L*a*b* system at three times: 24 hours after immersing in artificial salvia (baseline), 24 hours after fluoride varnishes application and after brushing. The amount of color changes was calculated for all of the specimens as follows: ΔE1 (difference between fluoride application-base line), ΔE2 (difference between brushing-fluoride application), and ΔE3 (difference between brushing-base line). $P < 0.05$ was considered as significant. Statistical analysis was performed by one-way ANOVA and post-hoc Tukey.

RESULTS: The maximum and minimum color changes after applying varnishes were observed by Nupro and Profluoride, respectively. A significant difference was observed between ΔE 1 values of all types of studied varnishes ($P < 0.01$) except Durashield and Fluorilaque ($P = 0.35$). After brushing, no significant difference was shown between color change of stained specimens due to Durashield, Fluorilaque, and Nupro. There was no significant difference between ΔE 3 values of Durashield and Fluorilaque.

CONCLUSION: Trends of color change after using all studied varnishes were clinically acceptable (ΔE < 3.3). Durashield, Nupro, Fluorilaque, and Profluoride varnishes can be used without adversely affecting the color of flowable composite resin.

KEYWORDS: Fluoride Varnish; Discoloration; Resin Composite

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For more than 30 years, fluoride varnish is being applied as an anti-caries material as well as in treating high sensitive tooth.[1] Fluoride varnish is a professionally used adherent agent which contains a high amount of fluoride in an alcohol based solutions of natural varnishes.[2] Fluoride varnish retains fluoride adjacent to the tooth surface for a period. It may be applied to the enamel, dentine or cementum of the tooth to prevent decay, remineralize the tooth surface and to treat dentine hypersensitivity. The concentration and form of fluoride may vary depending on the manufacturer, but most fluoride varnishes contain 5% sodium

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fluoride.[3] The mechanism of action for fluoride varnish is similar to a fluoride mouthwash. Calcium fluoride crystalline (CaF_2) deposits on the tooth surface and later convert to fluorapatite during remineralization.[4] Easy application, safety and easily being accepted by patients are the main reasons why it has been broadly applied. Furthermore, the amount of absorbed fluoride ions by tooth structure in this manner increases, compared to other methods. Different types of fluoride varnishes are available in the market which could contain either sodium fluoride with high concentration of fluoride ion (22600 ppm) or difluorosilane with lower concentration of fluoride ion (1000 ppm). Sodium fluoride based varnishes have a temporary effect on color of teeth and could have effects on the color of composite resin restorative materials.[5-7]

Discoloration of tooth-colored restorative material is the main reason to replace the fillings.[8] Color stability is an important factor for the long-term success of esthetic restorations. Under oral conditions, esthetic restorations may be exposed to light, moisture, stain and mechanical wear, which often result in esthetically undesirable color changes. Remineralizing agents such as fluoride varnishes used for reducing caries may also cause changes in color and surface roughness of the dental materials. All of the composite restorations would have color changes caused by their contact with colored compounds. These color change may either be clinically considerable or not. The extent of color stability of composites depends on the size of fillers, the amount of the matrix resin, and the type of the color releasing medium.[9-12]

There is limited information on the effects of fluoride varnishes on color change of composite resins. The extent of discoloration of various composites is different depending on the type and texture of composite resins and the chromogenesis of the medium in which the composite is preserved.[9,13] This study was done to investigate the impact of different brands of fluoride varnishes on the color change of flowable composite resin. The null hypothesis was that use of fluoride varnishes does not influence on color change of composite resin.

Methods

This laboratory study was conducted on 40 specimens of flowable composite resins (Tetric flow, Ivoclar Vivadent, Schaan, Liechtenstein). Cylindrical plastic molds of 9 mm in diameter and 2 mm in height were used to prepare specimens. After the composites were placed in the molds, a glass slide of 1 mm thick was placed on top of mold to prevent air trapping and to create a smooth surface. The specimens were cured for 40 seconds using High Power Intensity Astralis 7 device (Ivoclar Vivadent, Liechtenstein) with an intensity of 750 mw/cm^2.

Then, the upper surface of specimens was wet polished using a composite polishing kit (SofLex, 3M, USA). The specimens were immersed in artificial salvia solution inside an incubator at 37 °C for 24 hours. Then, they were divided into four groups.

- Group 1: Sodium fluoride 5% varnish Durashield (Sultan, USA) (n =10)
- Group 2: Sodium fluoride 5% varnish Nupro (Dentsply, USA) (n = 10)
- Group 3: Sodium fluoride 5% varnish Profluoride (Voco, Germany) (n = 10)
- Group 4: Sodium fluoride 5% varnish Fluoride (Pascal, USA) (n = 10).

Table 1 presents characteristics of materials used in this study (Table 1).

The color measurement was performed using easy shade spectrophotometer

(VITA Zahnfabrik, Germany) as follow:

1. Baseline evaluation (Measurement I):

Each sample was immersed in individual glass container with artificial saliva and placed at 37 °C for 24 hours, then color measuring was performed.

2. 24 hours following application of fluoride varnish (Measurement II):

Table 1. Characteristics of materials

Products	Composition	Manufacturer
Composite: Tetric flow	BISGMA, UDMA, triethylene glycol Dimethacrylate, inorganic filler 67.8% by weight (barium glass, ytterbium trifluoride, Silicone dioxide, fluorosilicate glass)	Ivoclar Vivadent, Schaan, Liechtenstein
Durashield fluoride varnish	Sodium fluoride 5%	Sultan/USA
Profluoride fluoride varnish		Voco/Germany
Nupro fluoride varnish		Dentsply/USA
Fluorilaque fluoride varnish		Pascal/USA

BISGMA: Bisphenol A-glycidyl methacrylate; UDMA: Urethane dimethacrylate

All the specimens were blot to dry and fluoride varnishes were applied using a special applicator on the outer surfaces of specimens, and after 5 minutes, the specimens were again immersed in new artificial salvia and placed at 37 °C for 24 hours, then color measuring was performed again.

3. 24 hours after brushing (Measurement III):

All the specimen surfaces were cleaned by an electrical toothbrush (Oral-B) and toothpaste (Colgate Total-Colgate-Palmolive Ltd., India) for 5 seconds. The specimens were immersed in new artificial salvia and stored at 37 °C for 24 hours, then color measuring was performed for the third time.

The indices L, a, and b were calculated and recorded for all samples on white background based on Commission Internationale de l'Eclairage (CIE) L*a*b* system by Easy Shade device. L* refers to value, range from 100 (perfect white) to 0 (perfect black). The parameters a* and b* were respectively considered as chromaticity on red-green axis and yellow-blue axis, with red (+a*), green (-a*), yellow (+b*), and blue (-b*). Then, color changes of specimens were calculated by Equation 1:[14,15]

$$\Delta E = [(\Delta L)^2+(\Delta a)^2+(\Delta b)^2]^{1/2}$$

ΔE1 = Difference between measurement II-I,

ΔE2 = Difference between measurement III-II,

ΔE3 = Difference between measurement III-I.

The extent of clinically acceptable color change was considered as 3.3 (ΔE < 3.3).[9]

Statistical calculation of findings was conducted with SPSS (version 20, IBM Corporation, Armonk, NY) and one-way ANOVA and post-hoc Tukey. $P < 0.05$ was considered as significant.

Results

Mean color change, separately for each varnish was presented in table 2. The maximum and minimum color changes after applying varnishes were occurred in Nupro (ΔE1 = 1.90 ± 0.20) and Profluoride (ΔE1 = 0.58 ± 0.06) groups, respectively (Table 2). Color change of composite specimens by Nupro was significantly higher than Durashield and Profluoride and Fluorilaque ($P < 0.01$, $P < 0.01$, $P < 0.01$; respectively). Profluoride caused changes in color of specimens significantly less than Durashield and Nupro and Fluorilaque ($P < 0.01$, $P < 0.01$, $P < 0.01$; respectively). No significant difference was observed between ΔE1 values of Durashield and Fluorilaque ($P = 0.35$).

Table 2. Mean ± SD of color change

Groups	ΔE1* (mean ± SD)	ΔE2** (mean ± SD)	ΔE3*** (mean ± SD)
Durashield	1.38 ± 0.09	1.99 ± 0.17	1.85 ± 0.17
Nupro	1.90 ± 0.20	1.95 ± 0.24	1.14 ± 0.05
Profluoride	0.58 ± 0.06	0.61 ± 0.05	0.85 ± 0.04
Fluoirlaque	1.49 ± 0.18	1.93 ± 0.09	1.80 ± 0.08
P	< 0.01	< 0.01	< 0.01

*ΔE1: Color change between fluoride application-base line, **ΔE2: Color change between brushing-fluoride application, ***ΔE3: Color change between brushing-base line, SD: Standard deviation

After brushing, no significant difference was showed between ΔE3 values of specimens due to Durashield, Fluorilaque, and Nupro, but these values were significantly higher than that of Profluoride ($P < 0.01$, $P < 0.01$, $P < 0.01$; respectively). There was no significant difference between ΔE3 values of Durashield and Fluorilaque, but these values were significantly higher than that of Nupro and Profluoride ($P < 0.01$, $P < 0.01$; respectively).

The ΔE 3 value of Profluoride was significantly lower than that of Nupro ($P < 0.01$). ΔE1, ΔE2, and ΔE3 of all specimens were not clinically noticeable. Figure 1 illustrated the mean values of ΔE1, ΔE2, and ΔE3 for all groups.

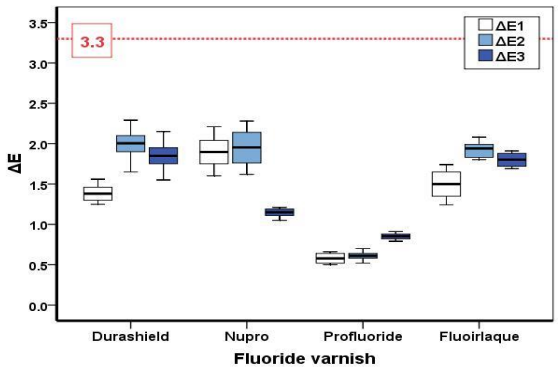


Figure 1. Mean ± SD (standard deviation) of color change

ΔE1: Color change between fluoride application-base line, ΔE2: Color change between brushing-fluoride application, ΔE3: Color change between brushing-base line

Discussion

In this research, the impacts of four common types of fluoride varnishes on the extent of color change of flowable composite were examined. Because flowable composite resins commonly used in pediatric dentistry to restore small defects of deciduous teeth or sealing deep pits and fissures of permanent molar teeth.[16] The results showed clinically acceptable color change of the specimens after fluoride varnish application (i.e., $\Delta E < 3.3$). To examine color of the composite, easy shade spectrophotometer instrument was used, which is the most accurate measure for examining color changes. Applying this instrument is one of the advantages of our research.[9] This results are in line with that of the Autio-Gold and Barrett study,[17] in which the authors investigated the impacts of fluoride varnish on the ionomer glass and composite restorative materials and concluded that fluoride varnish caused clinically acceptable color change in composites ($\Delta E < 3.3$).

A factor influencing the extent of color stability is the surface roughness of the materials; moreover, some studies have reported an association between the extents of polishability and the amounts and dimension of filler particles.[9,18]

In Prabhakar et al. study,[19] application of fluoride varnish on the glass ionomer material resulted in a significant change in color and surface roughness but after brushing no statistically significant color change was observed. It was observed that fluoride varnish on setting formed a layer on teeth or restorative material which might be the cause of the discoloration. Brushing causes reduction in color change probably due to partial removal of the varnish layer. They have also represented that the composition and size of the filler particles affect both color and surface roughness of the dental materials. The relative susceptibility of glass ionomer to color alteration could be related to the porosity of the glass particles. Furthermore, glass ionomer shows more color change due to its hydrophilic property and greater surface destruction.[12] Researchers reported that hydrophilic materials stain more than hydrophobic materials.[6]

Debner et al.[20] showed that sodium based fluoride varnishes could cause temporary color change of both teeth and restorative materials; however, none of those changes were clinically considerable, which is compatible with the results from the present study.

The study of Salama et al.[21] on the impact of fluoride varnish applications on the surface of restorative materials showed that the surface roughness of restorative materials is increased due to applying fluoride varnish,

which itself could justify the color change of composite restorative materials.

Further studies are recommended on various types of tooth-colored restorative materials and other forms of fluoridated protective agents.

Conclusions

The color change caused by the influence of fluoride varnishes Durashield, Nupro, Fluorilaque, and Profluoride were not clinically considerable ($\Delta E < 3.3$) and can be used without adversely affecting the color of restorative material.

Conflict of Interests

Authors have no conflict of interest.

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Evaluation of X-ray protective shielding used in dental offices in Kerman, Iran, in 2014

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Original Article

Abstract

BACKGROUND AND AIM: Protective equipment, such as lead aprons and thyroid shields, is effective in reducing patient radiation. This study was conducted for evaluation the use of thyroid shields and lead aprons in dental offices, in Kerman, Iran, in June 2014.

METHODS: In this descriptive-analytical study, 106 dental offices with active X-ray machines were evaluated in Kerman. The information was recorded on a data sheet consisting of eight questions in three fields of the rate of the use of lead aprons, thyroid shields and taking part in radiation protection courses. Data were evaluated using frequency distribution and chi-squared test.

RESULTS: In this study, 12.3% of clinics were equipped with lead aprons but only 5.7% used them for all the patients. Only 10.4% of Kerman Dental Clinics had thyroid shields. Approximately, 9.7% of Kerman dentists had participated in continuous retraining courses on radiation protection. There was a significant relationship between clinics equipped with lead aprons with more job experience.

CONCLUSION: The results showed that the rate of the use of lead aprons and thyroid shields in dental clinics equipped with X-ray machines in Kerman is not sufficient and is far from the international standards. Therefore, it is suggested that radiation protection equipment be promoted and oral and dental radiologists be responsible for the use of such equipment in their clinics.

KEYWORDS: Patient Protection; Radiation; Dentists

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Dental X-rays are valuable tools in diagnosing oral and dental diseases, and the proper use of these radiographs is beneficial for patients. However, the use of dental radiology procedures requires caution because the X-rays cause potential damage to cells and tissues.[1]

Manifestations of damage caused by radiation may appear after 10-20 years.[2] Although the risk associated with dental radiography is certainly minor, it cannot be considered completely free of risk.[3] Therefore, specific attention should be paid to radiation safety and dentists need to be updated with changes in techniques and equipment and change their practice.[4,5]

Technical developments in equipment and systems significantly reduce X-ray doses to patients with the use of protective equipment, such as lead aprons and thyroid shields that are effective in reducing

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radiation.[6] The use of E-speed films and direct digital radiography, compared with D-speed films, can reduce exposure time, leading to a decrease in radiation dose.[7,8] In addition, thyroid collar is a lead shield used to protect the thyroid gland from scattered radiation and is recommended for all the intraoral exposures, especially in small children and adults with thyroid disorders. A lead apron is a flexible shield placed over the chest to protect reproductive organs from scattered radiation and recommended for intraoral and extraoral exposures. Therefore, there are many reasons to use a lead apron and thyroid sheath to protect patients from the harmful effects of radiation.[9]

However, many studies have shown that dentists do not follow the precautions and safety factors, especially in their private practice. The results of a study in North-East England showed that a significant proportion of dentists were not making full use of opportunities to reduce dose to their patients.[10] The results a study in Turkey showed that lead aprons and thyroid collars were used by a small number of dentists.[6] Furthermore, the previous studies in Iran showed that rate of the use of lead aprons and thyroid shields in dental clinics is not sufficient.[11,12] Nisha et al.,[13] in India, Zangoie Booshehri et al.[14] in Yazd, Iran, and Tavakkoli et al.[15] in Tehran, Iran, have focused on increasing knowledge of dentists about the hazards of radiation. Furthermore, these studies showed that the dentists should implement recent and appropriate radiation protection techniques and guidelines in their offices.

There is no data available on the practice of dentists about protection during dental radiology procedures in Kerman, Iran. The aim of this study was to determine the use of thyroid shields and lead aprons in dental clinics equipped with X-ray machines in Kerman.

Methods

This research was a cross-sectional study of dental clinics that had active X-ray machines in Kerman, Iran, in June 2014. A total of 139 dentists had active X-ray machines in their clinics, of which 106 dentists (76.2%) were enrolled in the study after obtaining informed consent. The rest either were not available or did not consent to research.

The survey tool was a checklist consisting of questions about (1) demographic characteristics of dentists, (2) use of lead aprons, (3) use of thyroid shields, and (4) passing the radiation protection courses.

The statistical analysis was performed by SPSS software (version 21, IBM Corporation, Armonk, NY). Data were analyzed in terms of frequency distribution, and chi-squared test was used to distinguish the difference the significance of differences between the variables. The level of significance was considered at 5%.

Results

In this study, 106 dental offices equipped with X-ray machines were evaluated. The time passed of graduation and clinic establishment were 8.7 ± 4.2 and 7.2 ± 4.1, respectively. The most dentists had graduated from Kerman (29.2%) and Tehran (22.6%) universities.

The results of questions about radiation protection are presented in table 1. According to these results, 12.3% [confidence interval (CI) 95%: 6.0-18.6%] and 10.4% (CI 95%: 4.1-16.7%) of dental offices in Kerman were equipped with lead aprons and thyroid shields, respectively. Only 9.7% of dentists evaluated had participated in radiation protection courses (Table 1).

To investigate the association between years in practice with questions about radiation protection, these variables were divided into two groups: less or equal to 10 years and more than 10 years. The results are shown in table 2. Based on the table, there was a significant relationship between clinics equipped with lead aprons with time passed the establishment of the office (P = 0.001). This relationship was marginally significant for the time after graduation (P = 0.060).

Table 1. The results of answers to questions about radiation protection

Questions	n (%)
Do you have a lead apron in your clinic?	
Yes	13 (12.3)
Do all your patients wear a lead apron while being exposed to X-ray?	
Yes	6 (5.7)
The millimeter of your lead apron	
0.2	0 (0)
0.3	2 (1.9)
0.4	0 (0.0)
0.5	3 (2.8)
Do you have a thyroid shield in your clinic?	
Yes	11 (10.4)
Which type of thyroid shield do you use?	
Small	1 (0.9)
Medium	8 (7.6)
Large	0 (0)
Do you use a thyroid shield for children?	
Yes	11 (10.4)
Do you use a thyroid shield for adults?	
Yes	8 (7.6)
Have you participated in continuous learning courses about radiation protection at a university?	
Yes	10 (9.7)

Discussion

Based on guidelines for protecting the patients during radiographic examinations, they must be provided with a shielded apron for gonad protection and a thyroid shield. Thyroid skin exposure can be reduced by 33-84% in adults and 63-92% in children by using a thyroid shield.[3] The findings of this study showed that radioprotection for the patient was not favorable and far from international standards.

In this study, 12.3% of clinics were equipped with lead aprons but only 5.7% of clinics used it for all the patients, consistent with a study carried out in Turkey, in which, 8.7% of dentists used lead aprons.[6] In a study in Tabriz, Iran,[9] lead aprons were used by 16.2% of dentists, which is little more than that in this study.

Table 2. Relationship between rate of the use of lead apron and thyroid shield with job time passed after graduation and clinic establishment

Questions	Time passed after graduation		P	Time passed of clinic establishment		P
	> 10 n (%)	≤ 10 n (%)		> 10 n (%)	≤ 10 n (%)	
Have a lead apron in clinic						
Yes	9 (20.5)	4 (6.5)	0.060	9 (32.1)	4 (5.1)	0.001
No	35 (79.5)	58 (93.5)		19 (67.9)	74 (94.9)	
Use a lead apron for all patients						
Yes	4 (8.8)	2 (3.3)	0.390	4 (13.3)	2 (2.6)	0.098
No	41 (91.2)	59 (96.7)		26 (86.7)	74 (97.4)	
Have a thyroid shield in clinic						
Yes	6 (13.6)	5 (8.1)	0.500	6 (20.0)	5 (6.6)	0.110
No	38 (86.4)	57 (91.9)		24 (80.0)	71 (93.4)	
Pass the course about radiation protection						
Yes	5 (11.9)	5 (7.8)	0.400	5 (17.8)	5 (6.4)	0.200
No	37 (88.1)	59 (92.2)		23 (82.2)	73 (93.6)	

The previous studies in Iran showed that radioprotection for patients using lead apron was not suitable. The results a study in Yazd showed that none of the dental offices lacked lead aprons.[11] In Isfahan,[12] only 10% of dentists used lead apron.[12]

Although, our results indicated that there was a significant correlation between more job experience and clinics equipped with lead aprons, there was no significant relationship between the use of lead apron and more job experience. In Isfahan, there was a reverse relationship between job experiences with dentist's awareness about the potential dangers of radiation and radiation dose reduction.[12] These findings show the importance of continuing education in radiation protection. However, dentists with more job experience should also continually update their knowledge based on standard protocols.

In our study, only 10.4% of dental clinics had thyroid shields and 7.5% of clinics used it for adults, and all of them used it for children and 2.9% used it only for children. In Tabriz, thyroid shields were used in 8.5% of the cases,[9] consistent with our results. The results of our study and research in Tabriz are higher than studies in Isfahan,[12] and Turkey,[6] in which 4.5% and 3.7% used lead collars, respectively.

It seems that dentists have not necessary knowledge about the efficacy of these shielding (lead apron and thyroid collar) on reducing the dose to patients, and prefer to increase the speed of treatment. Although in these studies a small number of dentists used lead aprons and thyroid shields, a study conducted in universities of the United States and Canada showed that 95% of dental practitioners used lead aprons for extraoral radiography and 85% of subjects used lead collars for intraoral radiography.[16] In addition, the results of a study in Iranian dental schools showed that in relation to the availability of radiation protection facilities (such as lead aprons, thyroid shields, and lead-impacted walls) in dental schools, there was a favorable situation.[17] The main differences between our results and other studies might be due to the samples evaluated, showing that radioprotection methods are more common in universities than offices.

In addition, our results showed that 8 out of 13 dentists did not know how much the thickness of lead was in their lead apron in their offices. Studies have indicated that the shielded apron and thyroid shield must have a lead equivalence of at least 0.25 mm of lead.[1] In this study, 8 and 1 out 11 dentists reported average and small size of thyroid shields, respectively. Two dentists did not have any information about their thyroid shield size. Based on previous studies, thyroid shields are available in the market based on size, location of the thyroid gland in the neck, and compatibility. These protective shields are in three sizes: small, medium, and large. The small one is used more often in children, the medium one in adolescents, and the large one in adults.[18]

The results of this study and other studies indicate that the dentists' knowledge about radiation dose reduction techniques was not adequate. Zangoie Booshehri et al.[14] in Yazd showed that the knowledge of dentists about radiation protection techniques was very poor and attempts should be made to improve dentists' knowledge about radioprotection techniques. Other studies in England,[10] Isfahan,[12] Tehran,[14] also emphasize the need for continuing education after graduation. This may be because of the large number of dentists have not received the necessary training in the field of radiation protection either in the university or after training, and had not been updated in radiation protection practices, and consequently, lead to the failure to implement the best radiographic practice.

It seems that after graduation dentists must update their knowledge by attending meetings, reading dental journals, and participating in continuous education courses in universities or the atomic energy organization. Alcaraz et al.[5] assessed the influence of European Union legislation and

recommendations on radiation doses in intraoral dental radiography in Spain. The results point to a dose reduction of 19% in 7 years. In our study, only 9.7% of Kerman dentists participated in continuing education courses and most dentists who were relatively new graduates should be required to take such courses to optimize protection against radiation exposure of their patients.

The limitations of this study were that some dentists did not cooperate and all of the protection techniques such as the kind of radiographic films, and X-ray barriers in the office were not assessed. However, in this study, we assessed protective shielding (lead apron and thyroid shields) that is very effective for gonad and thyroid protection. It is recommended that more studies be done with consideration of all factors and radiation protection equipment.

Conclusion

The findings of this study showed that methods of radioprotection for the patients were not favorable and were far from international standards. In general, dose reduction techniques are considered less important in offices compared to educational centers. Therefore, dentists must update their safety awareness and the availability of new equipment, and techniques that could further improve the diagnostic capacity of radiographs and decrease exposure, which necessitates more continued education in this field.

Conflict of Interests

Authors have no conflict of interest.

Acknowledgments

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Comparing pain and pain-related behavior in children with invented telescopic dental needles

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Original Article

Abstract

BACKGROUND AND AIM: Pain control is an important part of pediatric dentistry. The purpose of this study was to evaluate pain and behavioral reaction who receive an injection with conventional and telescopic dental needles.

METHODS: A total of 50 healthy children aged 4-8 years were included to this study to get a dental injection with the telescopic or the conventional dental needles. Two observers scored videos of children at the time of injection procedures based on sound, eye, motor (SEM) scale and distress reaction to evaluate the observed pain-related behavior. Children completed a face version of visual analog scale (VAS) after injection. Reliability of observer's opinion evaluated and was established at 96%. Independent t-test and chi-square tests were used for statistical analysis. Statistical significance was defined at $P < 0.0500$.

RESULTS: This study was conducted among 23 girls and 27 boys with mean age 5.3 ± 1.4. The pain scores according to VAS for the telescopic, and the conventional dental needles were 40.20 ± 10.50 and 56.40 ± 14.63, respectively, which was statistically significant between the two groups ($P = 0.0001$). The difference of SEM values for the telescopic and the conventional groups were statistically significant in totals as well as individual parameters ($P = 0.0001$). According to mean distress scores, patients showed less muscle tension, less verbal protest and less movement when receiving the telescopic needles ($P < 0.0500$).

CONCLUSION: Telescopic dental needles with the ability of using topical anesthesia before needle insertion and covering needle sight out of patient's eyes may be a good intervention to reduce pain and anxiety of children during dental injection.

KEYWORDS: Pain; Anxiety; Injection; Dentistry

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Dental treatment under anesthesia is usually associated with pain and anxiety. Pain is a multifactorial event.[1] Various physical and psychological factors control the relationship between pain and pain agent.[2,3] It seems that there is a close relation between pain and anxiety during dental injection, anxious patients show more pain perception and duration.[4,5] The previous study on Dutch children showed that 14% of 4-11 years old children were anxious about dental treatment and injection were the most fear factor.[6,7] Milgrom et al.[8] considers general anxiety of injections, including pain and fear of injury, to be the main aspects of dental injection. Fear of needles in 19% of children aged 4-6 years has been found significantly.[9]

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Children's dental anxiety prevents them from dental clinic and causes abnormal behavior of children in the future that may lead to avoidance of treatment and irregular attendance in adulthood.[10-13] Painless injection is effective in reducing pain and anxiety and increase patient cooperation and trust between doctor and patient and lead to comfortable admission of next treatment.[12,13]

Dentists have developed their skills to reach almost painless injections and to deliver more comfortable local anesthesia before starting the dental procedure.[13]

Although treatment under anesthesia scientifically acceptable, it always associated with risk of death[5] also treatment under general anesthesia is not financially affordable for minor dental.[14] New invented telescopic dental needle, based on its special design that covers the needle's appearance out of patient's eyes and the ability of using topical anesthesia at the site of injection, would control pain during various pediatric dental procedures. Therefore, the purpose of this study was to evaluate the effectiveness of telescopic dental needle for the first time in reducing pain and anxiety and compare it with the conventional dental needle during pediatric dental procedures.

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

Methods

This study was conducted among 50 healthy children aged from 4 to 8 years [n = sample size, = Z value (e.g., 1.96 for 95% confidence level)], P = Percentage picking a choice, expressed as decimal (20% used for this study), d = Confidence interval (CI), expressed as decimal (2% used for this study)], who visited a private Dental Clinic in Kerman, Iran, in a period of 3-month, were included in the randomization process. Parental consent from was taken from patients before treatment. Ethical code was obtained from the Ethics Committee of Kerman University of Medical Sciences, under number of IR.Kmu.rec.1394.312. This clinical study with registration number of Iranian Registry of Clinical Trials (IRCT) IRCT 2015113025300N1 had recorded to IRCT site. Only patients with no previous experience of dental injection were included to the study. They all required dental restorative of posterior maxillary teeth under local anesthesia. Children who could be able to complete the face version of visual analog scale (VAS), no allergy to lidocaine or other anesthetic agents, no suspected or known developmental delay, free from any systemic diseases were included to the study. Extremely anxious children had excluded from the study. Parents of the children were informed that two special anesthetic injection devices were being studied: (1) a conventional syringe with a standard needle and (2) a conventional syringe with a recently new design telescopic coated dental needle (patent number 85929).

Dentist explained the anesthesia procedure similarly for both techniques, and the dentist announced local anesthesia as a dental hypnotic juice to all the children. Each child was randomly based on a randomization list assigned to either the telescopic system or the conventional injection condition. The end result was two groups of 25 children each. Each patient participated only once in the study. Both injections were given in essentially the same manner by one experienced dentist, at the same environment regarding light and temperature. In the case of the telescopic coated needles, an anesthetic cartridge was placed in syringe. The telescopic cover tubing was covering the needle (Figure 1). A sterile cotton pellet saturated in topical anesthetic gel (20% benzocaine topical anesthetic gel (Topex™, Sultan, New York, USA), connected to the head of the telescopic cover (Figure 1, a). In the telescopic coated dental needles, injection was initiated by contact of sterile cotton pellet to the soft tissue of injection site for 60 seconds. Once the target area of injection was reached, needle aspiration was performed by the usual thumb backpressure. After negative blood aspiration, injection was applied, and children were

carefully monitored for the signs of adverse sensation. Injection phase was continued for about 60 seconds until depletion of the contents of the anesthetic cartridge. In the telescopic needle group because of its new design dentist had the ability of using topical anesthetic gel with the telescopic cover at the same time of needle insertion, but in the conventional group, topical gel had to use previously and separately before needle insertion. All injections were administered in approximately 90-120 seconds.

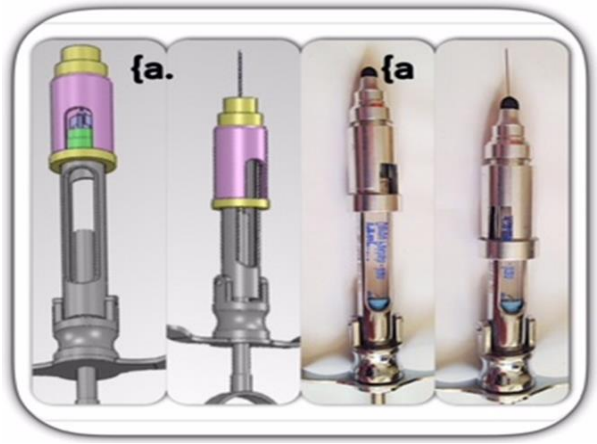


Figure 1. New invented telescopic coated dental needles (a: Topical anesthetic gel place)

The anterior middle superior alveolar injection had used for all children in two groups. 2% lidocaine with 1:100000 epinephrine (Schein, New York, USA), and 27-gauge short dental needles (Monoject, Sherwood Medical, St. Louis, MO, USA) were used in this study.

We used standard video to memorize the injection phases of treatment. The videotaped of injection period was analyzed by two independent observers (a psychologist and a last year dental student), who were trained to analyze video of children who were not included in the study. Intra-rater reliability was established at 96%. Children's reaction during injection evaluated according to the: Sound, eye, motor (SEM) scale: which were evaluated patient's pain, anxiety, and pain-related behavior. Each category scored ranged from 0 (comfort) to 3 (sever discomfort). Total score was range from 0 to 9. A lower score indicates less and higher score indicates more severe physical reaction to the injection (Table 1). Two independent observers analyzed children's reaction based on their videotape during injection period.

VAS: After the dental injection, the child was asked to point out on the face version of VAS according to his or her level of pain. Six faces, presenting different levels of pain/distress, were presented parallel to the scale. The scale included of 11 points on a scale of 0 (pain-free) to 10 (unbearable pain) (Figure 2).

Distress: Because the behavioral response of children in dentistry is a mixture of anxiety and pain, and these two concepts are difficult to separate, distress behavior was evaluated as well. Distress behavior can be defined as an occurrence of emotions felt or behavior displayed, during dental treatment, which is caused by factors like pain and anxiety. The distress behavior was measured using Venham's anxiety and cooperative behavior during three phases of injection (anticipation, first 30 seconds interval, and second 30 seconds interval). The scale consists of 6 points: [1] 1: relaxed, 2: uneasy, 3: tense, 4: reluctant, 5: resistant, and 6: out of contact or untreatable.

Table 1. Sound, eye, motor (SEM) scale for assessment of children behavior

Parameter	0	1	2	3
	Comfort	Mild discomfort	Moderate discomfort	Severe discomfort
Sound	No sound	Nonspecific sound	Verbal complaint, raise voice	Verbal complaint, shouting, crying
Eye	No sign	Eyes wide, show of concern, no tears	Tears, sudden eye movements	Crying, tears covering the face
Motor	Relaxed body and hand status	Hands show some distress, muscular tension	Sudden body and hand movements	Hand movement for defense, pulling head away

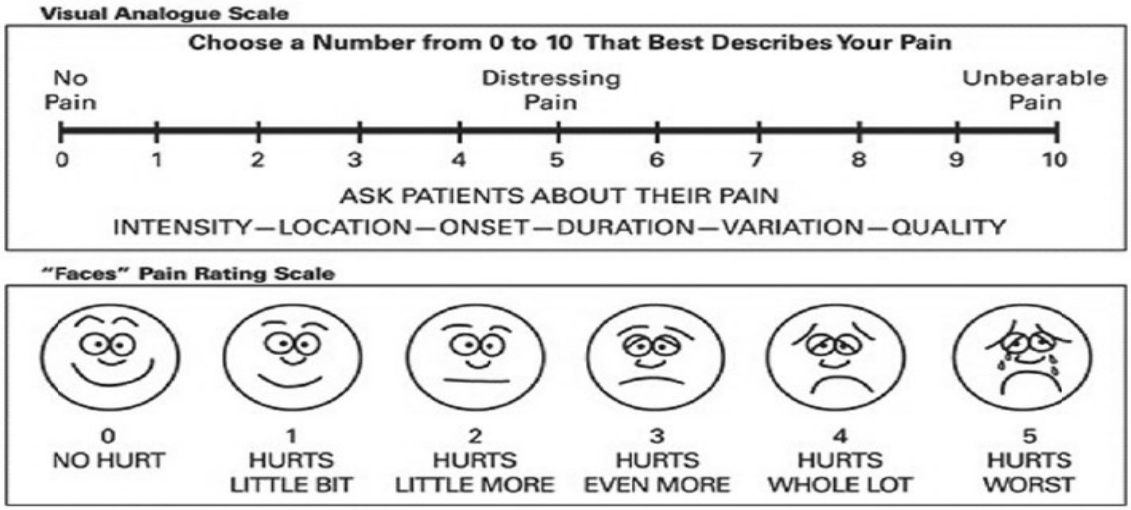


Figure 2. Visual analog scale (VAS) for assessment of children's pain perception

The treatment procedures summarized step by step in flow diagram of the study (Figure 3). T-test was used for self-reported pain (VAS) and the different pain-related behaviors based on SEM scale. Distress scores on the Venham rating scale for the anticipation phase, and for the first and the second interval, were analyzed using a multivariate general linear model. Statistical significance was defined at $P < 0.0500$.

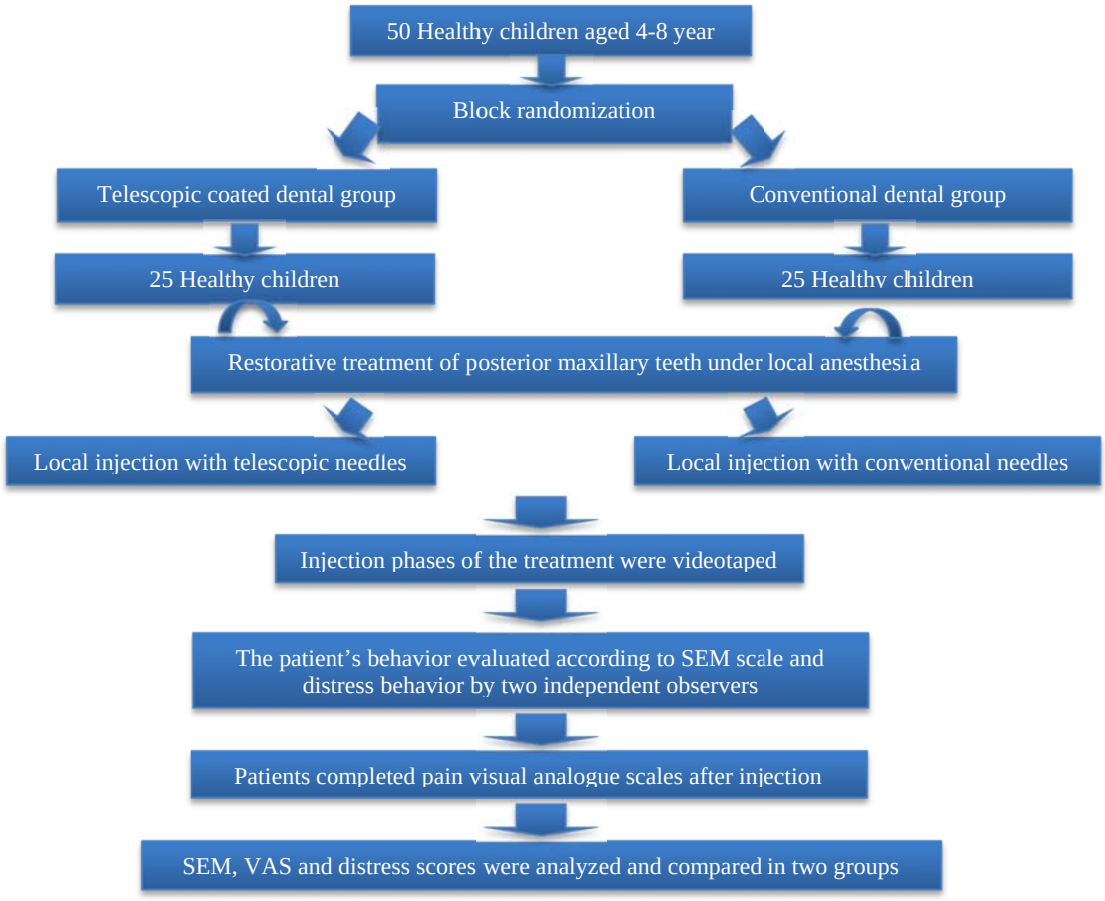


Figure 3. Flow diagram of the study

Table 2. Sound, eye, motor (SEM) scores among two injection methods

Parameter	Conventional (mean ± SD)	Telescopic (mean ± SD)	P*
Sound	1.80 ± 0.75	1.40 ± 0.61	< 0.0010
Eye	1.75 ± 0.65	1.31 ± 0.48	< 0.0010
Movement	1.73 ± 0.66	1.24 ± 0.58	< 0.0010
Total	5.40 ± 1.72	4.05 ± 1.34	< 0.0010

*Significant difference between the two groups (P < 0.0500), SD: Standard deviation

Results

This study was conducted among 50 children (23 girls and the rest of them were boys) aged 4-8 years (mean age 5.3 ± 1.4). The two experimental groups were equal regarding age and gender. Children did not have any previous dental experiences. Table 2 indicated the SEM scores for the telescopic and the conventional needle injections. The means of SEM values for the telescopic, and the conventional groups were significantly different in totals as well as sound, eye and motor parameters individually (P = 0.0001).

The VAS mean value for the telescopic needle was 40.20 ± 10.50 (range: 0-100) and for the conventional needle was 56.40 ± 14.63 (range: 0-100), respectively, with statistically significant lower VAS scores in the telescopic group (P = 0.0001).

Significant differences were found relating to the distress response of the children between the different injection techniques during three injection phases (Table 3).

Discussion

New invented telescopic dental needles showed lower pain and anxiety during injection and children felt more comfortable when telescopic dental needle was used. Pain control is an essential part of dental treatment.[15,16] The objective anxiety of children association to needle prick have a wide range, from seeing needle to the pain of needle insertion.[17] We had used VAS which is a reliable factor to analyze the pain of injection.[18] Children's behavioral reaction is a mixture of anxiety and pain specially during dental treatment and because these two concepts are difficult to separate and[19] it was also decided to use valid and reliable method of distress behavior.[21,29] SEM scale was used to evaluate patient's pain, anxiety, and pain-related behavior.[22] We used SEM scale and distress behavior next to the VAS, since based on the previous study in some 4-5 years old children the cognitive level is not yet sufficiently developed to understand the pain VAS scale.[19]

Dental injection is the only part of dental procedures that pedodontist cannot use tell, show, do technique about it.[23] In the conventional technique, the dentist covered children's eyes so they did not see the needle during injection. Seeing the needle during injection conditions creates fear in children and may change his/her reaction to the covering children's eyes caused the reaction of children and provoked their anxiety.[2] In the telescopic needle, because of its new design that covers the needle's appearance, dentist had the opportunity to show the syringe which was similar to marker and explained to the children that we are going to color your teeth, so there was no need to cover the children's eyes, and that caused more cooperation of children.

The pain response of children receiving a local anesthesia injection with the telescopic

Table 3. Mean distress scores for the conventional and the telescopic methods of injection

Injection phase	Injection method		
	Conventional [mean (95% CI)]	Telescopic [mean (95% CI)]	P*
Anticipation	1.15 (0.85-1.45)	0.60 (0.30-0.90)	0.0400
First 30 seconds interval	1.54 (1.23-1.85)	0.85 (0.55-1.15)	0.0030
Second 30 seconds interval	1.56 (1.25-1.86)	0.91 (0.63-1.20)	0.0020

*Significant difference between the two groups (P < 0.0500), CI: Confidence interval

coated injection in comparison with the conventional method was more positive, as they showed less body movement, less muscle tension, and less verbal protest. One reason was due to the ability of using topical anesthetic gel with telescopic needles. Local anesthetic gel blocks terminal fiber of sensory neurons, so could change pain realization and pain response of a patient.[24-27] Since we had used topical anesthetic gel in both groups, so the reason of lower injection pain in the telescopic groups could be related to lower patient's anxiety in the telescopic groups due to its new design that covers the needle from patient's eyes during injection time and also duration of injection period. The injection time with the telescopic needles was a little bit longer than of the conventional method, which was due to the use of topical anesthetic gel at the same time of injection period in the telescopic group. In the conventional technique, we had used topical anesthetic gel previously before needle insertion, so dentist had to speed up the injection time in some anxious patients to finish the injection period as soon as possible.[28] The telescopic coated dental needles by providing less stress and anxiety in patients, it gave the dentist the ability to deliver the solution slowly, and it would be anticipated that they provide a comfortable injection.

Telescopic needle has got certain limitations as well: Some highly anxious children are already highly sensitive and distressed when entering the treatment room and it seems that the pain related behavior is not influenced by the type of injection method.[29] To positively change the anxiety threshold of these highly anxious children during the anticipatory part of the treatment, more treatment sessions or treatment under hypnotic situation are probably needed.[30] Since the telescopic system had larger size than conventional syringe, in some children who had smaller mouth, dentist had problem to fit the telescopic needle in children's mouth, which need to work on product procedures to be able to make it in compact size to be more convenience for patients and dentist. The long-term benefit may involve reduction of dental anxiety, admission to future treatments and development of proper behavior toward oral health.[31]

Conclusion

However, not all children seem to benefit equally from the use of the telescopic system, it seems that low-anxious and even some high-anxious children with no previous dental experience have the most positive reaction, which makes the telescopic needle a useful system in normal practice instead of expensive and high-risk procedures like general anesthesia. Further studies are required for the telescopic needles with an improved structure more suitable for dentist and patient's application and also use of this new invention in another site of the mouth and different anesthesia techniques other than buccal infiltration before its routine use in dentistry.

Conflict of Interests

Authors have no conflict of interest.

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Prevalence and severity of dental caries in school students aged 6-12 years in Mafraq governorate: Northeast of Jordan

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Original Article

Abstract

BACKGROUND AND AIM: Dental caries is a chronic disease with a high prevalence despite its preventability. Untreated dental caries can cause substantial pain and suffering, and imposes a significant public health and economic burden. Our aim was to determine how prevalent and sever dental caries are among school children between 6 to 12 years of age from a mixed population (Jordanians and Syrian refugees) at Mafraq Governorate, Northeast of Jordan, as well as to evaluate their habits with regards to oral hygiene.

METHODS: The survey was a cross-sectional study conducted on 1286 public school children. All students were examined using a mirror and lit probe with a dental unit for decay-missing-fillings for deciduous teeth (dmft) and decay-missing–fillings for permanent teeth (DMFT); oral hygiene habits were also recorded.

RESULTS: Among 1286 school children, 21.1% were Syrian refugees. The caries prevalence was 78.7% with dmft ranges from 2.3-4.4 and DMFT ranges from 0.4-1.8. There were significant caries indices (SiC) of 7.0 and 2.7 for deciduous teeth and permanent teeth, respectively. About 29.2 % of the students never brushed their teeth, and 93.3% did not have any previous dental treatment. All tested indicators of oral health status were worse among Syrian refugee students compared to Jordanian students, although this difference was not statistically significant.

CONCLUSION: The caries prevalence in this age group in Mafraq was very high. One-third of the examined students had very high deft and DMFT scores, which reflected negligence of children oral health. Untreated dental caries was the main component of DMFT scores among the examined population, indicating lack of dental care services for those children, especially for refugees.

KEYWORDS: Deciduous Teeth; Dental Caries; Decay-Missing-Fillings

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Oral health problems in children including dental caries development will not affect only the health status of a nation, but will also affect the overall health care expenditure with its effect on the economy.[1] The resulting infection and oral pain associated with dental caries will have a tremendous effect on children with impacts on sleeping and growth, causing behavioral problems, affecting their ability to adapt and respond to different social burdens of such effects.[2]

Dental caries is a preventable disease. Despite this fact, it is still the most common chronic disease affecting children. This put a huge burden on oral health providers and

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public health sectors to adapt policies to promote healthier eating habits, water fluoridation, and teeth brushing.[3,4]

According to the World Health Organization (WHO), 60%-90% of schoolchildren in the world have or had caries, and Asia and South America are the most affected regions.[5] In a public survey, prevalence of dental caries was 41.6% among 6-years-old Jordanian children, and more than 67.0% of the total DMTF were D.[6] The prevalence of dental caries was even higher in another survey, with prevalence of 72.9% for 12- to 13-years-old children in north of Jordan and a D component of 92.0% of the total DMFT.[7]

Jordanian National Women's Health Care Center (NWHCC) conducted series of surveys in different parts of the country in collaboration with different governmental ministries in Jordan including health, education, and military. Previous results were published earlier.[8] The NWHCC is a Jordanian governmental–independent body aiming to promote health issues as well as providing health care for the least privileged communities throughout Jordan and to gather information and data for researchers and policy makers by health indicators surveys.[9]

The Mafraq governorate, located in the Northeast of Amman, the capital of Jordan, is one such community. Mafraq covers the second largest area in the kingdom and has 4 districts that are largely spread across the governorate: Mafraq capital (Mafraq Casabah) district, Ruwaished district, North Badiya (Badiah Shamaliyah) district, and West Badiya (Badiah Gharbiyah) district.[10] In 2011, the civil war in Syria resulted in the immigration of more than 1.5 million Syrian refugees to Jordan, and their main border crossing points were located at the Mafraq governorate, which covers close to 300 kilometers of the border with Syria. Additionally, many people were settled in the governorate. The largest refugee camp for Syrian refugees, Zaatari, is located 10 km east of Mafraq. According to the United Nations Higher Commission for Refugees (UNHCR), the presence of Syrian refugees in Mafraq caused a strain on natural resources and increased rental prices, youth unemployment, waste, and demands for water, health, and education.[11] This was reflected as a direct impact on the quality of medical services in the hosting governorate, and there was significant pressure on medical centers and hospitals.[12]

Our aim was to determine how prevalent and sever dental caries are among school children between 6- to 12-year-old from a mixed population (Jordanians and Syrian refugees) at Mafraq governorate, Northeast of Jordan, as well as to evaluate their habits with regards to oral hygiene.

Methods

Over 6 month's period, the NWHCC trained teams conducted an oral health survey for students aged 6-12 years of age from six public schools within the governorate of Mafraq (distributed between three districts). The Ruwaished district was not included because of its small population (4.6%), which is distributed over a large area, having the lowest population density in the entire Kingdom.[10] Two schools per district were selected for the survey based on the number of students: grades 1 to 4 were mixed gender schools, all examined students after grade 4 were girls as regulations prevent mixed schools after that (10-12 years).

Ethical approval for the study was granted from the ethical committee of the Jordanian Ministry of Health (Code: MOH REC 160019). All students were examined after approval from their parents by signing an informed consent. Demographic and oral behavioral data were collected, and all students had a full oral and dental examination. The data sheet was pre-validated by experts committee of dentists and dental care nurses. A mobile dental clinic was used to examine all students at the schools; disposable examination sets (pre-packed mirror and explorer) and disposable latex gloves were used during the examination.

Oral health clinical examination followed WHO recommendations in its 4th edition.[13] to

standardized the examination procedures and to decrease differences in examination outcome, all general practitioner dentists who conducted the clinical examination attended a training course before starting the survey. Pre-survey assessment of agreement was performed between examiners, with Kappa inter-examiner of 0.93 and intra-examiner of 0.98.

Tooth decay was defined according to WHO criteria as 'cavities with a softened dentine floor', we had previously used this definition in a study.[8] Number of teeth with untreated decay (cavity) was defined as DT/dt (decayed teeth). The number of teeth with decay in the past that had been repaired by operative procedures were defined as FT/ft (filled teeth). MT/mt (missing teeth) was used to describe teeth removed or extracted because of decay. The sum of DT/dt, MT/mt and FT/ft, which represented the total number of teeth affected by tooth decay was referred to as the DMFT/dmft. Permanent tooth decay was represented by DMFT, and dmft indicated decay in primary teeth. The level of tooth decay in a population can be represented by the mean values of DT/dt, MT/mt, FT/ft and DMFT/dmft as well as by the proportion of the population affected by each type of decay.[14] The DMFT/dmft ratio represents the total number of teeth affected in the past and present, this value is a cohort that is more representative of the oral health status than the DT/dt value, which indicates those teeth requiring attention because of untreated decay; therefore we chose DMFT/dmft for evaluation and reporting in this study, although this index can be criticized for not counting either enamel caries, or caries activity, or even teeth or surfaces at special risk, in addition to not confirming the reason for decay extraction during examination, especially for deciduous teeth.[15] However, it is good in providing descriptive information for trends monitoring and policy makers' awareness of dental health. Significant caries index (SiC) was used in this survey to overcome the limitation in the distribution of DMFT. The SiC refers to the one-third of the population that are more severely affected by dental caries.[16] A new global oral health goal of a SiC score less than 3 in 12-year-olds was set by WHO as one of the new global health goals to be accomplished by 2015.[16] Statistical analysis was performed using SPSS for Windows (version 20, IBM Corporation, Armonk, NY). The chi-squared test was used for statistical evaluation. A P-value < 0.05 was considered statistically significant.

Results

Among 1286 school children examined, 78.9% were Jordanian and 21.1% were Syrian refugees, 63.0% were females and 37.0% were males; 45.6% were in Casabah district, 30.9% in Badiah Shamaliyah and 23.5% in Badiah Gharbiyah. The distribution of students per age group is shown in figure 1.

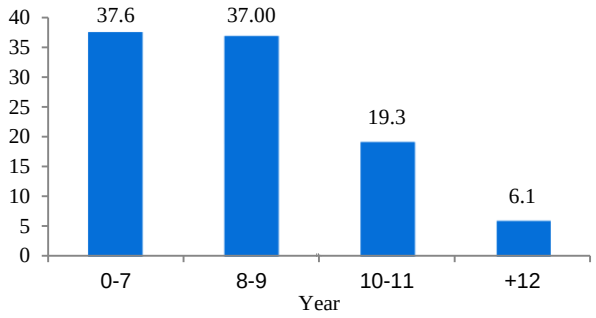


Figure 1. Distribution of students according to age group

Most of the school students (93.3%) never had dental treatment. Only 6.7% had previous dental treatment, and of those, 4.5% were males. Figure 2 show that 29.2% of school students never brushed their teeth.

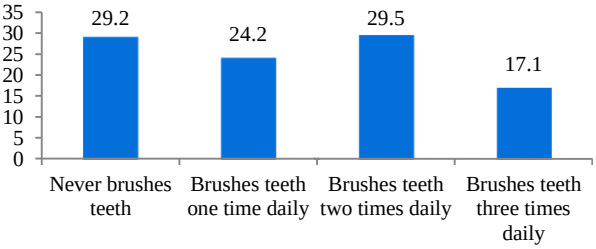


Figure 2. Distribution of school students according to the frequency of tooth brushing

Table 1. DMFT, dmft, SiC/dmft and, SiC/DMFT scores by gender, district, age group, frequency of tooth brushing and nationality

Score	dmft	SiC/dmft	DMFT	SiC/DMFT
Gender				
Male	3.5	7.3	0.6	2.2
Female	2.7	6.8	1.1	2.8
District				
Casaba	2.3	6.7	0.4	2.0
Badiah Gharbiyah	2.5	7.4	0.5	2.2
Badiah Shamaliyah	4.4	7.1	1.8	3.2
Age group (year)				
6-7	4.0	7.5	0.4	2.1
8-9	3.1	6.7	0.7	2.3
10-11	1.5	5.9	1.5	2.7
+12	0.8	5.1	3.1	4.1
Frequency of tooth brushing				
0	4.0	7.4	1.2	3.0
1	3.0	6.7	0.5	2.5
2	1.9	6.5	0.9	2.6
3	3.1	6.9	0.8	2.4
Nationality				
Jordanian	2.9	6.8	0.6	2.5
Syrian	3.4	7.6	1.1	2.8
Total	3.0	7.0	0.9	2.7

DMFT: Decay-missing-fillings for permanent teeth; dmft: Decay-missing-fillings for deciduous teeth; SiC: Significant caries index

The caries prevalence was 78.7% (67.9% for deciduous teeth alone and 32.7% for permanent teeth alone). Table 1 shows the dmft, DMFT and SiC per gender, district, age group, frequency of tooth brushing and nationality. The dmft index was 3.0 and was highest in Badiah Shamaliyah (4.4) and in the 6- to 7-year-old age group (4.0). There was no statistically significant difference in gender or frequency of tooth brushing ($P > 0.05$). The SiC were 7.0 and 2.7 for deciduous and permanent teeth, respectively. A SiC for permanent teeth was highest in North Badiya (Badiah Shamaliyah) district (3.2). Gender and frequency of tooth brushing did not significantly affect the SiC. There was no significant difference between Syrian refugee students and Jordanian students in dmft, DMFT, SiC/dmft and SiC/DMFT scores, although there was a trend toward worse indices among Syrian refugee students ($P < 0.05$).

Dental decay component d or D was the major component of d+m+f, D+M+f (84.5%-95.1%) with only less than 10% of filled teeth. The same was true when %d, %m, %f & %D, %M, and %F were calculated for Syrian refugee students; no significant difference could be demonstrated between the two groups ($P > 0.05$, table 2).

Table 2. %D, %M, %F and %d, %m and %f by gender, district, age and nationality

%	Gender		District			Age group (year)				Nationality		Total
	Male	Female	Casaba	Badiah Gharbiyah	Badiah Shamaliyah	6-7	8-9	10-11	12+	Jordanian	Syrian	
d	90.9	91.6	92.0	86.4	92.9	93.3	90.4	84.5	95.1	91.4	91.1	91.3
m	7.3	5.2	4.1	13.3	4.4	3.9	6.9	13.9	3.3	5.8	6.6	6.1
f	1.8	3.3	3.9	0.3	2.7	2.8	2.7	1.6	1.6	2.8	2.2	2.6
D	94.4	92.3	85.2	96.2	94.9	89.5	94.8	94.2	90.5	92.5	93.6	92.8
M	2.6	1.8	7.6	0.6	0.3	6.8	0.9	1.6	0.4	1.9	2.3	2.0
F	3.0	5.8	7.2	3.2	4.9	3.7	4.3	4.2	9.1	5.4	4.9	5.2

Discussion

The caries prevalence among 6- to 12-year-old school children in Mafraq was very high. One-third of the examined students (SiC index) had a very high dmft and DMFT (7.0 and 2.7, respectively), which reflected negligence of children oral health. Untreated dental caries was the main component of DMFT scores among the examined population, indicating lack of dental care services for those children, especially for refugees.

Even though this study used convenience sampling with its limitation as a non-representative sample, it does give insight into the prevalence and severity of caries, as well as the oral hygiene and dental care practice among school children in this part of Jordan.

Among school children aged 6-12 years (mixed dentition stage), the prevalence of caries exceeded the recommended target of the WHO and Federation of Dentistry International aiming less than 50% caries-free children by 2000.[17] The prevalence was close to that in our previous survey of Tafelah school children in the same age group (70.6% and 28.0% for deciduous and permanent teeth, respectively).[8] Our results were in line with previous similar surveys in Jordan[6,7] and countries with similar social, economic, and cultural characteristics.[5] On the other hand, more developed countries like the United Kingdom,[18] Italy,[19] and Germany[20] reported better results with a 50.0% caries-free schoolchildren.

The deft index was 3.0 and was the highest in Al Badia Shamaliyah (4.4) and in the 6- to 7-year-old age group (4.0). The SiC for deciduous teeth (7.0) was much higher than the recommended goal for 2015;[15] it was highest in the 6- to 7-year-old age group (7.5). European studies conducted in the nineties reported different mean dmft in primary dentition in children aged 5-7 years with a range between 0.9 and 8.5. Spain and Denmark reported lowest values (1.0 dmft and 1.3 dmft respectively). A higher value was mean dmft values below 2.0 and was also reported in Finland, the Netherlands, and Norway (mean deft less than 2).[21] Our results of mean dmft was higher than those reported by these studies.

Mixed dentition gives the opportunity to study the association between the number of dental caries and the primary and permanent teeth. Many studies have suggested a clear relationship between presence of dental caries in the primary and permanent teeth,[22] indicating a predictive potential for presence and severity of dental caries in primary teeth on the prevalence and severity of dental caries in permanent teeth.

The mean DMFT in this study was 0.9, which was highest in North Badiya (Badiya Shamaliyah) (1.8) and 12-year-old school children at a value of 3.1. Our DMFT score may represent lower numbers than the actual caries severity in the community secondary to discrepancy in the age group distribution for this selected sample; with more deciduous teeth and fewer permanent teeth in the studied group (6- to 9-year-old age). Despite this discrepancy in age group, the caries index score of permanent teeth (2.7) was relatively high; it was highest in North Badiya (Badiya Shamaliyah) (3.2) and 12-year-old school children (5.1). our reported score was like the reports form two studies including 12-year-old Sicilian and Sardinian children (2.88 and 2.4 respectively),[23,24] while a study from Greece reported a score ranging between 2.77 to 6.74 for the children with the same age group.[25] Two studies from Spain reported lower scores of 1.33 DMFT in the same age group, with a set up goal to reduce it below 1.0 by 2015.[26,27] for German and Hungarian 8- to 9-years-old children, the mean DMFT was 0.7 and 0.4 respectively.[28] Higher scores of dmft and DMFT in North Badiya (Badiya Shamaliyah) may be attributed to socioeconomic differences[23] and may indicate that more attention should be paid to this specific population.

Untreated decay represents a major component of the caries index. The high prevalence of untreated dental caries was like

other previous studies.[6-8] Low dental visit rates (93.3% of school students had never visited a dentist) which was reflected by many untreated caries could be explained by the absence of dental awareness, lack of affordable health care services or limited access to dental care.

Poor oral health habits indicated the fact that approximately one-third of school students never brushed their teeth, and was not compatible with the WHO recommendation for public health efforts to make fluoridated toothpaste affordable in developing countries.[29]

The effect of tooth brushing on development of dental caries was not apparent in this study, which was an unexpected finding. Our results revealed that tooth brushing did not positively influence the severity of dental caries as dmft or DMFT or SiC. This can be explained by either that the response did not reflect the true practice in this group or the tooth brushing technique was less effective in preventing caries. This relationship may be affected by confounders like the age at which brushing was started, dietary habits including ingestion of sugar and refined food, genetic predisposition, and lack of public fluoridation techniques, supporting that the cause of caries is multifactorial.[30]

The small trend toward better dental and oral health among Jordanians compared to Syrian refugees can be explained by the lack of care for Syrian refugees during their stay in Syria before they move to Jordan.[31] Prior to their arrival, refugees lack access to appropriate health care in addition to many social and psychological trauma's including family member's loss, income loss, separation from their communities or threats.[32] Stress encountered by Syrian refugees and their parents can negatively affect the oral health of students.[33] These results were like other study that showed refugees complained from high debris, more calculus, higher gingivitis, decayed, missing, or filled teeth scores.[34] These results suggested that refugees suffer from more unmet oral health need and inability to access proper dental services in their communities which put more pressure and burden on those who provide health care for refugees (governmental and non-governmental) to put more efforts to provide them with a more complex and a higher state of health care than the needs of the general local population.[35]

Despite the above-mentioned limitations of sampling and indexing, our results demonstrated that dental caries is still a major dental health problem among schoolchildren in Jordan. like other developing countries, lack of oral health experts and poor health infrastructure, is affecting the dental services provided for school children, the unlimited availability of refined sugar products with no awareness policies and protocol to decrease their consumption by children is another possible cause for this high prevalence of dental caries. Oral health and dental care information should be part of prenatal counseling to provide the expectant mothers with such instructions as early as possible. Access to dental care should be available for all communities aiming to provide such communities with a preventive care as well as a curative care.

Conclusion

This study documented a high prevalence of dental caries among schoolchildren aged 6–12 years in Mafraq, Jordan, and there were SiC of 7.0 and 2.7 for deciduous and permanent teeth, respectively, which reflected negligence of children oral health. Untreated dental caries was the main component of DMFT scores among the examined population, indicating lack of dental care services for those children, especially for refugees. Oral hygiene measures were poor in the study population.

Conflict of Interests

Authors have no conflict of interest.

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Frequency of oral and maxillofacial giant cell lesions in Iran in a period of 22-year (1991-2012)

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Original Article

Abstract

BACKGROUND AND AIM: Giant cell lesions as a group of the oral and maxillofacial lesions are common and potentially destructive. The aim of this study was to assess the frequency of oral lesions containing giant cells in a 22-year period in Isfahan Dental School, Iran.

METHODS: In this epidemiological, cross-sectional, retrospective study the archive information in the Department of Oral Pathology, School of Dentistry between 1991 and 2012 was used. All information obtained from the patients records with giant cell lesions [peripheral giant cell granuloma (PGCG), central giant cell granuloma (CGCG), aneurysmal bone cyst, and Cherubism and Brown tumor] were analyzed using SPSS, chi-square test and Fisher ($P < 0.050$).

RESULTS: Of the 8217 cases with pathology records, 591 cases (7.1%) were giant cell lesions. The most common lesion was PGCG (68.5%). The prevalence of lesions in the mandible was more than the maxilla ($P = 0.039$), and also the prevalence of these lesions in woman was slightly more than men ($P = 0.078$).

CONCLUSION: The giant cell lesions were more common in women and in the mandible. They were seen more frequently in the second decade of life. Regards the results of this study, we can prevent PGCG using methods such as improvement of oral hygiene.

KEYWORDS: Epidemiology; Giant Cells; Granuloma

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Knowledge of clinical epidemiology and clinical features of lesions can lead to early diagnosis and proper control of each lesion. This could be avoided the affected areas from further damages. Giant cell lesions are some of the potentially destructive oral jaw lesions which have shown significant outbreak in various studies.[1] Giant cell lesions of the jaws were separated from other jaw lesions by Jaffe[2] when they were termed "giant cell reparative granulomas."[1] These lesions which show multinucleated giant cells in histopathologic features composed of central giant cell granuloma (CGCG), peripheral giant cell granuloma (PGCG), giant cell tumor (GCT), aneurysmal bone cysts (ABC), brown tumors associated with hyperparathyroidism and Cherubism disease.[1]

Katsikeri et al.[3] have reported PGCG was more prevalent in the fourth to sixth decades of life and in females. Some researchers believe that this lesion can cause by local irritation factors such as improper prosthesis and accumulation of plaque.[4-6] Neville et al.[7] discussed a wide age range for this lesion

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from first to sixth decades of life. The mean age of the patients ranged from 31 to 41 years in several extensive reviews, and this lesion has been reported in females.[7]

In one study, incidence of CGCG was estimated 0.001% in the general population[8] and Jadu et al.[9] showed 60% of cases occur before age 30. Gungormus and Akgul[10] in a study reported that CGCG has been occurred in 89% of cases before the age of 40% and 78% of cases presented in females.

ABC, at first, was described by Jaffe and Lichtenstein.[11] It is an uncommon lesion which in a 20-year study only 17 cases have been reported.[12] Cherubism is a rare non-neoplastic genetically inherited disease and tends to involve the mandible more than maxilla.[13]

In a study have been carried out by Mohajerani et al.[14] in the central-northern part of Iran, giant cell lesions were most frequently diagnosed among females, in the 2nd and 3rd decade of life and in the anterior part of the mandible. In this study, PCGC is the most common giant cell lesion in both jaws and ABC showed the lowest prevalence (1.4%) among these lesions.

The prevalence of these lesions showed a wide variation which results from differences in population groups, styles of life and some other clinical factors.[6] The most studies have examined each of the giant cell lesions separately.[5,6] Therefore, to achieve the unique and specific result more extensive studies in different geographic regions are required.

This study aimed to evaluate the frequency and demographic specifications of oral and maxillofacial lesions containing giant cells in the central part of Iran (Isfahan).

Methods

This study is a cross-sectional study (Ethical Committee Number: 293011) and has been reported descriptively. Sampling was done using available data (Existing data), from Department of Oral and Maxillofacial Pathology, School of Dentistry, Isfahan University of Medical Sciences. All patients were assessed during 1991-2012.

Available records of giant cells lesions (PGCG, CGCG, ABC, Cherubism and Brown tumor) from diagnostic reports were collected. Name of the lesion and patients information including age, gender, and location of the lesion were assessed. Records that were incomplete and did not have the necessary clinical information were excluded. All microscopic slides (H and E staining) were reviewed by two pathologists simultaneously to confirm the diagnosis. The information was analyzed using SPSS software (version 19, SPSS Inc., Chicago, IL, USA), chi-square test and Fisher's exact test ($P < 0.050$).

Results

Among the 8217 pathologic records in the Isfahan Oral and Maxillofacial Pathology Department, 635 cases were giant cell lesions. Among these, 44 cases were excluded due to incomplete clinical information and 591 cases were analyzed.

The most frequent lesion was PGCG (68.5%). The frequency distribution of the lesions was shown in table 1.

Table 1. The frequency of giant cell lesions

The type of lesion	n (%)
PGCG	405 (68.5)
CGCG	168 (28.4)
ABC	12 (2.0)
Cherubism	2 (0.3)
Brown tumor	4 (0.7)
Total	591 (100)

CGCG: Central giant cell granuloma; PGCG: Peripheral giant cell granuloma; ABC: Aneurysmal bone cysts

In table 2, the dispensation of the lesions according to gender has been shown. The data showed that 47.7% of males and 52.3% of females had PGCG. The difference between males and females was not significant ($P = 0.051$). In CGCG group (the second most frequent lesion), respectively, 37.5% of the patients were males and 62.5% were females, and the differences between them were significant ($P = 0.001$). The

frequency of ABC was not statistically significant differences among males and females with chi-square test (P = 0.378).

Table 2. Frequency of giant cell lesions based on gender

Type of lesion	Gender		
	Male [n (%)]	Female [n (%)]	Total [n (%)]
PGCG	193 (47.7)	212 (52.3)	405 (68.5)
CGCG	63 (37.5)	105 (62.5)	168 (28.4)
ABC	7 (58.3)	5 (41.7)	12 (2.0)
Cherubism	1 (50.0)	1 (50.0)	2 (0.3)
Brown tumor	3 (75.0)	1 (25.0)	4 (0.7)
Total	267 (45.2)	324 (54.8)	591 (100)

P ≤ 0.050 was considered significant.
CGCG: Central giant cell granuloma; PGCG: Peripheral giant cell granuloma; ABC: Aneurysmal bone cysts

The highest incidence rate of giant cell lesions was in the second decade of life, although the most common lesion; PGCG; showed the highest incidence in the fifth decade. One case of Cherubism in the first decade of life and another one in the third decade of life were seen. The distribution of other lesions can be seen in table 3.

According to table 4, 63.3% and 36.7% of the lesions were seen in the upper and lower jaw, respectively. The differences between these were significant (P = 0.039).

Discussion

The data of this study showed that the most common giant cells lesion was, PGCG, similar to the study conducted by Tandon et al.[15] and Gümüşok et al.[16] In contrast, Mullapudi et al.[17] showed that CGCG s constituted the majority of giant cell lesions.

This reactive hyperplastic benign lesion usually occurred due to local trauma and originated from tooth periodontal fibers or mucoperiosteum.[18] Chatherine said that the highest incidence of this lesion was seen in age range 41-50 years. Then, the most common age of onset were the first and fourth decades of life. Reactive lesions such as PGCG, when occurred in children can growth rapidly and within a few months reach to substantial size, interfering with the eruption of the teeth and cause bone resorption. Early detection of these lesions leads to a more conservative surgical approach and create a lower risk for tooth and supporting bone.[19]

In the present study, the prevalence of PGCG was nearly equal in the two genders; this finding is consistent with a number of earlier studies.[17,20,21] In contrast, Salum et al.[22] and Zhang et al.[23] showed the incidence of this lesion was higher in male. The reason of this difference could be explained by different population groups.

In this study, these lesions are more common in the mandible, which is consistent with the results of other studies.[17,20,24,25] According to these results, PGCG as the most common lesion contained giant cell have equal incidence in both genders and its prevalence was higher in the fifth decade of life and in the mandible. Environmental factors which caused this lesion such as calculus, dental plaque, and others irritating factors could indicate poor oral health status in the population study.

Table 3. Frequency of giant cell lesion based on age

Age (year)	Lesion					
	PGCG [n (%)]	CGCG [n (%)]	ABC [n (%)]	Cherubism [n (%)]	Brown tumor [n (%)]	Total [n (%)]
0-10	67 (16.5)	20 (11.9)	2 (16.7)	1 (50.0)	0 (0)	90 (15.2)
11-20	45 (11.1)	70 (41.7)	7 (58.3)	0 (0)	4 (100)	126 (21.3)
21-30	48 (11.9)	23 (13.7)	2 (16.7)	1 (50.0)	0 (0)	74 (12.5)
31-40	69 (17.0)	25 (14.9)	0 (0)	0 (0)	0 (0)	94 (15.9)
41-50	86 (21.2)	11 (6.5)	0 (0)	0 (0)	0 (0)	97 (16.4)
51-60	60 (14.8)	12 (7.1)	1 (8.3)	0 (0)	0 (0)	73 (12.4)
61-70	30 (7.4)	7 (4.2)	0 (0)	0 (0)	0 (0)	37 (6.3)
Total	405 (68.5)	168 (28.4)	12 (2.0)	2 (0.3)	4 (0.7)	591 (100)

P ≤ 0.050 was considered significant.
CGCG: Central giant cell granuloma; PGCG: Peripheral giant cell granuloma; ABC: Aneurysmal bone cysts

Table 4. Frequency of giant cell lesion based on location of lesion

Lesion	Location		
	Maxilla [n (%)]	Mandible [n (%)]	Total [n (%)]
PGCG	152 (37.5)	253 (62.5)	405 (68.5)
CGCG	63 (37.5)	105 (62.5)	168 (28.4)
ABC	0 (0)	12 (100)	12 (2.0)
Cherubism	1 (50.0)	1 (50.0)	2 (0.3)
Brown tumor	1 (25.0)	3 (75.0)	4 (0.7)
Total	217 (36.7)	374 (63.3)	591 (100)

$P \leq 0.050$ was considered significant.
CGCG: Central giant cell granuloma; PGCG: Peripheral giant cell granuloma; ABC: Aneurysmal bone cysts

The second most common lesion in this study is the CGCG. This benign bone lesion was described by Jaffe for the first time in 1935.[2] The clinical behaviors of these lesions show a significant difference, occasionally they are asymptomatic lesions and usually detected on routine physical examination. Sometimes these lesions have been diagnosed with rapid onset, pain, paresthesia, root resorption, and teeth divergence.[20]

In this study, the most patients with CGCG were females that significant differences were found in comparison with males. This finding is consistent with previous results,[7,20] and some studies have been shown this frequency two times greater in females.[9,20] The prevalence of these lesions was higher in the second decade of life. It is also in close agreement with previous studies.[9,20,21] Mullapudi et al.[17] showed CGCG was the most common oral and maxillofacial giant cell lesion and a history of trauma can be ascertained. In previous studies, the incidence of CGCG was higher in the mandible which is consistent with the results of the present study.[7,9,21,26,27]

The third lesion in view of incidence in this study is the ABC with 12 cases (2%). In a similar study, this prevalence is reported 1.39%[14] and in a separate study conducted in China, the prevalence of ABC for a period of 20-year were recorded 17 cases.[28] Several theories have been suggested for the etiology of this lesion. In 1978, Hillerup and Hjorting-Hansen[29] suggested that ABC, simple bone cyst, and CGCG get up some vascular defect. Jaffe and Lichtenstein[27] suggested ABC arises from a pre-existing lesion of bone, frequently. Panoutsakopoulos et al.[30] and Dal et al.[31] demonstrated that primary ABCs represent chromosomal translocation t (16; 17) (q22; p13). These findings show that the primary and secondary ABCs represent different ideas; primary ABCs getting up gene translocation and secondary ones arising from a pre-existing lesion (changes in vascular hemostatic balance).

In this study, all cases with ABC except one case have been seen in patients under 30 y/o and in the mandible. The other studies have shown somewhat similar results. In various studies, 90% of ABC has been reported in the mandible and more cases occur in the posterior part of the mandible.[12,27,32] Results of Sun et al.[12] from 17 patients with ABC showed 9 patients were males and 8 were females. In this study, this lesion was seen in 7 males and 5 females, and there is no significant difference between them. Furthermore, this study is consistent with previous similar study[12] and shows approximately equal prevalence in two genders.

Brown tumor with 4 cases (0.7% of all lesions) has been shown in this study. This non-neoplastic lesion happened in patients with hyperparathyroidism, result to abnormal bone metabolism and local destruction. This condition commonly was seen in the cortical bone, and the mandible shows a higher incidence than maxilla.[33,34] In this study, three cases of this lesion occurred in the mandible that confirms previous findings.

Cherubism in recent literature reviews has been introduced as an autosomal dominant genetic disorder. In this syndrome, normal bone is replaced with fibrous tissue and cellular immature bone. The mandible is affected more than maxilla, usually. Other clinical presentation like bilateral swelling of the cheeks leads to ocular manifestations.[35,36]

In the present study, one case of Cherubism was seen in the first decade and another case in the third decade of life that totally consists 0.3% of all giant cell lesions.

At the end, another lesion that belongs to the group of giant cell containing lesions is GCT. The GCT that occurs in the jaw bone is not definitely known, and there is a controversy about it.[20]

In the present study, no case of GCT was observed. In this regard, many researchers believe that this tumor belongs to the region outside the jaw and basically it is distinguishable from the CGCG. However, some researchers consider this disease as a different appearance of one disorder.[9,37]

Conclusion

According to these results, giant cell lesions were more common in females and in the mandible. Furthermore, they occur more in the second decade of life. Furthermore, PGCG had the higher incidence rate among other giant cell lesions. The results can be useful in various fields such as oral health promotion programs for maintaining good oral health care. In conclusion, this study can be used and helpful as an epidemiological data in conjunction with other similar studies for giant cell lesions.

Conflict of Interests

Authors have no conflict of interest.

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