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Original Articles

Determination of the most accepted facial angles and anterior-posterior chin position in patients seeking cosmetic surgery in Shiraz, Iran

Reza Mehravaran DDS, OMFS, Sara Samadi (47-52)

Use of rubber dam among dentists working in the west part of Iran

Ensi Kolyaei DMD, DDS, Masoud Bashiri DMD, DDS, Roya Safari-Faramani MSc,
Ebrahim Nasrollahi DMD, DDS, Mohammad Rastegar-Khosravi DMD, DDS (53-57)

Evaluation of teeth whitening with application of novel toothpaste containing ozone

Horieh Moosavi DDS, Lila Vaziri MD, Omid Rajabi PhD, Fatemeh Rezaee (58-65)

Knowledge of physical education teachers' toward tooth avulsion in Tehran, Iran

Jafar Panahi MSc, Mohammad Reza Havasian MSc, Mohammad Ali Roozegar DMD, MS (66-71)

A cross-sectional survey on the relationship between some biologic maternal characteristics and dental status of pregnant women in Isfahan, Iran, in 2012

Maryam Allameh DDS, Heidar Khademi DDS, MS, Masoomeh Eslami DDS (72-78)

The detection of salivary glucose, caries and periodontal status in patients with diabetes mellitus

Shahla Kakoei DDS, MSc, Bahareh Hosseini DDS, MSc, Ali Akbar Haghdost PhD, Mojgan Sanjari MD,
Maryam Alsadat Hashemipour DDS, MSc, Ahmad Gholamhosseinian PhD (79-84)

A comparative study of the cleaning effect of various ultrasonic cleaners on new, unused endodontic instruments

Masoud Parirokh DMD, MS, Zeynab Kazemizadeh DMD, MS, Arash Shahravan DMD, MS,
Ghasem Sahranavard DMD, MS, Ali Akbar Haghdost MD, PhD (85-91)

Clinical characteristics of peripheral ossifying fibroma: A series of 20 cases

Mohammad Reza Zarei DDS, MD, Nader Navabi DDS, MD, Goli Chamani DDS, MD,
Sepideh Pour-Monajemzadeh DDS (92-97)

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TelFax: +98 34 32133440

Email: johkmu@kmu.ac.ir

Email: johkmu@yahoo.com

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Farzanegan Radandish Co.

Postal Code: 81465-1798, Isfahan, Iran

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Table of Contents

Original Articles

Determination of the most accepted facial angles and anterior-posterior chin position in patients seeking cosmetic surgery in Shiraz, Iran

Reza Mehravaran DDS, OMFS, Sara Samadi (47-52)

Use of rubber dam among dentists working in the west part of Iran

Ensi Kolyaei DMD, DDS, Masoud Bashiri DMD, DDS, Roya Safari-Faramani MSc, Ebrahim Nasrollahi DMD, DDS, Mohammad Rastegar-Khosravi DMD, DDS (53-57)

Evaluation of teeth whitening with application of novel toothpaste containing ozone

Horieh Moosavi DDS, Lila Vaziri MD, Omid Rajabi PhD, Fatemeh Rezaee (58-65)

Knowledge of physical education teachers' toward tooth avulsion in Tehran, Iran

Jafar Panahi MSc, Mohammad Reza Havasian MSc, Mohammad Ali Roozegar DMD, MS (66-71)

A cross-sectional survey on the relationship between some biologic maternal characteristics and dental status of pregnant women in Isfahan, Iran, in 2012

Maryam Allameh DDS, Heidar Khademi DDS, MS, Masoomeh Eslami DDS (72-78)

The detection of salivary glucose, caries and periodontal status in patients with diabetes mellitus

Shahla Kakoei DDS, MSc, Bahareh Hosseini DDS, MSc, Ali Akbar Haghdoost PhD, Mojgan Sanjari MD, Maryam Alsadat Hashemipour DDS, MSc, Ahmad Gholamhosseinian PhD (79-84)

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Determination of the most accepted facial angles and anterior-posterior chin position in patients seeking cosmetic surgery in Shiraz, Iran

Reza Mehravaran DDS, OMFS¹, Sara Samadi²

Original Article

Abstract

BACKGROUND AND AIM: Beauty standards are related to race and change over time with cultural changes. The criteria obtained for a specific race cannot be used as treatment planning criteria for other races and societies. It seems that no thorough study has been carried out in Iranian context to determine the acceptability of these standards. In this study, the desired nasolabial (NL), nasofrontal (NF), chin-neck (Ch-N) angles and anterior-posterior chin position from the point of view of people seeking esthetic surgery were determined.

METHODS: In a cross-sectional, descriptive study, 500 people seeking esthetic surgery referring to School of Dentistry and Chamran Hospital in Shiraz, Iran, were asked to see images and record their desired angles in a questionnaire. The samples were chosen from people with ages ranging from 18 to 48 years old referred to the Hospital in 2012 and 2013. The silhouette profile image of a young girl with normal face ratios was used. Data were analyzed via SPSS software using chi-square and t-tests. Chi-square test was used to compare nominal data and student's t-test to compare quantitative data. $P < 0.050$ was considered as significant.

RESULTS: The mean age of subjects in our study was 27 years. From the 500 subjects, 35.4% were males and 64.6% were females. Average desired Ch-N, NL and NF were 118.28, 137.8 and 107.8 respectively. Desired mean for the anterior-posterior chin position was 6.23 mm.

CONCLUSION: According to this study, no significant differences were found between the desired face sizes in Iranian community and other communities.

KEYWORDS: Cosmetic Surgery, Beauty Cultures, Beauty

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Beauty is an ill-defined concept that is obvious to the observer, however, it is difficult to quantify.¹ Beauty is that "which gives the highest degree of pleasure to the senses or to the mind and suggests that the object of delight approximates one's conception of an ideal." Research also demonstrates that the attractiveness contributes to the on-the-job success of men and women and the face of people in the community plays an important role in their acceptability.² small changes in detail, even those produced by such

innocuous modalities as cosmetic, can affect changes that are perceived dramatic.³ For instance, the public frequently assumes that the bearer of a severe Class II or severe Class III pattern is a slow, dull individual.⁴

It is true that standards of beauty change over time and across cultures.² From ancient Egypt through the renaissance, western civilization has recorded in sculpture many refined concepts of facial esthetics, common to all these concepts was public recognition of the "the esthetic ideal" of each period.⁴ In the last century, with innovation of safe and

1- Assistant Professor, Department of Oral and Maxillofacial Surgery, School of Dentistry, Shiraz University of Medical Sciences, Shiraz, Iran

2- Student of Dentistry, Department of Dental Surgery, Student Research Committee, School of Dentistry, International Branch, Shiraz University of Medical Sciences, Shiraz, Iran

Correspondence to: Sara Samadi

Email: rasa.aras@yahoo.com

efficient esthetic surgery methods, the people's interest in these types of surgeries has significantly increased. In the United States, esthetic surgery increased to 529000 cases between 1981 and 1995.⁵ Statistics shows that Iran is a country with the highest frequency of plastic surgery operations.⁶ It seems that some factors like cultural background,⁷ media advertisement⁸ increased people motivation to undergo cosmetic surgery. Concepts of facial beauty also seem to cross-cultural and racial line and also change over time and cultures.³

There are other studies on the desired face proportions and angles of other races. Iglesias-Linares et al. investigated faces of 80 attractive faces selected by American journals in the last 10 years. They determined the accepted nasofrontal (NF) and nasolabial (NL) angles.⁹ Yehezkel and Turley measured desired NF and NL angles in the mid- and late-20th century by exploring the attractive figures in fashion magazines in California.¹⁰

The criteria obtained for a specific race cannot be used as treatment planning criteria for other races and societies.¹¹ Given the high growth rate of esthetic surgeries in Iran, there is a need for patterns and criteria suitable for the culture and race of this area. The angles and sizes that influence the face and can be changed by esthetic surgery are: NL, NF, Ch-N angle and the anterior-posterior chin position.

It seems that there have been no comprehensive studies on determining the acceptability of these sizes and angles in Iranian society. Therefore, esthetic surgeons usually use the findings of foreign research that have little proportion to traditional and cultural interest in the country to plan treatments. In this study, the desired angles and proportions from the point of view of people seeking esthetic surgery were determined.

Methods

In this cross-sectional, descriptive study, 500 people seeking esthetic surgery referred to School of Dentistry and Chamran Hospital in

Shiraz, Iran, were asked to see images and record their desired Ch-N, NF, NL angles, and the anterior-posterior chin position in a questionnaire. The samples were chosen from people with ages ranging from 18 to 48 years old referred to the Hospital in 2012 and 2013.

The colored digital image of the profile was obtained using a Samsung smart camera (WB-500). The profile image was obtained in a standard sized procedure by positioning the subject 5 feet from the camera with the head in the natural head posture and lip at rest.

To prepare the image used for the purpose of this study, the silhouette profile image of a young girl with normal face ratios was used. Angles and sizes measured in this study were as the following:

NL angle: The angle between two lines tangent on columella and the upper lip mucocutaneous junction from subnasal point.¹²

NF angle: The angle between the two tangent lines on the forehead and the dorsum of the nose from radix point.¹³ N-Ch angle: The angle between two lines tangent on submental and neck areas.¹⁴

Anterior-posterior chin position: This is measured based on the distance of the most prominent anterior point of the chin (POG) soft tissue from the line that is perpendicular to the horizon from the subnasale point.¹² In these images, each of the NF, N-Ch, NL angles, and the anterior-posterior chin position were changed separately with equal amounts relative to the standard amount by Adobe Photoshop_cs6 (Figures 1-4). In each image, an angle was changed, and the rest of the angles and proportions were kept constant.

Images were classified in separate categories and hence that in each group an angle or size was changed. Each image was marked with a code, and the subjects were asked to select the desired image in each category and record it in his questionnaire. As the images belonged to a female, the result can be considered only in relation to female patients.

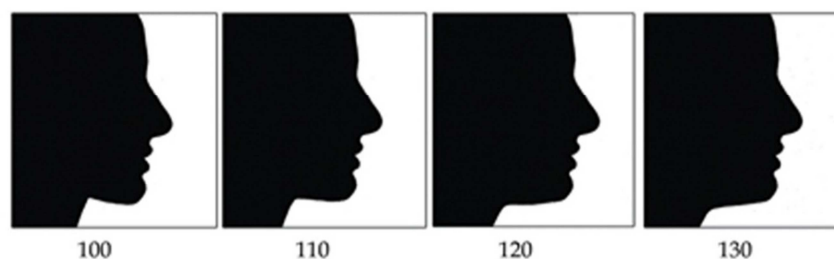


Figure 1. Photographs of neck-chin angle

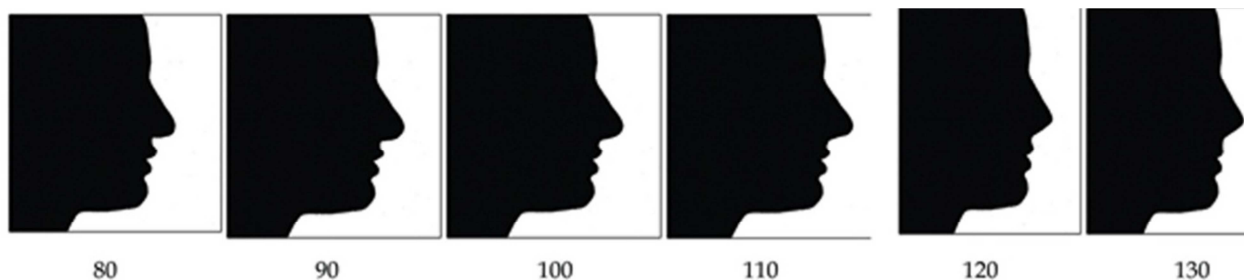


Figure 2. Photographs of nasolabial angle

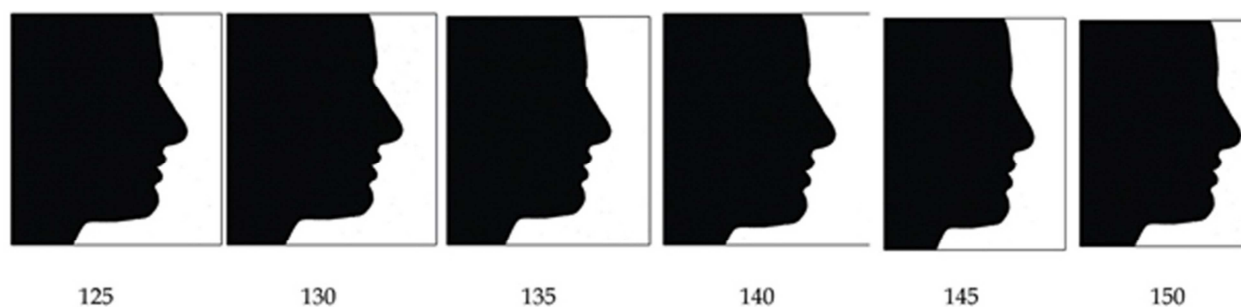


Figure 3. Photographs of nasofrontal angle

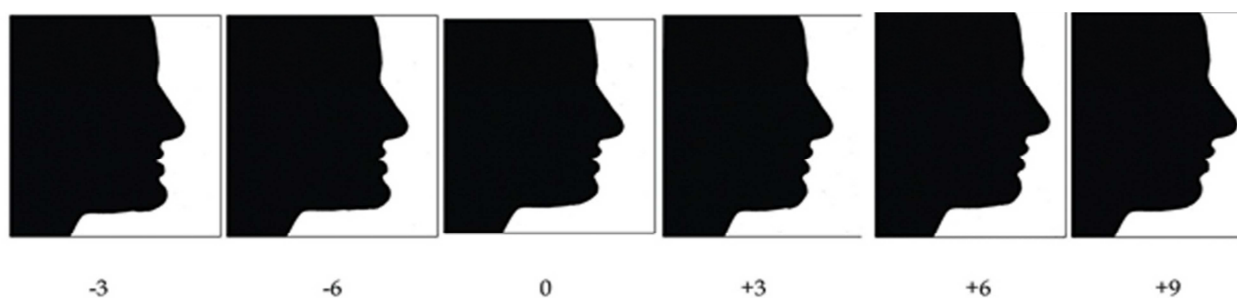


Figure 4. Photographs of anterior-posterior chin position

The results of the questionnaire were classified and the number of votes obtained for each image was determined. Data were analyzed by SPSS software (version 18, SPSS Inc., Chicago, IL, USA) using chi-square and t-test. Chi-Square test was used to compare nominal data and student's t-test to compare quantitative data. $P < 0.050$ was considered

as significant.

Results

The mean age of the subjects in our study was 27 years. Of the 500 subjects, 35.4% were males and 64.6% were females. Regarding N-Ch angle, the most desired angle was 120 ($P < 0.001$) following by 130°. It appears that

older people were more likely to choose more acute angles than younger people ($P = 0.028$) (Table 1).

In general, the average desired angle for this measure was 118.28° . The most desired NF angle from the subjects' point of view was 135° followed by 145° ($P = 0.056$). There was no relationship between age and sex of voters with their selected angles. The mean value for this angle was 137.8° (Table 2).

The studied patients chose 120° as their most desired NL angle followed by 110° ($P < 0.001$). Most female voters chose 120° and most male voters chose 110° . The overall mean value for this angle was 107.8° . Regarding anterior-posterior chin position determined by measuring the distance from POG to subnasal perpendicular line, the most desired value was 9 mm followed by 6 mm ($P < 0.001$). The average desired anterior-posterior chin position was 6.23 mm (Table 2).

Overall, no significant differences between the subjects' sex and NL, NF and N-Ch angles and anterior-posterior chin position were found. Furthermore, there were no significant differences between age and NL, NF angles and anterior posterior chin position.

Discussion

In our study, we have tried to investigate a

number of face angles and sizes in sagittal plan and to determine the ideal amounts from Iranians' point of view. It seems that every society's ideals of beauty change over time. In contrast, the concept of attractiveness is different from one ethnicity to the other.¹⁵ Therefore, the need for updating esthetic surgery guidelines in each society seems essential.¹⁶

In our study, the ideal sizes and angles were determined through a questionnaire accompanied by a series of face photographs. The procedure had been used in many other studies as well,^{17,18} However, to omit the influence of makeup, hairstyle and skin color on the voters' judgment,¹⁹ we prepared dark silhouette pictures. A number of other studies had used photographs of movie, TV and fashion stars to determine desired sizes,^{9,10} although the problem with this method is the impact of the celebrity's popularity on the judgment of voters.²⁰

In our study, the image of a woman was used to determine ideal sizes. The reason was women's highest request for esthetic surgery in our community compared to men's.⁶ It seemed that this was also true in other communities.²¹ In this study, the average N-Ch angle was 118° which was almost concurred with the standard value.²²

Table 1. Frequency and percentage of neck-chin angle

Neck-chin angle	100		110		120		130	
Age (year)	34-48	18-33	34-48	18-33	34-48	18-33	34-48	18-33
Frequency	11	35	29	107	42	134	26	126
Percentage	42	7	6	21	8	27	4	25
Total	9		27		35		29	

Table 2. Frequency and percentage of NF and NL angles and anterior-posterior chin position

NF angle			NL angle			Anterior-posterior chin position		
Degree	Frequency	Percentage	Degree	Frequency	Percentage	Position	Frequency	Percentage
125	74	14.8	80	40	8.0	-6	5	1.0
130	72	14.4	90	76	15.2	-3	7	1.4
135	101	20.2	100	99	19.8	0	12	2.4
140	76	15.2	110	100	20.0	+3	99	19.8
145	100	20.0	120	109	21.8	+6	174	34.8
150	77	15.4	130	76	15.2	+9	203	40.6

NF: Nasofrontal; NL: Nasolabial

Regarding the NF angle, our study determined the desired average angle of approximately 138°. This was consistent with the results of Berneburg et al.,²³ However, the most popular NF angle for Iranians was 130°.²⁴

In our study, the ideal NL angle was approximately 108°, which was expected because the normal size of this angle is 90-110 in women.¹² However, this result was a little more than the most common angle among the Iranian race which is 98°.²⁴ In the contrary to our study, people had been interested in more acute NL in similar studies conducted before.^{10,25,26} A logical justification could be the tendency of people towards more protrude lips. In these studies, the more protrusion of the upper lip, the smaller the NL angle. However, in our study, despite a slight change in the shape of lips this did not occur.

The anterior-posterior chin position in our study was set back a little more than normal, which is consistent with Sforza et al.,²⁷ and Yehezkel and Turley study.¹⁰ However, study of Abu Arqoub and Al-Khateeb found results not consistent with ours.¹⁷ In the study of Turkkahraman and Gokalp,¹⁸ men voted to convex profile more than women. Women voted to women with a concave profile.

However, in our study there was no difference in the male and female votes.

Conclusion

Generally, according to the findings of this study, there were no significant differences between the desired face sizes in Iranian community and other communities. In some other studies, there had been no difference between the ideal face sizes in several races.^{6,10} This might be due to the same effect of ubiquitous media on different ethnic groups and strict patterns of beauty through the world.

Conflict of Interests

Authors have no conflict of interest.

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References

1. Yellin SA. Aesthetics for the next millennium. *Facial Plast Surg* 1997; 13(4): 231-9.
2. Patnaik V, Singla Rajan K. Anatomy of 'A Beautiful Face & Smile'. *J Anat Soc* 2003; 52(1): 74-80.
3. Lehocky B. Anthropometry and cephalometric facial analysis. In: Mathes SJ, Hentz VR, Editors. *Plastic surgery*. 2nd ed. Philadelphia, PA: Saunders Elsevier; 2006. p. 1-30.
4. Peck H, Peck S. A concept of facial esthetics. *The Angle Orthodontist* 1970; 40(4): 284-317.
5. Gilman SL. *Creating beauty to cure the soul: race and psychology in the shaping of aesthetic surgery*. Durham, NC: Duke University Press; 1998.
6. Salehahmadi Z, Rafie S. Factors affecting patients undergoing cosmetic surgery in Bushehr, Southern Iran. *World J Plast Surg* 2012; 1(2): 99-106.
7. Haas CF, Champion A, Secor D. Motivating factors for seeking cosmetic surgery: a synthesis of the literature. *Plast Surg Nurs* 2008; 28(4): 177-82.
8. Slevac J, Tiggemann M. Attitudes toward cosmetic surgery in middle-aged women: body image, aging anxiety, and the media. *Psychology of Women Quarterly* 2010; 34(1): 65-74.
9. Iglesias-Linares A, Yanez-Vico RM, Moreno-Manteca B, Moreno-Fernandez AM, Mendoza-Mendoza A, Solano-Reina E. Common standards in facial esthetics: craniofacial analysis of most attractive black and white subjects according to People magazine during previous 10 years. *J Oral Maxillofac Surg* 2011; 69(6): e216-e224.
10. Yehezkel S, Turley PK. Changes in the African American female profile as depicted in fashion magazines during the 20th century. *Am J Orthod Dentofacial Orthop* 2004; 125(4): 407-17.
11. Mafi P, Ghazisaeidi MR, Mafi A. Ideal soft tissue facial profile in Iranian females. *J Craniofac Surg* 2005; 16(3): 508-11.

12. Epker BN. Management of nasal deformities associated with dentofacial deformities. In: Epker BN, Stella JP, Fish LC, Editors. *Dentofacial deformities*. 2nd ed. St. Louis: Mosby; 1999. p. 1715-52.
13. Rohrich RJ, Muzzaffar AR, Oneal RM. Preferred Anatomic Terms for Rhinoplasty. In: Symposium DR, Gunter JP, Rohrich RJ, Adams WP, Smith H, Editors. *Dallas Rhinoplasty: Nasal Surgery by the Masters*. St. Louis: Quality Medical Publishing Inc; 2007. p. 1-9.
14. Prendiville S, Kokoska MS, Hollenbeak CS, Caplin DA, Cooper MH, Branham G, et al. A comparative study of surgical techniques on the cervicomental angle in human cadavers. *Arch Facial Plast Surg* 2002; 4(4): 236-42.
15. Hwang HS, Kim WS, McNamara JA. Ethnic differences in the soft tissue profile of Korean and European-American adults with normal occlusions and well-balanced faces. *Angle Orthodontist*, 2002; 72(1): 72-80.
16. Todd SA, Hammond P, Hutton T, Cochrane S, Cunningham S. Perceptions of facial aesthetics in two and three dimensions. *Eur J Orthod* 2005; 27(4): 363-9.
17. Abu Arqoub SH, Al-Khateeb SN. Perception of facial profile attractiveness of different antero-posterior and vertical proportions. *Eur J Orthod* 2011; 33(1): 103-11.
18. Turkkahraman H, Gokalp H. Facial profile preferences among various layers of Turkish population. *Angle Orthod* 2004; 74(5): 640-7.
19. Wuerpel EH. A classic revisited. Ideals and idealism by Edmund H. Wuerpel, 1931. *Angle Orthod* 1981; 51(1): 6-23.
20. Sahin Saglam AM, Gazilerli U. Analysis of Holdaway soft-tissue measurements in children between 9 and 12 years of age. *Eur J Orthod* 2001; 23(3): 287-94.
21. Brown A, Furnham A, Glanville L, Swami V. Factors that affect the likelihood of undergoing cosmetic surgery. *Aesthet Surg J* 2007; 27(5): 501-8.
22. Epker B. Evaluation of the face. In: Fonseca RJ, Marciani RD, Turvey TA, editors. *Oral and maxillofacial surgery*. 2nd ed. Philadelphia, PA: Saunders; 2009. p. 1-59.
23. Berneburg M, Dietz K, Niederle C, Goz G. Changes in esthetic standards since 1940. *Am J Orthod Dentofacial Orthop* 2010; 137(4): 450-9.
24. Fariaby J, Hossini A, Saffari E. Photographic analysis of faces of 20-year-old students in Iran. *Br J Oral Maxillofac Surg* 2006; 44(5): 393-6.
25. Sforza C, Laino A, D'Alessio R, Grandi G, Tartaglia GM, Ferrario VF. Soft-tissue facial characteristics of attractive and normal adolescent boys and girls. *Angle Orthod* 2008; 78(5): 799-807.
26. Armijo BS, Brown M, Guyuron B. Defining the ideal nasolabial angle. *Plast Reconstr Surg* 2012; 129(3): 759-64.
27. Sforza C, Laino A, D'Alessio R, Grandi G, Binelli M, Ferrario VF. Soft-tissue facial characteristics of attractive Italian women as compared to normal women. *Angle Orthod* 2009; 79(1): 17-23.

Use of rubber dam among dentists working in the west part of Iran

*Ensi Kolyaei DMD, DDS¹, Masoud Bashiri DMD, DDS¹,
Roya Safari-Faramani MSc², Ebrahim Nasrollahi DMD, DDS³,
Mohammad Rastegar-Khosravi DMD, DDS⁴*

Original Article

Abstract

BACKGROUND AND AIM: Although Rubber dam (RD) usage is one of the ideal and standard methods for isolating the teeth in several operative procedures of dentistry, General Dental Practitioners often neglect it. Many studies within several countries have reported various frequencies for RD application. There is no such study for Iran, so we conducted a study to report the frequency of its application and the effective factors.

METHODS: This cross-sectional study carried out across the west part of Iran in 2013. A total of 525 general Dental Practitioners from the public and private sectors selected by stratified random sampling using a list from 3 big western cities of Iran. The data were collected using self-administrated checklist.

RESULTS: The prevalence of RD application among General Dental Practitioner was 0.2% (confidence interval 95%: 0.196-0.204). RD instrument was existed in around 7.0% of cases. The main reason of the General Dental Practitioner to avoid RD application was supposing it is time-consuming procedure and causing patients stress (58.9%).

CONCLUSION: Despite the advantages of RD application, its usage is not recognized as a routine and common method of isolation during dental procedures even roots canal therapy by Iranian General Dental Practitioners.

KEYWORDS: Rubber Dam, Isolation, Endodontic Treatment, General Dental Practitioner

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Since the rubber dam (RD) introduction by Barnum in 1864, its application has improved operative General Dental Practitioner in many ways for more than 145 years. A drier field, better visibility and access, increased patient comfort, and infection control, prevention of aspiration instruments and ingestion of irrigation material and retraction of soft tissue are only a few of the many advantages of using a RD.^{1,2}

Although General Dental Practitioners are taught in school that RD isolate selected teeth and safeguard the rest of the patient's mouth during treatment, most of fresh General

Dental Practitioners falsely assume that RD are only training tools used for academic purposes at school.³

RD usage is considered as one of the ideal and standard method for isolating the working area in root channel treatment, adhesive procedures and operative procedures.⁴ General Dental Practitioners often avoid use of RD, supposing that it would stress the patient and its application is time consuming but in fact Isolation with RD cause less stress in children and adolescents comparing to relative isolation with cotton rolls if applied by an experienced General Dental Practitioner and also it can save

1- Student of Dentistry, Department of Endodontic, School of Dentistry, Kurdistan University of Medical Sciences, Sanandaj, Iran

2- PhD Student, Department of Biostatistics and Epidemiology, School of Public Health, Kerman University of Medical Sciences, Kerman, Iran

3- Assistant Professor, Department of Endodontics, School of Dentistry, Kermanshah University of Medical Sciences, Kermanshah, Iran

4- Assistant Professor, Department of Endodontics, School of Dentistry, Kurdistan University of Medical Sciences, Sanandaj, Iran

Correspondence to: Ensi Kolyaei DMD, DDS

Email: nc.kolyaei@gmail.com

valuable treatment time.^{5,6} Many studies have been done to evaluate the frequency of RD usage within several countries and showed various frequencies for RD application.⁷⁻¹⁰ We could not find any related research about usage of RD by Iranian dentists.

The aim of this study is designed to evaluate the frequency of RD application by the General Dental Practitioners working in three big cities located in the west part of Iran and find out the main reasons why General Dental Practitioners apply it or not.

Methods

The Kermanshah, Iran, Institutional Review Board approval for the publication of the curriculum and the post-simulation experience survey results was obtained for this study. This was a cross-sectional study carried out across the west part of Iran in 2013. Kermanshah, Kurdistan and Ilam in Iran were selected. A study conducted in the corresponding capital cities, Kermanshah, Sanandaj and Ilam.

Five hundred and twenty-five General Dental Practitioners from the public and private sectors selected by stratified random sampling using a list. We consider city as strata. Most of the cases were selected from Kermanshah (308) then Sanandaj (141) and 80 cases were selected in Ilam. Total numbers of General Dental Practitioners in these cities are as follows: 426 General Dental Practitioners in Kermanshah, 206 in Sanandaj and 113 in Ilam. We sampled 70% of them, on average. We excluded specialists, and only General Dental Practitioners were included.

We defined the socioeconomic status of the area based on the opinion of the local people. Three main categories were affluent areas, middle and disadvantage areas. The data were collected by using self-administrated checklist that included demographic information and items about the RD application. Data on frequency of RD usage and the associated reason for use or not, experience of aspiration the materials by

the client, availability of the instruments requires for management of aspiration in the office, their knowledge in managing the unlike aspiration case were collected.

Results

Five hundred and eighteen General Dental Practitioners entered in the study (response rate: 98.7%). Mean age was 39.91 (standard deviation: 6.21) and 63.3% were male. More than 60.0% were graduated from the public universities across Iran. Around 42.0% of the General Dental Practitioners were working for 5-10 years. About 61.8% of respondents worked in affluent areas, and only 17.4% were in low economic area. The basic characteristics of the study population are presented in table 1.

Table 1. Basic characteristics of the dentists participating in the study

Variable	Frequency (%)
Sex	
Male	328 (63.3)
Female	190 (36.7)
University	
Public	313 (60.4)
Azad	99 (19.1)
Foreign	106 (20.5)
Location of clinic	
Affluent	320 (61.8)
Middle	108 (20.8)
Disadvantage	90 (17.4)
Carrier length (year)	
5 or less	131 (25.3)
5-10	216 (41.7)
10 or more	171 (33.0)

All the study population reported that they had been taught about RD in the University; however, only one of them was a regular RD user in the case of composite and amalgam restoration. The prevalence of RD application among General Dental Practitioner was 0.2% (confidence interval 95%: 0.196-0.204). The solo General Dental Practitioner, who applies RD, was a 45 aged with more than 10 years working experience. RD instrument was existed in around 7% of

cases. The main reason of the General Dental Practitioner to avoid RD application was supposing it is time-consuming procedure and causing patients stress (58.9%).

More than 90% of the General Dental Practitioners did not report any case of aspiration. Although, all the General Dental Practitioners were taught on the management of the emergency cases more than 10.0% of them had none of the requiring equipment. Emergency drugs were the only available equipment for the management of emergency cases (Table 2).

Discussion

Our study showed that only 1 (0.2%) out of 518 General Dental Practitioners participated in survey applies RD during dental procedures and 99.8% have never used RD, which is higher

than all studies done before such as the one done in USA,⁹ Nigeria,¹¹ United Kingdom,¹² Saudi Arabia,⁷ Cameroun,¹³ New Zealand,¹⁴ Czech¹⁵ and Denmark¹⁶ whereas our sample size was bigger than the ones in Cameroun-33,¹³ Nigeria-100¹¹ and Czech-450.¹⁵

All respondents reported being taught to apply RD during undergraduate period in both types of dental colleges (Public, Azad Universities) and even the ones graduated from universities in foreign countries, but in study by Kapitan and Sustova¹⁵ only 32 of respondents received RD application training.

The percentage of regular RD users (0.2%) indicates that almost all General Dental Practitioners disregard using RD due to different reasons, which is similar with the result of the study by Mala et al.¹⁶ who showed that 26.0% of students reported that

Table 2. Data on RD application among dentists

Variable	Frequency (%)
Being taught at the university	
Yes	518 (100)
No	0 (0.0)
Existing RD instrument in the office	
Yes	34 (6.6)
No	484 (93.4)
Use of RD	
Yes	1 (0.2)
No	517 (99.8)
Reasons for not using	
Patients stress and uncomfortable	62 (12.0)
Time consuming	147 (28.5)
Patients stress and uncomfortable and time consuming	304 (58.9)
Other reasons	3 (0.6)
Aspiration occurrence	
Yes	41 (7.9)
No	477 (92.1)
Being taught for the management of the aspiration case	
Yes	518 (100)
No	0 (0.0)
Existing equipments in the case of emergency	
Yes	458 (88.4)
No	60 (11.6)
Type of equipments in the case of emergency	
Just laryngoscope	0 (0.0)
Just emergency drugs	445 (97.4)
Either laryngoscope and emergency drugs	12 (2.6)

RD: Rubber dam

their RD usage would have decreased when starting their private practice.

An inverse association between working experience and application of RD is stated by Kapitan and Sustova¹⁵ and Peciuliene et al.,¹⁷ however Jenkins et al.¹⁸ found a positive association. In this study as the cases that uses the RD was so rare, despite a relatively large sample size this result in the lack of statistical power to study the associated factors. National studies to evaluate factors influencing General Dental Practitioners to apply RD are recommended.

The most common reasons for avoiding RD placement by our respondents were being time consuming the RD placement and stressing the patient, which are accordance with studies done by Ahmad¹⁹ and Filipović et al.²⁰ this finding is due to overestimating time by General Dental Practitioner while if aspiration occurs they would need more and more time to stable the situation and save their patient.

Conclusion

Considering the effect of RD application on

the dental procedures such as better visibility, providing a drier field, increasing patient comfort and preventing infection it is necessary to emphasis more on its application.^{1,2} Despite these advantages RD application is not recognized as a routine, and common method of isolation during dental procedures even root canal therapy by Iranian General Dental Practitioners. Their main reason is time-consuming and patient discomfort. It is needed to re-educate them and provide an opportunity to modify their attitude when they finished their course in the university.

Conflict of Interests

Authors have no conflict of interest.

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References

1. Karaouzas L, Kim YE, Boynton JR, Jr. Rubber dam isolation in pediatric patients: a review. *J Mich Dent Assoc* 2012; 94(1): 34-7.
2. Bruce WS, Sharon C. Practical tips for the dental assistant to simplify the process for dry field isolation. *AEGIS Communications* 2011; 7(3): 22-6.
3. The Dentists Insurance Company. Rubber Dam It [Online]. [cited 2004]; Available from: URL: http://www.thedentists.com/risk_management/articles/rubber_dam_it?prolificView=8.
4. American Association of Endodontists. Dental Dams [Online]. [2012 Nov 30]; Available from: URL: http://www.aae.org/uploadedfiles/publications_and_research/guidelines_and_position_statements/dentaladamstatement.pdf.
5. Ammann P, Kolb A, Lussi A, Seemann R. Influence of rubber dam on objective and subjective parameters of stress during dental treatment of children and adolescents - a randomized controlled clinical pilot study. *Int J Paediatr Dent* 2013; 23(2): 110-5.
6. Innes N. Rubber dam use less stressful for children and dentists. *Evid Based Dent* 2012; 13(2): 48.
7. Al-Fouzan KS. A survey of root canal treatment of molar teeth by general dental practitioners in private practice in Saudi Arabia. *Saudi Dent J* 2010; 22(3): 113-7.
8. Al-Omari MA, Al-Dwairi ZN. Compliance with infection control programs in private dental clinics in Jordan. *J Dent Educ* 2005; 69(6): 693-8.
9. Hill EE, Rubel BS. Do dental educators need to improve their approach to teaching rubber dam use? *J Dent Educ* 2008; 72(10): 1177-81.
10. Koch M, Eriksson HG, Axelsson S, Tegelberg A. Effect of educational intervention on adoption of new endodontic technology by general dental practitioners: a questionnaire survey. *Int Endod J* 2009; 42(4): 313-21.
11. Udoeye CI, Jafarzadeh H. Rubber dam use among a subpopulation of Nigerian dentists. *J Oral Sci* 2010; 52(2): 245-9.
12. Lynch CD, McConnell RJ. Attitudes and use of rubber dam by Irish general dental practitioners. *Int Endod J* 2007;

- 40(6): 427-32.
13. Onana J, Ngongang A. Hygiene and methods of decontamination, disinfection and sterilization in dental offices in Yaounde. *Odontostomatol Trop* 2002; 25(97): 45-51. [In French].
 14. Koshy S, Chandler NP. Use of rubber dam and its association with other endodontic procedures in New Zealand. *N Z Dent J* 2002; 98(431): 12-6.
 15. Kapitan M, Sustova Z. The use of rubber dam among Czech dental practitioners. *Acta Medica (Hradec Kralove)* 2011; 54(4): 144-8.
 16. Mala S, Lynch CD, Burke FM, Dummer PM. Attitudes of final year dental students to the use of rubber dam. *Int Endod J* 2009; 42(7): 632-8.
 17. Peciuliene V, Rimkuvienė J, Aleksejuniene J, Haapasalo M, Drukteinis S, Maneliene R. Technical aspects of endodontic treatment procedures among Lithuanian general dental practitioners. *Stomatologija* 2010; 12(2): 42-50.
 18. Jenkins SM, Hayes SJ, Dummer PM. A study of endodontic treatment carried out in dental practice within the UK. *Int Endod J* 2001; 34(1): 16-22.
 19. Ahmad IA. Rubber dam usage for endodontic treatment: a review. *Int Endod J* 2009; 42(11): 963-72.
 20. Filipović J, Jukić S, Miletić I, Pavelić B, Malčić A, Anić I. Patient's attitude to rubber dam use. *Acta Stomatologica Croatica* 2004; 38(4): 319-22.

Evaluation of teeth whitening with application of novel toothpaste containing ozone

Horieh Moosavi DDS¹, Lila Vaziri MD², Omid Rajabi PhD³, Fatemeh Rezaee⁴

Original Article

Abstract

BACKGROUND AND AIM: The aim of this study was to evaluate the effectiveness of different whitening toothpastes, focusing on the experimental ozonated toothpaste.

METHODS: This laboratory study included a sample of 48 sound human molar teeth. Teeth were randomly assigned into four groups according to toothpaste treatment to be evaluated objectively (colorimetric method) and subjectively (visual assessment) (n = 12). Group I: Ozonated toothpaste (experimental); Group II: Non-ozonated toothpaste (experimental); Group III: Aqua fresh whitening triple protection; and Group IV: Nasim (toothpaste without a chemical whitening agent). After tea staining and color assessment, the teeth were subjected to a tooth brushing regime as for 6 weeks, done twice a day, 2 min each time (total: 168 min). Next, color changes were determined after brushing by instrumental and visual methods.

RESULTS: Analysis of variance and the Tukey tests were used for evaluating statistical data ($\alpha = 0.05$). Color change by instrumental index showed that ozonated and aquafresh toothpastes increased teeth whitening; however, the amount color change was not significant ($P > 0.050$). With visual assessment there was a significant difference between mean color change among the four groups ($P = 0.008$).

CONCLUSION: Ozonated toothpaste caused significant whitening changes in discolored teeth from a clinical point of view by visual assessment.

KEYWORDS: Ozone, Toothpaste, Whitening

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People have a strong desire to have white teeth and many patients are dissatisfied with their current tooth color as indicated in a number of recent studies.¹ As a result, nowadays, clinical professional treatments are available to patients in conjunction with daily oral hygiene tools such as various toothpastes meant to remove certain types of dental discoloration. These toothpastes contain chemical or abrasive whitening compounds. There are many methods to improve tooth color, namely tooth bleaching or the removal

and control of extrinsic stain and placement of esthetic restorations.²

The introduction of different formulations of peroxide and their product variety, such as gels, rinses, gums, mouthwash, strips, and coloring agents, are available over the counter in pharmacies, as well as being conveniently available from the internet. They are alternative solutions for at-home dental whitening.³ Tooth color is dependent on the color of dentin and on internal and external absorbed stains.^{4,5} Any change in the structure of enamel, dentin and pulp of a

1- Associate Professor, Dental Materials Research Center, Department of Operative Dentistry, School of Dentistry, Mashhad University of Medical Sciences, Mashhad, Iran

2- General Dentist, Department of Operative Dentistry, School of Dentistry, Mashhad University of Medical Sciences, Mashhad, Iran

3- Associate Professor, Department of Medicinal Chemistry, School of Pharmacy, Mashhad University of Medical Sciences, Mashhad, Iran

4- High School Student, Emam Hussein Institute, Mashhad, Iran

Correspondence to: Horieh Moosavi DDS

Email: moosavih@mums.ac.ir

tooth crown can cause changes in the way light passes through the tooth and hence, result in tooth color changes.⁶

It is very important to determine the essential etiology of tooth discoloration for conducting a successful treatment. Changes in tooth color can be divided into two main groups of internal and external or a combination of both.⁴ The most common reason of external color changes are dark foods, usage of some medications, tobacco use, certain types of bacteria in oral flora and the presence of pits, fissures, cracks or defects in the enamel.^{7,8} Some extrinsic stains that remain on the tooth for a long time become intrinsic. The removal and control of extrinsic stain is possible with toothpaste and in particular, tooth whitening formulations, which typically contain optimized chemical and abrasive ingredients to maximize cleaning.⁹ The whitening effects of chemical ingredients can be observed quickly after 4-7 days, whereas abrasive agents show their influence over a longer period (2-4 weeks).¹⁰

Scientific support, as suggested by demonstrated studies, for ozone therapy presents a potential for an a traumatic, biologically-based treatment for conditions encountered in dental practice and that ozone can be successfully used for lightening the yellowish tinge of tetracycline-stained rat incisors.^{11,12} Hence in this study, special ozonated toothpaste was used in order to whitening teeth. The evaluation of whitening toothpaste on tooth color changes can be measured with a colorimeter, spectrophotometer or by comparison with a vita shade guide under controlled lighting conditions.⁹ According to the best of the authors' knowledge, no one employed in trial an ozonated toothpaste as a teeth whitening agent. The aim of this study was to evaluate the effectiveness of different types of toothpaste products in teeth whitening, with a focus on the experimental ozonated toothpaste by the colorimetric and visual methods.

Methods

This laboratory study was conducted on 48 recently extracted sound human molar teeth under a protocol approved by the Ethics Committee of the Mashhad School of Dentistry, Mashhad University of Medical Sciences, Iran (87892/2009). Formalin solution 10% was used to disinfect the teeth. First, an ultrasonic cleaner and then rubber cup with the prophylaxis paste by low speed handpiece were used for 2 min to remove debris and stains on teeth crown surfaces. Next, all teeth were examined for any cracks and decay due to restorations, crown color change and other possible defects. Then, the roots were cut by a disc from the cemento-enamel junction and good quality clear nail polish was used to seal the crown bottoms and then were mounted in immediate self-cured acrylic (Akro Pars, Iran).

Each sample was mounted in the center of a cylinder and labial surfaces of all teeth were placed toward the outside with about 1 mm of the labial surface remaining out of the acrylic. These cylinders were selected based on the holes' diameter of the artificial tooth brush device so as to be able to place the mounted samples in the holes. Each tooth was immersed separately in cans containing standardized black tea bag (Golestan, Iran Co) solution for 2 weeks using the method described by Sulieman et al.¹³

The tea solution was prepared by boiling 2 g of black tea with 100 ml of distilled water for 5 min and then filtered to remove the tea leaves from the infusion. In order to simulate the oral environment, the samples were kept inside an incubator at 37 °C while being immersed in tea solution. During this time, the tea solution was changed daily. After tea staining, since the purposed was to evaluate tooth whitening in where the toothpaste has been designed to have an effect on the average intrinsic tooth paste color, the teeth were thoroughly polished to remove any traces of surface extrinsic stain. This was then followed by a brushing protocol with the

tested toothpastes.

Teeth were randomly divided into four groups of 12 teeth each as follows: Group I: Ozonated toothpaste (experimental; the peroxide concentration was equivalent to 25-50 mmol/g of H₂O₂), Group II: Non-ozonated toothpaste (control), Group III: Aqua fresh whitening triple protection toothpaste, Group IV: Nasim (toothpaste without any chemical whitening agent). Tooth brushing was done by an electric device (Nemo, Mashhad, Iran). Teeth color measurements were conducted in two stages; first, after tooth staining (Stage T1), and immediately after tooth brushing (Stage T2) with different types of toothpastes. The shade of each tooth was measured by the colorimetric method and visual assessment.

Objective color assessment of samples was done by the colorimeter color eye (XTH, X-rite, Grand Rapids, MI, USA). The surface of each tooth was covered with an acid-resistant nail varnish, leaving a window of approximately 4 mm × 4 mm at the center of the buccal surface exposed. This device was used under the same light conditions and the evaluator held the same position during the two stages for all of the teeth. The samples were completely dried by cotton before colorimetric assessment.

In this study, the standard light source was D65 and the whiteness index was E313. The device was calibrated by the device's enclosed white pill before conducting the color assessment and then the desired sample was placed under the diaphragm at the light source. All the color changes between the two-stages of color assessment were recorded as L* (lightness), a* (redness), and b* (yellowness) axes based on the CIE Lab (Commission International de l'Eclairage) system. An L* value indicates the lightness of tooth samples and the range is from 0 = black to 100 = white, whereas a*, and b* values indicate positions on red/green (+a = red, -a = green) and yellow/blue (+b = yellow, -b = blue) axes, respectively. Total color

difference (ΔE) was calculated by the following formula:

$$\Delta E^2 = \Delta a^2 + \Delta b^2 + \Delta L^2$$

Standard vita shade guide (Vita, Zahnfabrik, Germany) tabs that were arranged from B1 to C4, corresponding to a grade of whitening from 1 to 16 was used. Although this scale is not linear in the truest sense, the changes were treated as though they represented a continuous and approximately linear ranking for the purpose of analysis. A trained evaluator conducted the visual evaluation and repeated measurements consequently 2 times for each tooth in middle of sunny days (10 am). Initially, the teeth were placed on a dark background to simulate the dark oral environment. Next, color assessment was performed under a uniform and constant light environment in the laboratory for all samples that were done in two-stages. Vita color differences were calculated by the following formula:

$$\Delta \text{ Vita shade change} = \text{Vita score (treatment)} - \text{Vita score (baseline)}$$

The ozone used in this study was produced in the pharmacology research laboratory by an American made ozone-generating machine with the ability to produce 13 g of ozone per hour. Due to the unstable properties of ozone, ozone gas was blown into an olive oil tank by a pipe at a speed of 13 g/h to make ozonated olive oil. Then, the olive oil was converted into a gel with full oxidization properties after 48 h periods to be used as toothpaste in group I of this study.

The pH 8.5 of ozonated olive oil was obtained by adding 1 m sodium hydroxide solution and then sodium lauryl sulfate was added to reach a 0.1% concentration. The tooth brushing regimens were performed equally for 6 weeks, twice a day and each time for 2 min. For the artificial brush system, the total period of brushing was equivalent to 168 min. Equal amounts of toothpaste were used for all samples after

every 2 min, fresh toothpaste was placed on the surface of the teeth and the surfaces were kept moist during brushing. When the samples were not in use, they were stored in water and away from light. Immediately after brushing with the four toothpastes, the sample colors were evaluated by colorimetric and visual assessments and data was recorded. One-way analysis of variance (ANOVA) and Tukey tests were used to analysis the color data that were obtained by colorimeter and visual assessments. Significant levels were considered to be $\alpha = 0.05$.

Results

In colorimetric assessment, from one stage to the next, the mean L^* value showed a significant increase (Figure 1).

From Stage I to II the mean a^* value decreased in all groups, except for the non-ozonated toothpaste group; however, this reduction was significant only in the aqua fresh group (Figure 2).

In all groups, except for the non-ozonated toothpaste group, from Stage I to II the mean b^* value decreased and this value was significant in the ozonated and aquafresh dentifrice groups (Figure 3).

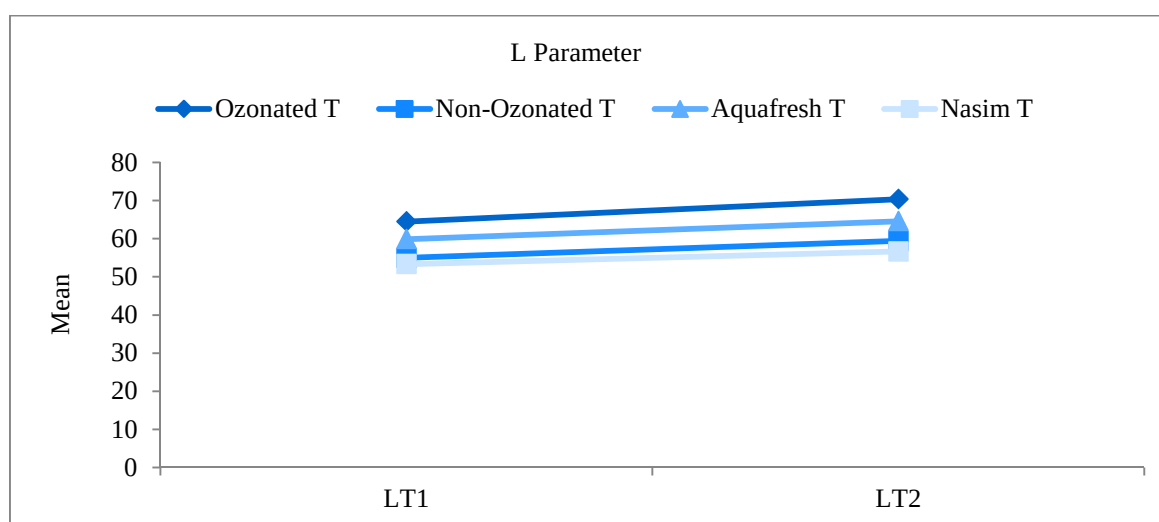


Figure 1. Mean of L parameter changes before and after brushing with different toothpastes

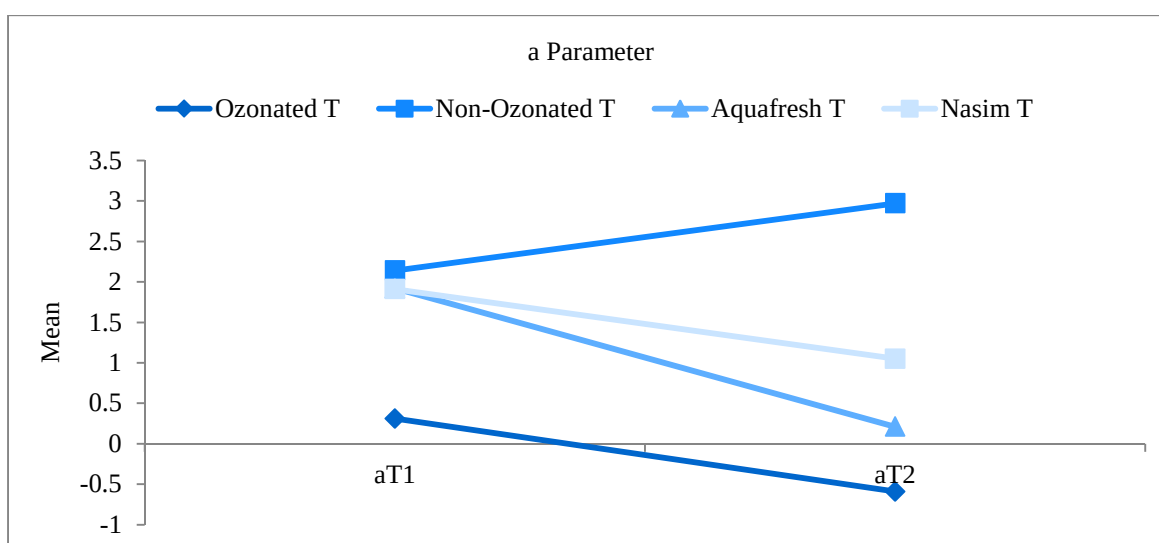


Figure 2. Mean of a^* parameter changes before and after brushing with different toothpastes

Among the four groups that were assessed by the colorimetric method, comparison was done between the color difference (ΔE) using the ANOVA test. Minimum color differences or color change was obvious in Group IV and between Stages I and II. The amount of color change among the two stages of color assessment among the experimental groups was not significant (Table 1).

The test result showed that there was a significant difference between the ranking of mean color change done by visual assessment among the four types of toothpastes ($P = 0.008$). Tukey post-hoc test indicated that there was a significant difference between

Groups I and III and with other groups regarding color changes by visual assessment (Table 2).

Discussion

Various bleaching agents have been introduced to whiten teeth, such as urea, nitric acid (or aqua fortis), chlorine, pyrozone, svpraksyl, hydrogen peroxide, ether, sodium perborate, carbamide peroxide, gly-oxide, proxigel,^{9,14,15} potassium cyanide, oxalic acid, ammonium, sodium peroxide, hydrogen dioxide¹⁶⁻¹⁸ and blue covarine.^{10,18,19} In addition, toothpastes containing carbamide peroxide 10% have also entered the marketed.²⁰

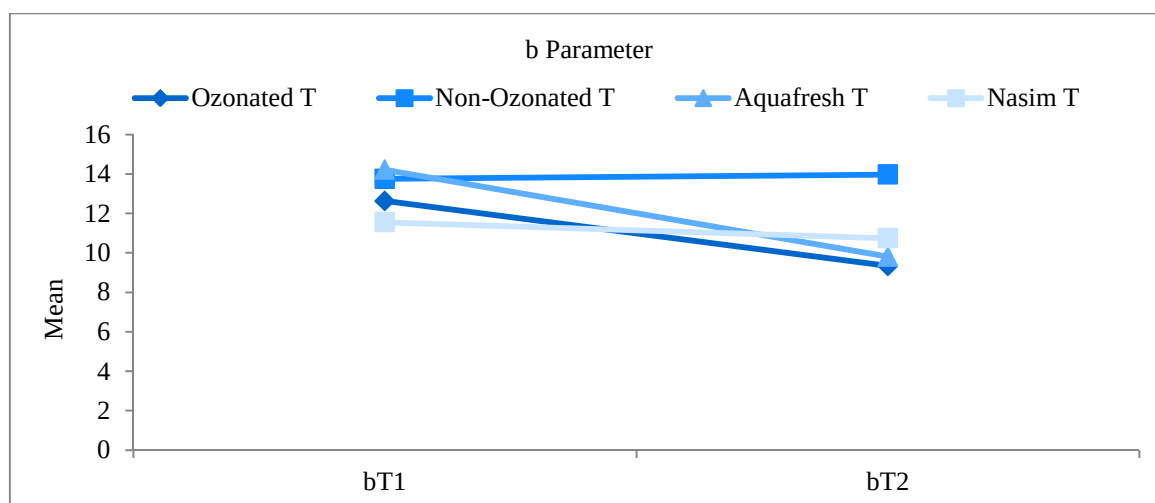


Figure 3. Mean of b* parameter changes before and after brushing with different toothpastes

Table 1. Comparison of mean color change with colorimetric assessment for the experimental toothpastes

Color change between 2 times	Experimental groups	N	Mean	SD	P
ΔE I, II	Ozonated T	12	7.64	2.48	0.073
	Non-ozonated T	12	6.41	3.46	
	Aquafresh T	12	7.81	4.26	
	Nasim T	12	4.57	2.60	

SD: Standard deviation

Table 2. Comparison of mean color change with the vita shade guide assessment for the experimental toothpastes

Color change between 2 times	Experimental groups	N	Mean $\Delta Vita$ (SD)
$\Delta Vita$ I, II	Ozonated T	12	-12.25 (1.48) ^a
	Non-ozonated T	12	-0.92 (1.78) ^b
	Aquafresh T	12	-5.00 (2.34) ^c
	Nasim T	12	-1.50 (1.16) ^b

Values with the same superscript letters are not statistically different; SD: Standard deviation

At present, the use of ozone in dentistry has been recommended for the sterilization of dental cavities, carious lesions, root canals, periodontal pouches and herpetic lesions.^{11,21} Medical grade ozone is a mixture of pure ozone and pure oxygen with the ratio of 0.05-5% ozone and 95.0-99.5% oxygen. Since ozone molecules are instable, ozone should be used immediately after being prepared. After preparation, half of the mixture begins to transform into oxygen after an hour, whereas the other half becomes oxygen; therefore, making it impossible to store ozone for a long time. In order to control the breakdown of ozone to oxygen, a medium with aqueous properties to promote quick conversion or a medium with more viscous properties to retard conversion can be used.²¹⁻²³

The ozone used in this study was produced in Mashhad Pharmacology Research Laboratory by use of an American made ozone-generating machine with the ability to produce 13.5 g of ozone per hour. The ozone gas was blown into the olive oil tank by a pipe and with the speed of 13 g/h. The olive oil was converted to gel with completely oxidized properties after 48 h period. Ozonated olive oil with a pH of 8.5 was obtained by mixing with 1 m sodium hydroxide solution and then adding sodium lauryl sulfate to reach a 0.1% concentration. In this study, the ozone gas was used as a special gel for teeth whitening and its quality was compared with other toothpastes with have different components.

The evaluation impact of these materials to improve color was conducted by the colorimetric test and the measurement of sample colors were conducted based on the Lab coloring system and eye criteria or by ranking. In lab system, the color profile of the object is to be determined in three axis of value, hue and chroma; L^* (lightness), a^* (red-green) and b^* (yellow-blue) respectively. To determine the color difference, the values listed can be calculated between two objects or two various phases and is shown by ΔE criteria.^{24,25}

In the current study, the color of teeth was determined for group classification and baseline color after staining with tea and the next step was to use the different toothpastes to compare their effects on whitening. In examining the color parameters of this study, the mean L^* value increased significantly from baseline to after brushing, hence whiter teeth. Furthermore, a decrease in a^* value is a sign of whitened teeth. The value of a^* decreased in all toothpastes with the exception of non-ozone toothpastes.

The a^* value reduction was significant in Aquafresh toothpaste and more noticeable in ozonated toothpaste groups. Regarding b^* value, a decrease in b^* value is also a sign of whitened teeth and this was observed in all toothpastes, except for the non-ozonated toothpaste. Obviously, the reduction of a^* and b^* values were related to the presence of whitening compounds of the ozonated and Aquafresh brand toothpastes just as in the bleaching agents.

In comparing the effect of using different toothpastes and the difference results, the changes of a^* value was $< b^*$ and L^* values, which was probably related to the properties of color staining material of the tea. Based on the L^* a^* b^* color difference system, it is clinically important for the amount of $\Delta E = 3.3$, because this allows color change to be detectable by any observer. In evaluating the color changes in different times by the colorimetric method, ΔE was determined. We had the maximum mean color change in Aquafresh and ozonated toothpastes. All color changes were clinically visible and were above 3.3; however, these values were not statistically significant.

Thus, half of the null hypothesis of this study was accepted. In determining teeth color ranking by eye, the most mean color ranking changes were in the ozonated toothpaste and the least was in the non-ozonated one. There was a significant difference between mean color changes visually evaluated in the four types of

toothpaste. Therefore, the second half of the null hypothesis was rejected. It was determined that there was a significant difference between the color ranking changes between ozonated and aquafresh with other toothpastes. The average teeth color ranking change was brighter (12 and 5 score respectively) with the ozonated and aquafresh toothpastes; while, the amount of color lightening in the non-ozonated toothpaste and Nasim brand had almost the same color ranking; about one score. Similar to other studies that used the colorimetric and visual assessment methods, both methods showed visible clinical changes and the obtained data by both methods mostly confirmed each other. However, visual assessment is not as accurate as the colorimetric method.^{2,4,25}

Therefore, ozonated and aquafresh toothpastes caused tooth whitening after 6 weeks of brushing. Based on the obtain results, the role of ozone in the composition of the new toothpaste for bleaching of discoloration with a formulated ozone concentration were confirmed in this study. Ozone, such as the other dental bleaching materials that have already been introduced, is able to assist in removing tooth discoloration probably with the help of its oxidizing agent. Furthermore, the whitening role of ozonated toothpaste cannot be strictly attributed to surface wearing because in the non-ozonated toothpaste group the composition and the application regime was quite similar to ozonated toothpaste. Hence,

the ozone whitening role in this study was confirmed as in similar previous studies.^{12,25}

Considering the mentioned beneficial effects for ozone,^{11,26-29} it is recommended that in future studies the impact of the new ozonated toothpaste on other types of discolorations, other substrates and tooth-colored materials, persistence of its whitening effect, and changes on enamel microstructure in terms of tooth hardness level, wear and mineral content level be investigated. Also, by conducting a clinical trial, the long-term application of ozonated toothpaste, its biological effects and possible complications should be identified and resolved.

Conclusion

With the limitations of the study, it can be concluded that: The added benefit of ozone in toothpaste is that it has a bleaching effect on the teeth, and has some great results. Ozonated toothpaste caused significant whitening changes in discolored teeth in comparison to without ozonated toothpaste.

Conflict of Interests

Authors have no conflict of interest.

Acknowledgments

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References

1. Joiner A. The bleaching of teeth: a review of the literature. *J Dent* 2006; 34(7): 412-9.
2. Joiner A, Philpotts CJ, Ashcroft AT, Laucello M, Salvaderi A. In vitro cleaning, abrasion and fluoride efficacy of a new silica based whitening toothpaste containing blue covarine. *J Dent* 2008; 36(Suppl 1): S32-S37.
3. Polydorou O, Hellwig E, Hahn P. The efficacy of three different in-office bleaching systems and their effect on enamel microhardness. *Oper Dent* 2008; 33(5): 579-86.
4. Meireles SS, Heckmann SS, Leida FL, dos S, I, Della BA, Demarco FF. Efficacy and safety of 10% and 16% carbamide peroxide tooth-whitening gels: a randomized clinical trial. *Oper Dent* 2008; 33(6): 606-12.
5. ten Bosch JJ, Coops JC. Tooth color and reflectance as related to light scattering and enamel hardness. *J Dent Res* 1995; 74(1): 374-80.
6. Joiner A, Jones NM, Raven SJ. Investigation of Factors Influencing Stain Formation Utilizing an in Situ Model.

- Advances in Dental Research 1995; 9(4): 471-6.
7. Watts A, Addy M. Tooth discolouration and staining: a review of the literature. *Br Dent J* 2001; 190(6): 309-16.
 8. Dayan D, Heifferman A, Gorski M, Begleiter A. Tooth discoloration--extrinsic and intrinsic factors. *Quintessence Int Dent Dig* 1983; 14(2): 195-9.
 9. Joiner A. Whitening toothpastes: a review of the literature. *J Dent* 2010; 38(Suppl 2): e17-e24.
 10. Collins LZ, Naeeni M, Platten SM. Instant tooth whitening from a silica toothpaste containing blue covarine. *J Dent* 2008; 36(Suppl 1): S21-S25.
 11. Nogales CG, Ferrari PH, Kantorovich EO, Lage-Marques JL. Ozone therapy in medicine and dentistry. *J Contemp Dent Pract* 2008; 9(4): 75-84.
 12. Tessier J, Rodriguez PN, Lifshitz F, Friedman SM, Lanata EJ. The use of ozone to lighten teeth. An experimental study. *Acta Odontol Latinoam* 2010; 23(2): 84-9.
 13. Sulieman M, Addy M, Rees JS. Development and evaluation of a method in vitro to study the effectiveness of tooth bleaching. *J Dent* 2003; 31(6): 415-22.
 14. Viscio D, Gaffar A, Fakhry-Smith S, Xu T. Present and future technologies of tooth whitening. *Compend Contin Educ Dent Suppl* 2000; (28): S36-S43.
 15. Haywood VB. Bleaching of vital and nonvital teeth. *Curr Opin Dent* 1992; 2: 142-9.
 16. Tredwin CJ, Naik S, Lewis NJ, Scully C. Hydrogen peroxide tooth-whitening (bleaching) products: review of adverse effects and safety issues. *Br Dent J* 2006; 200(7): 371-6.
 17. Tsubura S. Clinical evaluation of three months' nightguard vital bleaching on tetracycline-stained teeth using Polanight 10% carbamide gel: 2-year follow-up study. *Odontology* 2010; 98(2): 134-8.
 18. Ulukapi H. Effect of different bleaching techniques on enamel surface microhardness. *Quintessence Int* 2007; 38(4): e201-e205.
 19. Ashcroft AT, Cox TF, Joiner A, Laucello M, Philpotts CJ, Spradbery PS, et al. Evaluation of a new silica whitening toothpaste containing blue covarine on the colour of anterior restoration materials in vitro. *J Dent* 2008; 36(Suppl 1): S26-S31.
 20. Heymann HO, Swift EJ, Jr., Bayne SC, May KN, Jr., Wilder AD, Jr., Mann GB, et al. Clinical evaluation of two carbamide peroxide tooth-whitening agents. *Compend Contin Educ Dent* 1998; 19(4): 359-6, 369.
 21. Loncar B, Mravak SM, Matosevic D, Tarle Z. Ozone application in dentistry. *Arch Med Res* 2009; 40(2): 136-7.
 22. Bocci V, Zanardi I, Travagli V. Oxygen/ozone as a medical gas mixture. A critical evaluation of the various methods clarifies positive and negative aspects. *Med Gas Res* 2011; 1(1): 6.
 23. León OS, Menéndez S, Merino N, Castillo R, Sam S, Pérez L, et al. Ozone oxidative preconditioning: a protection against cellular damage by free radicals. *Mediators Inflamm* 1998; 7(4): 289-94.
 24. Bazzi JZ, Bindo MJ, Rached RN, Mazur RF, Vieira S, de Souza EM. The effect of at-home bleaching and toothbrushing on removal of coffee and cigarette smoke stains and color stability of enamel. *J Am Dent Assoc* 2012; 143(5): e1-e7.
 25. Ley M, Wagner T, Bizhang M. The effect of different fluoridation methods on the red wine staining potential on intensively bleached enamel in vitro. *Am J Dent* 2006; 19(2): 80-4.
 26. Manton DJ, Bhide R, Hopcraft MS, Reynolds EC. Effect of ozone and Tooth Mousse on the efficacy of peroxide bleaching. *Aust Dent J* 2008; 53(2): 128-32.
 27. Bezirtzoglou E, Cretoiu SM, Moldoveanu M, Alexopoulos A, Lazar V, Nakou M. A quantitative approach to the effectiveness of ozone against microbiota organisms colonizing toothbrushes. *J Dent* 2008; 36(8): 600-5.
 28. Fagrell TG, Dietz W, Lingstrom P, Steiniger F, Noren JG. Effect of ozone treatment on different cariogenic microorganisms in vitro. *Swed Dent J* 2008; 32(3): 139-47.
 29. Huth KC, Jakob FM, Saugel B, Cappello C, Paschos E, Hollweck R, et al. Effect of ozone on oral cells compared with established antimicrobials. *Eur J Oral Sci* 2006; 114(5): 435-40.

Knowledge of physical education teachers' toward tooth avulsion in Tehran, Iran

Jafar Panahi MSc¹, Mohammad Reza Havasian MSc¹,
Mohammad Ali Roozegar DMD, MS²

Original Article

Abstract

BACKGROUND AND AIM: Teeth are always faced with different traumas and all those traumas, which cause teeth to exit their sockets, are classified as avulsion. Avulsion most commonly occurs in 7-11 year olds. If sports tutors have enough information regarding replantation, they could play a significant role in prognosis of treatment. The purpose of this study was to assess physical education teachers' level of knowledge regarding avulsion of teeth in Tehran's Primary Schools, Iran, in 2012.

METHODS: This was a cross-sectional study which used a questionnaire consisting three parts including 21 questions. The first part was about demographic information; the second part was about traumatic lesion to tooth and the third part was about process of avulsed teeth protection. The questionnaire was completed by a random sample of volunteer sports tutors in Tehran Primary Schools. Collected data were analyzed using the SPSS software using the chi-square test.

RESULTS: About 160 subjects participated, 67.1% of the tutors had mid-level knowledge regarding the second part of the questionnaire, and 64.1% had a low level of knowledge regarding the third part. In relation to the second and third part of the questionnaire, a statistically significant relationship was observed between the age of the tutors and their level of information ($P < 0.050$). There was also a significant relationship between the level of information about the third section of the survey and the amount of experience the tutors had about avulsion ($P < 0.050$).

CONCLUSION: The results indicate a low level of knowledge in sports tutors in dealing with avulsed teeth and suitable media for transferring the teeth. Suitable educational programs for these tutors could be very useful in enhancing their knowledge and pertaining traumatized teeth.

KEYWORDS: Dental Trauma, Knowledge, Physical Education Teachers, Iran

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All traumatic experiences which lead to the separation of a tooth from the alveolar socket are defined as avulsion¹ that often occurs in the central maxillary teeth.² In an avulsion the periodontal membrane is separated, half of which is attached to the root and the other half is attached to the alveolar socket.³ Studies have shown that 10% of the population have experienced tooth traumas during their childhood, and 16.1% of them are faced with avulsed teeth.^{4,5}

One of the main etiological factors for

avulsion in a permanent dentition is sports activities and in the deciduous dentition is falling on hard objects.¹ Owing to insufficient information regarding management of this matter in non-specialized personnel, when such instances occurs suitable treatment is not readily given.⁶ Healing after the incident depends highly on the immediate actions and procedures, which carried out to protect the avulsed teeth.^{7,8} Replantation was first mentioned in the 11th century by Abu Classis as a means for replacing a tooth that had come out of its socket.^{9,10}

1- Student of Dentistry, Department of Periodontics, School of Dentistry, Ilam University of Medical sciences, Ilam, Iran

2- Assistant Professor, Department of Periodontics, School of Dentistry, Ilam University of Medical Sciences, Ilam, Iran

Correspondence to: Mohamad Ali Roozegar DMD, MS

Email: roozegar2015@gmail.com

Avulsion mainly occurs in 7-11 year olds whose central incisors are starting to erupt, and the prognosis of replanting the avulsed tooth depends highly on preoperative factors such as time duration being out of oral cavity, substances applied to root surface and transferring media of the teeth, before the final treatment by dentists.¹¹ So far, many different studies are done about the level of knowledge of the dentist, athletic trainers and schools teachers in rural and urban areas in a different region of the world and also in Iran.¹²⁻¹⁵ These studies can be effective for planning in this field. The best treatment for avulsion is immediate replantation within 15 min.^{2,10} Due to the fact that most incidents occur during school time^{16,17} and 13-39% off all dental traumas occurs during sports period,¹⁸ it is important to evaluate the level of information that tutors, especially sports tutors have regarding this matter. If these individuals have a scientific and practical approach in dealing with avulsion incidents, the avulsed tooth can be saved more successfully, which could results from losing a tooth, in the future. Therefore, the aim of this study was to assess the knowledge of physical education teachers in Tehran, Iran, regarding managing of avulsed teeth.

Methods

The study was a cross-sectional investigation across a random sample of public primary schools located in 19 areas of Tehran. Sample size was calculated 160 for a descriptive design, considering previous studies.^{19,20} Participation to the study was on volunteer base after providing information to target group and reassurance of confidentiality of providing information. Data collection was continued to reach the required sample size. The questionnaire was designed using questionnaires in similar studies.^{14,15,20,21} Moreover, the validation was carried out in a panel expert and among 10 experts in the subjects. Cronbach's alpha was calculated ($\alpha = 0.70$) and the questionnaire was

modified after a pilot study among 20 subjects before the main study and their data were excluded from the analysis. The questionnaire completed by participants in the selected schools. As did the questionnaire has three sections, including demographic data (sex, age, work experience, experience of tooth avulsion), in the first part. Information regarding types of traumas to teeth was answered in the second part. The questions included two case of trauma to teeth.

Questions for Case 1 were: "A Maxillary anterior tooth of an 8-year-old girl was broken, but does not lose his consciousness: Is it a milk tooth? What is the most appropriate action for this event? And, the questions for case II (tooth coming out from the alveolar socket) was: "a maxillary anterior tooth of a 13-year-old boy was broken on event, what is the most appropriate for this event? And they had two correct answers. So if both right answers were chosen, the level of information was considered as good level, if one of the right answers was chosen, the level of information was moderate and if no correct answers were given the level of information was considered as poor. The third section of the questions was about the best time for replantation of avulsed teeth, the method of replantation, the method of cleaning the avulsed root surface and transferring media of the teeth. In this section, there were nine questions and each correct answer was considered one score.

The scores accumulated for each respondent, and they were categorized to three groups. Scores 0-3 were classified as low information, those with a score of 4-6 had moderate information and those who scored 6-9 had a good level of information. The participants were categorized into two groups on the basis of their age for analyzing data. The data were analyzed using the SPSS software (version 18, SPSS Inc., Chicago, USA, IL) using the chi-square method.

Results

The data were analyzed for 156 subjects

(86 male and 70 female) with response rate of 99%. The mean age of the subjects was 32 years, and the respondents have a mean of 8 years work experiences. Only 23% of teachers had experiences of a case of trauma to children teeth. Majority (67.1%) of teachers had moderate information regarding the second part of the questions, and 64.1% had a low level of information regarding questions in the third part (Figure 1). The chosen best materials for rinsing an avulsed tooth by the tutors were normal saline with 29% and alcohol with 19% consecutively (Figure 2). There was no significant difference between male and female teachers in relation to the second and

third set of questions, ($P > 0.050$). Regarding relationship between age and awareness in the second and third parts of questions a statistically significant difference was observed ($P < 0.050$) (Table 1). This study indicated a positive effect on the level of knowledge about avulsion among people older than 40 years. There was also a statistically significant relationship between the level of knowledge regarding the third group of questions and having experience with avulsed teeth ($P < 0.050$) (Table 2). There was no significant relation between the years of work experiences and the level of awareness in the second and third group of questions ($P > 0.050$).

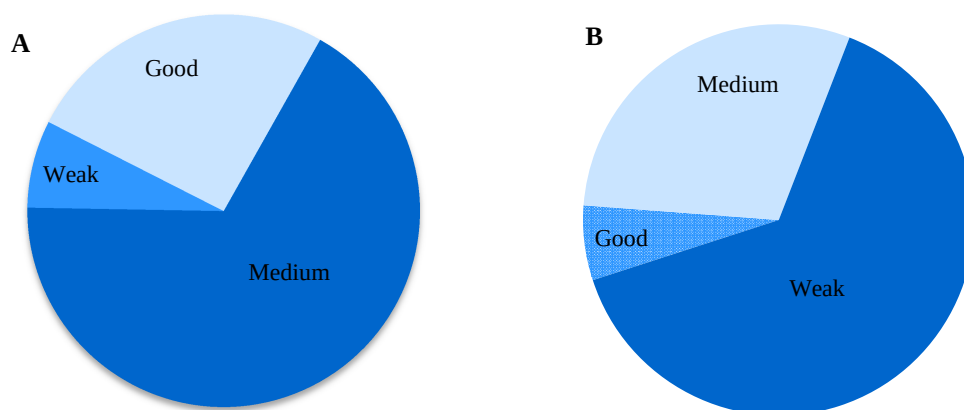


Figure 1. Level of participants' knowledge about type of dental trauma and management of avulsed teeth, A: Second part questions and B: Third part questions

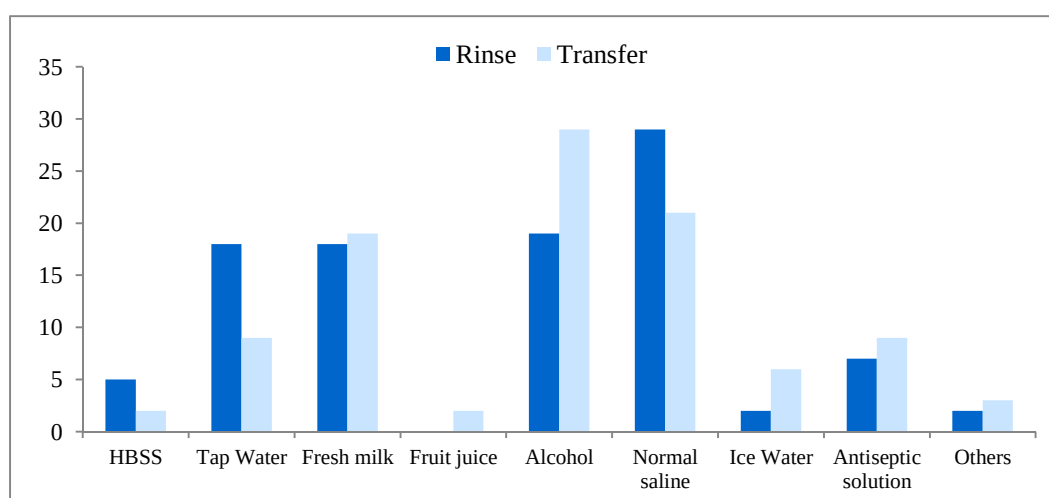


Figure 2. The best substance chosen by the tutors for protecting an avulsed tooth
HBSS: Hanks balanced salt solution

Table 1. Relationship between age and level of participants' knowledge about type of dental trauma and management of avulsed teeth

Questions	Knowledge of people			P
	Weak	Moderate	Good	
Questions regarding type of trauma				
Under 40 years old	5.5	63.6	30.9	0.018*
Above 40 years old	20.0	80.0	-	
Questions regarding management of avulsed teeth				
Under 40 years old	61.8	29.1	9.1	0.167
Above 40 years old	86.7	13.3	-	

*Significant

Table 2. Relationship between experience of avulsion and level of participants' knowledge about type of dental trauma and management of avulsed teeth

Questions	Knowledge of people (%)			P
	Weak	Moderate	Good	
Questions regarding type of trauma				
With experience of avulsion	4.8	61.9	33.3	0.440
Without experience of avulsion	10.2	69.4	20.4	
Questions regarding management of avulsed teeth				
With experience of avulsion	47.6	47.6	4.8	0.023*
Without experience of avulsion	75.5	16.3	8.2	

*Significant

Discussion

It has been reported that replanted teeth could survive around 40 years and they can last from a few decades to a lifetime, and the average lasting period is around 5-10 years.^{22,23} Nevertheless, replantation (intentional replantation) after avulsion has received much attention²⁴ in recent years, and it is important to prevent spending much money and time on lost teeth. The physical education teachers are one of the first people who are confronting traumatized teeth, and their role is important in preserving these teeth. Therefore, the purpose of this study was to help the matter by assessing the teacher's knowledge. In fact, if the tooth is not replanted within 5 min, it should be kept in a storage media in order to maintain the vitality of the periodontal ligaments.^{7,25}

The study results showed there is some shortness in the knowledge of physical education teachers regarding traumatized teeth. In the study Newman and Crawford carried out in England to analyze the level of awareness of sports instructors, based on 66 candidates from this group, 43% had an adequate level of information regarding

crown fractures.²⁶ As the study results showed the level of adequate knowledge concerning how to deal with avulsed teeth in sports teachers in Tehran included 67.1% of the sample, which higher than the report of Kaur et al.'s study.¹³

In study of Moieni et al. the level of knowledge of female sport instructors regarding avulsed teeth, has been reported 17.1% with low level of knowledge⁹ whereas in this study, only 8.6% of sports instructors had a low level of awareness. This difference is probably due to the lack of educational programs for target group, which leads to lack of knowledge in how to deal with such situations. In another study aimed at evaluating the level of awareness in dealing with avulsed in teeth in male sport instructors, the same results as above were shown.¹⁴ Furthermore in study of Sharifi et al. in analyzing the level of knowledge of primary school teachers in Kermanshah, Iran, in dealing with avulsed teeth was not enough which is in line with the results of this study.²⁷

In the study carried out by Vahhabi and Khoshsar on hygiene instructors in Tehran, 12.5% had medium awareness, 87.5% had a

good level of awareness and none had a low level of awareness. This difference in results is probably due to the different population being studied in this study¹⁵ and variation in the questions of the survey. Comparing the level of knowledge between male and female tutors, there was no significant difference and this goes to show that demographic factors have no effect on how much information the tutors have and it has also been reported in similar studies.^{17,28} The significant relation between the score of the tutors in the second and third section questions and their age in such a way showed an increase in age could likely increase in their knowledge and ability in dealing with avulsion. This finding is similar to study of Young et al. in Hong Kong.²⁹ Hence, it showed how the experience can be the effect of on the knowledge of teachers. When comparing the knowledge of teachers in relation to avulsion, based on their experience in the past with this incident, the results showed that those with experience in dealing with avulsion have more information those without it. These results is in line with study of Fux-Noy et al. results,³⁰ but differ from results of Moieni et al.⁹ and this may be due to the fact that less of population in that study had experience in dealing with this trauma.

Normal saline and alcohol were the most commonly chosen substances by teachers for rinsing and transferring the avulsed tooth. However, Hanks balanced salt solution (HBSS) is the best media available for storage of teeth after avulsion, but, unfortunately, is sparsely available in health centers in Iran.^{6,31}

Milk has a suitable pH and osmotic pressure and can keep the tooth alive and free of infection.³² Approximately, 19% of people in this study chose milk as the rinsing and transferring media, but in study of Blakyttny et al.³³ in England, 60.2% and in study of Touré et al.³⁴ in Senegal 21.95% of people choose milk as transferring media.

However, the study results confirmed previous studies findings, but it need to assess the teacher's knowledge in periodical surveys at national levels due to supply of information from different sources specially mass media nowadays. There is also a big variation across the country, which the participated sample could not be a representative of the whole country.

Conclusion

The results of this study confirmed a low level of information among teachers in dealing with avulsion and about suitable storage media. Therefore, educational courses to promote the level of their knowledge could be very helpful, and it is recommended that this course be added to their academic teaching course or even professional education courses.

Conflict of Interests

Authors have no conflict of interest.

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References

1. Andreasen JO, Andreasen FM, Andersson L. Textbook and color atlas of traumatic injuries to the teeth. Copenhagen, Denmark: Denmark; 1994. p. 683-416.
2. Andreasen J, Andreasen FM. Traumatic injuries to the teeth. In: Andreasen J, Andreasen FM, Andersson L, Editors. Textbook and color atlas of traumatic injuries to the teeth. 4th ed. Hoboken, NJ: Wiley; 2007.
3. Tsukiboshi M. Treatment planning for traumatized teeth. London, UK: Quintessence Publishing Company; 2000. p. 11-5.
4. Pavlek DI, Radtke PK. Postreplantation management of avulsed teeth: an endodontic literature review. *Gen Dent* 2000; 48(2): 176-81.
5. Petersson EE, Andersson L, Sorensen S. Traumatic oral vs non-oral injuries. *Swed Dent J* 1997; 21(1-2): 55-68.
6. Andreasen JO, Borum MK, Jacobsen HL, Andreasen FM. Replantation of 400 avulsed permanent incisors. 4. Factors

- related to periodontal ligament healing. *Dental Traumatology* 1995; 11(2): 76-89.
7. Flores MT, Andersson L, Andreasen JO, Bakland LK, Malmgren B, Barnett F, et al. Guidelines for the management of traumatic dental injuries. II. Avulsion of permanent teeth. *Dent Traumatol* 2007; 23(3): 130-6.
 8. Andersson L, Andreasen JO, Day P, Heithersay G, Trope M, Diangelis AJ, et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 2. Avulsion of permanent teeth. *Dent Traumatol* 2012; 28(2): 88-96.
 9. Moieni P, Kharazi Fard M, Anaraki R, Sadra E. Evaluation of martial arts instructor knowledge about tooth avulsion and associated factors in stadiums of Tehran in 2009. *J Res Dent Sci* 2013; 9(4): 219-23. [In Persian].
 10. Addo ME, Parekh S, Moles DR, Roberts GJ. Knowledge of dental trauma first aid (DTFA): the example of avulsed incisors in casualty departments and schools in London. *Br Dent J* 2007; 202(10): E27.
 11. Leung SF. Traumatic dental injuries to the permanent dentition. *Dental Bulletin* 2006; 11(8): 15-7.
 12. Upadhyay S, Rokaya D, Upadhyaya C. Knowledge of emergency management of avulsed teeth among general dentists in Kathmandu. *Kathmandu Univ Med J (KUMJ)* 2012; 10(38): 37-40.
 13. Kaur M, Gupta K, Goyal R, Chaudhary N. Knowledge and attitude of school teachers towards tooth avulsion in rural and urban areas. *International Journal of Scientific Study* 2014; 1(4): 17-20.
 14. Moieni P, Akbar H, Kharazi MJ, Sadra E. Evaluation of martial art masters knowledge about tooth avulsion and associated factors. *Iran J Pediatr Dent* 2012; 7(14): 31-6. [In Persian].
 15. Vahhabi S, Khoshsar R. Evaluation of knowledge of health coaches of Tehran's elementary schools about Dental Trauma emergencies in year 2002-2003 [Thesis]. Islamic Azad University Dental Branch of Tehran 2003. [In Persian].
 16. Mohandas U, Chandan GD. Knowledge, attitude and practice in emergency management of dental injury among physical education teachers: a survey in Bangalore urban schools. *J Indian Soc Pedod Prev Dent* 2009; 27(4): 242-8.
 17. Chan AW, Wong TK, Cheung GS. Lay knowledge of physical education teachers about the emergency management of dental trauma in Hong Kong. *Dent Traumatol* 2001; 17(2): 77-85.
 18. Mukram Ali F, Bhushan P, Inayatullah Khan M, Ustad F. Attitude and knowledge towards tooth avulsion among sports teachers. *Reviews of Progress* 2013; 1(3): 1-6.
 19. Underwood M, Barnett A, Hajioff S. Cluster randomization: a trap for the unwary. *Br J Gen Pract* 1998; 48(428): 1089-90.
 20. Ebrahimi N, Mohaajeri L. Evaluation of the knowledge of health and physical education coaches of Tehran, elementary school in facing with Avulsed teeth in the first half of year 2003 [Thesis]. Tehran, Iran: Islamic Azad University Dental Branch of Tehran 2003. [In Persian].
 21. Azari M, Nakhjavani B. Assessment of knowledge of coaches of care centers for mentally retarded children under the supervision of Tehran welfare Organization about how to deal with Avulsed teeth in year 2004-2005 [Thesis]. Tehran, Iran: Islamic Azad University Dental Branch of Tehran 2005. [In Persian].
 22. Cohen S, Burns RC. *Pathways of the Pulp*. 6th ed. St. Louis, Mosby; 1994. p. 375-86.
 23. Andersson L, Bodin I, Sorensen S. Progression of root resorption following replantation of human teeth after extended extraoral storage. *Endod Dent Traumatol* 1989; 5(1): 38-47.
 24. Gutmann J, Harrison JW. *Surgical endodontics*. Boston, Massachusetts: Blackwell Scientific Publications; 1991.
 25. Sigalas E, Regan JD, Kramer PR, Witherspoon DE, Opperman LA. Survival of human periodontal ligament cells in media proposed for transport of avulsed teeth. *Dent Traumatol* 2004; 20(1): 21-8.
 26. Newman LJ, Crawford PJ. Dental injuries: "first aid" knowledge of Southampton teachers of physical education. *Endod Dent Traumatol* 1991; 7(6): 255-8.
 27. Sharifi R, Mohtadizadeh A, Nourbakhsh R, Razavi Satvati SA. Knowledge of primary school teachers about the management of dental trauma in Kermanshah, 2012. *Educ Res Med Sci* 2014; 2(3): 28-30.
 28. Al-Jundi SH, Al-Waeili H, Khairallah K. Knowledge and attitude of Jordanian school health teachers with regards to emergency management of dental trauma. *Dent Traumatol* 2005; 21(4): 183-7.
 29. Young C, Wong KY, Cheung LK. A survey on Hong Kong secondary school students' knowledge of emergency management of dental trauma. *PLoS ONE* 2014; 9(1): e84406.
 30. Fux-Noy A, Sarnat H, Amir E. Knowledge of elementary school teachers in Tel-Aviv, Israel, regarding emergency care of dental injuries. *Dent Traumatol* 2011; 27(4): 252-6.
 31. Trope M. Protocol for treating the avulsed tooth. *J Calif Dent Assoc* 1996; 24(3): 43-9.
 32. Peterson LJ. *Contemporary oral and maxillofacial surgery*. 3rd ed. St. Louis: Mosby; 1998. p. 560-80.
 33. Blakytyn C, Surbutis C, Thomas A, Hunter ML. Avulsed permanent incisors: knowledge and attitudes of primary school teachers with regard to emergency management. *Int J Paediatr Dent* 2001; 11(5): 327-32.
 34. Touré B, Benoist FL, Faye B, Kane AW, Kaadioui S. Primary school teachers' knowledge regarding emergency management of avulsed permanent incisors. *J Dent (Tehran)* 2011; 8(3): 117-22.

A cross-sectional survey on the relationship between some biologic maternal characteristics and dental status of pregnant women in Isfahan, Iran, in 2012

Maryam Allameh DDS¹, Heidar Khademi DDS, MS², Masoomeh Eslami DDS³

Original Article

Abstract

BACKGROUND AND AIM: Dental caries is an infectious and transmissible disease. The interplay between pregnancy and oral health is obvious, but the risk factors are not known yet. The objective of this study was to determine the relationship between some selected risk factors in pregnancy and the dental status.

METHODS: The study sample consisted of 377 pregnant women attended for their routine antenatal visit at public hospitals in Esfahan city in 2012. Data, including age, number of previous deliveries, mean of pregnancy interval and gestational age were determined using interviewer-filled questionnaires. Oral health examination was performed by assessing mean number of decayed, missed and filled teeth (DMFT), according to the World Health Organization (WHO) criteria. Spearman analysis was used to identify maternal characteristics correlated to dental status.

RESULTS: The mean ($\pm$ standard deviation) DMFT among antenatal women were 10.6 ± 4.21 , with 4.10 ± 2.23 decayed teeth, 4.15 ± 2.12 missed teeth, and 2.32 ± 1.46 filled teeth. No significant difference of DMFT means were observed among the 3 gestation periods ($P > 0.05$). Moreover, the Spearman correlation test showed that the trend is for the DMFT to increase with age and the number of deliveries ($P < 0.05$).

CONCLUSION: Results of the present study showed that the age of mother and number of previous deliveries are the risk factors for increasing DMFT. The importance of dental care and decreasing risk factors before and during pregnancy must be educated widely among both the public and providers.

KEYWORDS: Decayed, Missed and Filled Teeth, Iran, Pregnant Women, Risk Factors

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Tooth decay is an infectious, transmissible disease commonly affected from biological, behavioral and socio-economic factors. In industrialized countries, it involves about 40-50% of adults.^{1,2} Up to know many preventive approaches have been examined in different target populations to reduce dental decay in the whole community. For example, USA office of disease prevention and health promotion in 2010 established objectives to reduce disparities among preschool children.³ However, programs aimed at reducing

disparities by focusing exclusively on children have encountered several barriers such as negative interactions with dentists and problems with access to dental care.^{4,5}

Gradually health care providers realized that to promote community oral health the preventive oral health schedules should be started earlier before the child is born.³ In this respect it is suspected that whenever oral health status in mothers is enhanced, both mother and child would experience benefits.⁶ Some of the examples of mothers' oral health influences on oral health of their children are

1- MSc Student, Department of Oral Medicine, School of Dentistry, Isfahan University of Medical Sciences, Isfahan, Iran

2- Associate Professor, Department of Oral Medicine, School of Dentistry, Isfahan University of Medical Sciences, Isfahan, Iran

3- Dentist, Private Practice, Isfahan, Iran

Correspondence to: Maryam Allameh DDS

Email: maryamallameh14@yahoo.com

as following: (1) Mothers with high caries levels can transmit tooth decay pathogens such as *Streptococcus mutans* to their children by saliva.^{7,8} (2) previous investigations show that there is a relationship between mother's oral hygiene and her pursuit for better oral health of her child.^{9,10} This concept is not new, and has led to the formulation of policies to improve maternal health;^{11,12} these programs mainly focus on pregnancy period of a woman life. However, recently Massachusetts extended dental care services to mothers from pregnancy to 3 years after the baby is born.¹³

Pregnancy is a cornerstone of a mother's life; in this time women may be more motivated to make healthy changes. Physicians can comment on their oral health issues, reduce the risk of mothers and so childhood caries through oral disease prevention, diagnosis, early management, and dental referral.¹⁴ Although pregnancy in itself has never been clearly associated with an increased incidence of dental caries, oral health indices in this period are higher than the general population.¹⁵⁻¹⁸ This may be due to financial, personal, and social barriers,¹⁹⁻²¹ less desire to receive dental services in this period (may be as a result of concerns for fetal safety during dental treatment from both practitioner and mother), or may be as a result of intraoral biologic changes such as hormonal imbalance, low oral cavity pH caused by frequent refluxes.¹⁵ To offer a comprehensive preventive program for oral health promotion, it is important to determine, which factors exactly place pregnant women at higher risk for dental infections. Although many studies have assessed social or behavioral risk indicators in mothers' oral health,²²⁻²⁸ investigations to denote biologic risk factors are scarce.

In a study evaluating the correlation of pregnancy, caries and gingivitis the authors reported an increase in caries intensity with advancing age and a higher rate of caries in women who delivered 1 or 2 times than those

who had no child.²⁹ In another research conducted by Radnai et al.³⁰ no significant correlation was founded between the number of previous pregnancy and the incidence of caries.

In contrast to Jago et al.³¹ and Kumar and Samelson¹² investigations, Vergnes et al.¹⁶ demonstrated a higher caries prevalence in the lower aged pregnant population. Furthermore, a significant correlation was detected between the trimester of pregnancy (gestational age) and the rate of missing teeth and decayed, missed and filled teeth (DMFT) in Kumar and Samelson study.¹²

The purpose of the present study was to evaluate the oral health status of antenatal women referred to governmental hospitals in Esfahan and to investigate its relationship with some of the maternal biologic risk indicators.

Methods

The present study involved a cross-sectional, population-based survey of a sample of 377 Isfahanian pregnant mothers attended for their routine antenatal visits from September until December in 2012 at public hospitals in Isfahan, Iran. The selection criteria for the participants of the present study were as follow: more than 16 years of age; do not have any mental or physical disease; have not received any medical treatment in the current pregnancy; being a moderate economic status (detected by directly asking family income and accessibility to health care services). They were all informed of the scope of the study and their written consent was obtained prior to clinical examination.

The survey collected data on maternal characteristics (age, number of pregnancies, pregnancies' intervals, gestational age) using an interviewer-administered pre-tested questionnaire. To assess dental status the DMFT index was measured for each individual as the sum of D + M + F (D = decayed teeth, M = missing teeth, which account for extracted teeth exclusively due to

caries; F = restored teeth only for the reason of caries) by two calibrated professional dentist. Examiners were given instructions to assess carious lesions according to the World Health Organization (WHO).³² The presence of carious lesions was recorded at the surface level of the teeth using sterile dental mirrors and explorers.

Analysis was performed with SPSS software (version 13.5, SPSS Inc., Chicago, IL, USA). Descriptive statistics of mean DMFT in this population were reported as well as cross-tabulations by age of mother, number of pregnancies, pregnancies' intervals and gestational age. Spearman rank correlation coefficient was used to explore any relationship between the variables and DMFT.

Results

Of a total of 377 pregnant women participated

in this study most of them (65.0%) were aged between 20 and 30 years old. More than one-half (55.9%) of pregnant women were in their third trimester while the minority (14.5%) were in their first trimester. The majority of women had experienced at least one birth prior to the index pregnancy, and the mean number of pregnancies in this study group was 1.99. The average of pregnancy intervals was 2.28 years and in up to 40% of cases the interval between this pregnancy and the previous one was below 1 year. Descriptive data about the means of D, M, F and DMFT for each maternal variable are presented in tables 1-4.

The mean DMFT among the whole sample were 10.60 ± 4.50 , with 4.10 ± 2.23 decayed teeth (D); 4.15 ± 2.12 missing teeth (M), and 2.32 ± 1.46 filled teeth (F), indicating that average 10 teeth were affected among pregnant women with at least 4 of these teeth

Table 1. Mean scores of D, M, F, DMFT ($\pm$ SD) according to age of mother

Age range (year)	D	M	F	DMFT
< 20	3.15 ± 1.24	0.57 ± 1.09	1.66 ± 0.55	5.38 ± 2.92
21-30	3.31 ± 1.30	1.34 ± 0.56	2.55 ± 1.93	7.19 ± 3.48
31-40	3.65 ± 1.00	3.35 ± 2.65	3.54 ± 3.00	10.53 ± 4.21
> 40	4.50 ± 1.87	7.00 ± 2.10	3.83 ± 3.37	15.33 ± 5.27

DMFT: Decayed, missed, and filling teeth; D: Decayed; M: Missing; F: Filled; T: Teeth; SD: Standard deviation

Table 2. Mean scores of D, M, F, DMFT ($\pm$ SD) according to mean of pregnancy interval

Mean of pregnancy interval (year)	D	M	F	DMFT
1	3.19 ± 0.93	2.25 ± 2.40	1.66 ± 2.13	7.09 ± 3.97
2	3.97 ± 1.23	2.97 ± 2.96	2.45 ± 1.99	9.37 ± 4.59
3	3.47 ± 1.00	2.06 ± 2.28	3.42 ± 2.88	8.94 ± 4.20
4	3.42 ± 1.21	1.67 ± 1.43	3.04 ± 2.46	8.12 ± 3.27
5	3.13 ± 1.77	2.26 ± 2.12	3.17 ± 2.71	8.56 ± 3.65
6	2.92 ± 0.76	1.54 ± 1.66	4.08 ± 3.45	8.53 ± 4.23
7	3.23 ± 0.83	1.92 ± 1.32	5.23 ± 2.13	10.38 ± 3.06
8	4.11 ± 2.30	1.61 ± 1.50	2.78 ± 3.89	8.50 ± 4.60

DMFT: Decayed, missed, and filling teeth; D: Decayed; M: Missing; F: Filled; T: Teeth; SD: Standard deviation

Table 3. Mean scores of D, M, F, DMFT ($\pm$ SD) according to number of previous deliveries

Number of previous deliveries	D	M	F	DMFT
0	2.00 ± 1.25	2.19 ± 1.24	1.80 ± 2.13	6.00 ± 4.24
1	3.16 ± 1.19	0.81 ± 1.17	2.14 ± 2.86	6.10 ± 3.22
2	3.28 ± 1.36	1.72 ± 1.87	2.71 ± 2.75	8.29 ± 3.46
3	3.77 ± 0.92	3.05 ± 2.48	3.59 ± 2.52	10.40 ± 3.92
4	4.00 ± 1.05	4.70 ± 2.26	2.20 ± 3.68	10.40 ± 3.92
5	4.00 ± 1.05	4.70 ± 2.26	2.20 ± 3.68	10.90 ± 5.27
6	4.00 ± 0.82	6.50 ± 2.52	3.00 ± 3.46	13.50 ± 6.55
7	4.33 ± 0.58	7.67 ± 4.04	4.33 ± 3.90	16.33 ± 7.37

DMFT: Decayed, missed, and filling teeth; D: Decayed; M: Missing; F: Filled; T: Teeth; SD: Standard deviation

Table 4. Mean scores of D, M, F, DMFT ($\pm$ SD) according to gestational age

Gestational age (month)	D	M	F	DMFT
1	2.06 $\pm$ 1.00	1.80 $\pm$ 0.19	1.54 $\pm$ 1.33	5.40 $\pm$ 2.25
2	2.75 $\pm$ 0.50	2.25 $\pm$ 1.26	3.00 $\pm$ 1.83	8.00 $\pm$ 2.44
3	2.82 $\pm$ 1.08	0.82 $\pm$ 1.78	2.55 $\pm$ 1.66	6.18 $\pm$ 2.96
4	3.64 $\pm$ 2.29	1.82 $\pm$ 1.94	2.27 $\pm$ 3.20	7.72 $\pm$ 4.81
5	3.59 $\pm$ 1.84	2.00 $\pm$ 2.20	2.06 $\pm$ 2.88	7.64 $\pm$ 4.49
6	3.48 $\pm$ 1.78	1.00 $\pm$ 1.14	1.71 $\pm$ 2.15	6.19 $\pm$ 3.35
7	3.32 $\pm$ 1.12	1.95 $\pm$ 2.42	2.75 $\pm$ 2.84	8.01 $\pm$ 3.98
8	3.35 $\pm$ 1.22	1.33 $\pm$ 1.70	3.05 $\pm$ 3.24	7.73 $\pm$ 3.98
9	3.38 $\pm$ 1.14	1.70 $\pm$ 2.06	2.55 $\pm$ 2.87	7.61 $\pm$ 4.04

DMFT: Decayed, missed, and filling teeth; D: Decayed; M: Missing; F: Filled; T: Teeth; SD: Standard deviation

having untreated dental caries. On average, among pregnancy months the highest mean of DMFT was related to 7th month; similarly, the highest mean of decayed teeth was in 4th month, the highest average of missing teeth was in 2nd month and in 8th month the average of filled teeth was the most. Nevertheless, table 5 shows there is not any significant relationship between D, M, F and DMFT with gestational age.

As it is demonstrated in table 5, the means of DMFT were correlated with the numbers of previous deliveries: Antenatal women who had experienced more than 3 deliveries, had significantly higher amounts of decayed, missed, filled teeth and DMFT compared with women in their intimate pregnancies ($P < 0.05$). Moreover, there is a significant correlation between F and mean pregnancies' interval. It is also followed from the table that the trend is for DMFT to increase with age: women aged 40 years and more presented a significantly higher number of decayed, missed, filled teeth and mean DMFT.

Discussion

Mean score of DMFT index in this study was

10.60 $\pm$ 4.21 with an average of 4.15 $\pm$ 2.12 for decayed teeth. A similar score was found in the city of Mashhad, Iran;²² where pregnant women had a mean DMF-T index of 10.29 $\pm$ 4.92 and an average D component equal to 5.55 $\pm$ 3.77 and Manaus, Amazonas (Brazil)³³ with the mean score of 10 for DMFT index. However, lower scores among pregnant women were found in Ahvaz (Iran),³⁴ where the average DMF-T index was 6.23 $\pm$ 3.01. Perhaps this discrepancy can be explained by differences of dietary habits of people in southern areas of Iran (like Ahvaz); as they consume more seafood and water (which naturally contain fluoride) due to climatic characteristics of these regions.³⁵

When comparing the prevalence of dental caries and mean of DMFT among pregnant and average population in the same range of age,³⁶ no significant difference was observed. The objective of this survey was to study the risk indicators associated with tooth decay and DMFT during pregnancy; we found that the mean DMF-T index and prevalence of dental caries among gravid women are positively correlated with age. This data confirms the results of Karunachandra et al.²⁷

Table 5. Spearman test of correlation between dental indices and risk indicators

Index	Age	Number of previous deliveries	Mean of pregnancy interval	Gestational age
DMFT	0.480	0.371	0.110	0.029
P	< 0.001*	< 0.001*	0.107	0.572
D	0.195	0.262	-0.107	0.051
P	< 0.001*	< 0.001*	0.118	0.321
M	0.466	0.418	-0.077	0.041
P	< 0.001*	< 0.001*	0.258	0.425
F	0.289	0.160	0.225	0.009
P	< 0.001*	0.002*	0.001*	0.862

*Significant at $\alpha = 5\%$; DMFT: Decayed, missed, and filling teeth; D: Decayed; M: Missing; F: Filled

and Jago et al.³¹ studies; however, it is in conflict with Vergnes et al.¹⁶ investigation that demonstrated tooth decay among pregnant women in France was statistically associated with lower age. Nevertheless, data achieved in the present study is in agreement with the findings of Pakshir³⁶ who showed in the general population of Iran prevalence of decayed teeth and mean DMFT score increases with advancing age. This may reflect the promoted awareness of individuals to health care behaviors with advancing age in developed countries like France and on the other hand double the importance of launching educational programs with adequate follow-ups to control its efficacy in different stages of a person life.

Number of previous deliveries as a predisposing factor for tooth decay has already been studied in Radnai et al.³⁷ survey, which demonstrated no correlation with tooth decay incidence, in spite of showing a significant relationship with DMFT index. In the present study, a significant association was found between the number of previous pregnancies with both DMFT index and the number of decayed teeth. Although not explored in the present investigation, this may be attributable to improper dietary habits and less self-care in women with more deliveries. Hence, older pregnant women and women with more previous deliveries may need more oral and nutritional health care than younger prenatal women expecting their first or the second baby.

Similar to gingivitis, which is aggravated by fluctuations in hormones during pregnancy,¹⁵ significant differences were noticed between the trimesters of pregnancy for mean decayed component,³⁸ and as the etiologies of caries flare during and after pregnancy is not well understood, achieving a good caries control by managing peripheral factors such as appropriate oral hygiene and instructing self-care to mothers is suggested.³⁹ For this and other reasons, it is necessary to conduct prenatal appointments along with more educating approaches in

order to preclude dental conditions from worsening later during and after pregnancy. In the present study although an increasing manner was observed in D component with advancement of gestational age but the difference was not significant ($P = 0.051$).

In this study, the relation was detected between F component and pregnancies' intervals. Given the above, the data suggest that there may be barriers that make it difficult for this population to obtain care, such as child bearing and homework after delivery, which make them to stay at home and even they do not feel any need for self-care.⁴⁰ Hence, it is recommended that in antenatal visits health professionals and obstetrician educate women about the importance of maintaining sufficient intervals between pregnancies.

As the sampling in the present study was performed in Isfahan, the results of the present study should not be generalized to the whole nation. A limitation of the present study was the lack of information on the social background of the sample population, and it is suggested in future studies to assess biologic markers in the context of the individual's socio-economic status.

Conclusion

Taken together, our data demonstrated that the oral health status of Isfahanian pregnant women was not satisfactory and there were some risk factors (age and number of previous deliveries) significantly correlated with DMFT index in pregnant women. It will be interesting to see these results confirmed in larger populations as they may add to our understanding of risk indicators and their prevention ways to maintain good oral condition during and after pregnancy. The importance of dental care and decreasing risk factors before and during pregnancy must be educated widely among both the public and providers.

Conflict of Interests

Authors have no conflict of interest.

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References

1. Brown LJ, Wall TP, Lazar V. Trends in caries among adults 18 to 45 years old. *J Am Dent Assoc* 2002; 133(7): 827-34.
2. Hescot P, Bourgeois D, Doury J. Oral health in 35-44 year old adults in France. *Int Dent J* 1997; 47(2): 94-9.
3. Weinstein P, Harrison R, Benton T. Motivating parents to prevent caries in their young children: one-year findings. *J Am Dent Assoc* 2004; 135(6): 731-8.
4. Mofidi M, Rozier RG, King RS. Problems with access to dental care for Medicaid-insured children: what caregivers think? *Am J Public Health* 2002; 92(1): 53-8.
5. Kelly SE, Binkley CJ, Neace WP, Gale BS. Barriers to care-seeking for children's oral health among low-income caregivers. *Am J Public Health* 2005; 95(8): 1345-51.
6. Milgrom P, Weinstein P. Early childhood caries: a team approach to prevention and treatment. Washington, DC: University of Washington in Seattle, Continuing Dental Education; 1999.
7. Berkowitz RJ. Acquisition and transmission of mutans streptococci. *J Calif Dent Assoc* 2003; 31(2): 135-8.
8. Kloetzel MK, Huebner CE, Milgrom P. Referrals for dental care during pregnancy. *J Midwifery Womens Health* 2011; 56(2): 110-7.
9. Dye BA, Vargas CM, Lee JJ, Magder L, Tinanoff N. Assessing the relationship between children's oral health status and that of their mothers. *J Am Dent Assoc* 2011; 142(2): 173-83.
10. Grembowski D, Spiekerman C, Milgrom P. Disparities in regular source of dental care among mothers of medicaid-enrolled preschool children. *J Health Care Poor Underserved* 2007; 18(4): 789-813.
11. Ressler-Maerlender J, Krishna R, Robison V. Oral health during pregnancy: current research. *J Womens Health (Larchmt)* 2005; 14(10): 880-2.
12. Kumar J, Samelson R. Oral health care during pregnancy and early childhood practice guidelines. New York, NY: New York State Department of Health; 2006.
13. Waldman B. Dental providers participating in mass health [Online]. [cited 2006]; Available from: URL: <http://www.mass.gov/eohhs/docs/masshealth/bull-2005/den-33.pdf>
14. Hughes D. Oral health during pregnancy and early childhood: barriers to care and how to address them. *J Calif Dent Assoc* 2010; 38(9): 655-60.
15. Silk H, Douglass AB, Douglass JM, Silk L. Oral health during pregnancy. *Am Fam Physician* 2008; 77(8): 1139-44.
16. Vergnes JN, Kaminski M, Lelong N, Musset AM, Sixou M, Nabet C. Frequency and risk indicators of tooth decay among pregnant women in France: a cross-sectional analysis. *PLoS One* 2012; 7(5): e33296.
17. Bakhmudov BR, Alieva ZB, Bakhmudov MB. Caries incidence assessment in young and mature nulliparous pregnant. *Stomatologiya (Mosk)* 2011; 90(5): 19-21.
18. Rakchanok N, Amporn D, Yoshida Y, Harun-Or-Rashid M, Sakamoto J. Dental caries and gingivitis among pregnant and non-pregnant women in Chiang Mai, Thailand. *Nagoya J Med Sci* 2010; 72(1-2): 43-50.
19. Bolden AJ, Henry JL, Allukian M. Implications of access, utilization and need for oral health care by low income groups and minorities on the dental delivery system. *J Dent Educ* 1993; 57(12): 888-900.
20. Atchison KA, Davidson PL, Nakazono TT. Predisposing, enabling, and need for dental treatment characteristics of ICS-II USA ethnically diverse groups. *Adv Dent Res* 1997; 11(2): 223-34.
21. Gilbert GH, Shelton BJ, Chavers LS, Bradford EH. The paradox of dental need in a population-based study of dentate adults. *Med Care* 2003; 41(1): 119-34.
22. Bahri Binabaj N, Bahri Binabaj N, Iliati H, Salarvand Sh, Mansoorian MR. Assessment of DMFT Index in Pregnant Women and its Relationship with Knowledge, Attitude and Health Behaviors in Terms of Oral and Dental Cares (Mashhad-2009). *Iran J Obstet Gynecol Infertil* 2012; 15(3): 13-20. [In Persian].
23. Marchi KS, Fisher-Owen SA, Weintraub JA, Yu Z, Braveman PA. Most pregnant women in California do not receive dental care: findings from a population-based study. *Public Health Rep* 2010; 125(6): 831-42.
24. Thomas NJ, Middleton PF, Crowther CA. Oral and dental health care practices in pregnant women in Australia: a postnatal survey. *BMC Pregnancy Childbirth* 2008; 8: 13.
25. Boggess KA, Urlaub DM, Massey KE, Moos MK, Matheson MB, Lorenz C. Oral hygiene practices and dental service utilization among pregnant women. *J Am Dent Assoc* 2010; 141(5): 553-61.
26. Timothe P, Eke PI, Presson SM, Malvitz DM. Dental care use among pregnant women in the United States reported in 1999 and 2002. *Prev Chronic Dis* 2005; 2(1): A10.

27. Karunachandra NN, Perera IR, Fernando G. Oral health status during pregnancy: rural-urban comparisons of oral disease burden among antenatal women in Sri Lanka. *Rural Remote Health* 2012; 12: 1902.
28. Keirse MJ, Plutzer K. Women's attitudes to and perceptions of oral health and dental care during pregnancy. *J Perinat Med* 2010; 38(1): 3-8.
29. Banoczy J, Orosz M, Gabris K, Nyarasy I, Rigo O, Schuder L. Investigation on the correlation of pregnancy, caries and gingivitis (author's transl). *Zahn Mund Kieferheilkd Zentralbl* 1978; 66(6): 573-81.
30. Radnai M, Gorzo I, Nagy E, Urban E, Eller J, Novak T, et al. The oral health status of postpartum mothers in South-East Hungary. *Community Dent Health* 2007; 24(2): 111-6.
31. Jago JD, Chapman PJ, Aitken JF, McEniery TM. Dental status of pregnant women attending a Brisbane maternity hospital. *Community Dent Oral Epidemiol* 1984; 12(6): 398-401.
32. World Health Organization. *Oral Health Surveys: Basic Methods*. 4th ed. Geneva, Switzerland: World Health Organization; 1997.
33. Bressane LB, da Silva Costa LN, Rebelo Vieira JM, Bessa Rebelo MA. Oral health conditions among pregnant women attended to at a health care center in Manaus, Amazonas, Brazil. *Rev Odonto Cienc* 2011; 26(4): 291-6.
34. Gharizadeh N, Haghihizadeh MH, Sabarhaji W, Karimi A. A study of dmft and oral hygiene and gingival status among pregnant women attending Ahwaz health centers. *Jundishapur Sci Med J* 2004; 4(43): 40-7. [In Persian].
35. Basir L, Khanehmasedjedi M, Haghighi M, Nemati Asl S. Evaluation and comparison of floozies and DMFT and their relation with the amount of fluoride in three flowing source of drinking water (Karooon, Maroon, Karkheh) in 12-15 years old students in Khozestan 2002. *J Dent Sch* 2006; 24(1): 14-23. [In Persian].
36. Pakshir HR. Oral health in Iran. *Int Dent J* 2004; 54(6 Suppl 1): 367-72.
37. Radnai M, Gorzo I, Nagy E, Urban E, Eller J, Novak T, et al. Caries and periodontal state of pregnant women. Part I. Caries status. *Fogorv Sz* 2005; 98(2): 53-7.
38. Kumar S, Tadakamadla J, Tibdewal H, Duraiswamy P, Kulkarni S. Factors influencing caries status and treatment needs among pregnant women attending a maternity hospital in Udaipur city, India. *J Clin Exp Dent* 2013; 5(2): e72-e76.
39. Vadiakas G, Lianos C. Correlation between pregnancy and dental caries. *Hell Stomatol Chron* 1988; 32(4): 267-72.
40. de Albuquerque OM, Abegg C, Rodrigues CS. Pregnant women's perceptions of the Family Health Program concerning barriers to dental care in Pernambuco, Brazil. *Cad Saude Publica* 2004; 20(3): 789-96.

The detection of salivary glucose, caries and periodontal status in patients with diabetes mellitus

Shahla Kakoei DDS, MSc¹, Bahareh Hosseini DDS, MSc², Ali Akbar Haghdooost PhD³,
Mojgan Sanjari MD⁴, Maryam Alsadat Hashemipour DDS, MSc²,
Ahmad Gholamhosseini PhD⁵

Original Article

Abstract

BACKGROUND AND AIM: Oral manifestations in patients with diabetes mellitus (DM) can have different causes. Possibly, one of these causes is salivary glucose. The aim of this study was to evaluate salivary glucose concentrations in patients with Type II DM and their association with oral and dental manifestations and compare them with normal adults.

METHODS: In this analytical study, 128 patients with Type II DM and 132 non-diabetic healthy individuals were selected. The subjects' blood and unstimulated salivary samples were collected. Salivary glucose concentrations were measured by glucose oxidase method. Then, the oral cavity and teeth were examined for oral manifestations such as ulcers, white and red plaques, lichenoid reaction, candidiasis and decayed missing filled teeth (DMFT) and periodontal disease index (PDI) indices. Data were analyzed by independent t-test and Pearson's correlation test.

RESULTS: The results of the present study showed that, in general, individuals with higher concentrations of salivary glucose had significantly higher DMFT and PDI, irrespective of belonging to the diabetic or the control group ($P < 0.050$). However, there was no significant correlation between salivary glucose concentrations and oral manifestations. Meanwhile, there was a significant correlation between salivary glucose concentration and glycated hemoglobin in patients with DM compared with the control group ($P < 0.001$).

CONCLUSION: The present study showed that the salivary glucose concentration had a positive association with DMFT and PDI in patients with DM and non-diabetic. In this study, we found an association between salivary and blood glucose in patients with DM.

KEYWORDS: Diabetes Mellitus, Decayed Missing Filled Teeth, Oral Manifestation, Periodontal Disease Index, Salivary Glucose

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Diabetes mellitus (DM) is a metabolic disorder that can have many oral manifestations, including xerostomia, bacterial, viral and fungal infections, poor wound healing, tooth cavities, gingivitis, periodontitis, periapical abscesses and burning mouth syndrome.¹ Increased

fluid excretion, lowered response to infections, microvascular changes and possibly increased salivary glucose concentrations can be found in DM patients.² Worldwide, researchers are interested in using saliva as a diagnostic fluid that contains proteins, enzymes, hormones and

1- Associate Professor, Department of Oral Medicine, School of Dentistry, Kerman University of Medical Sciences, Kerman, Iran

2- Assistant Professor, Department of Oral Medicine, School of Dentistry, Kerman University of Medical Sciences, Kerman, Iran

3- Professor, Department of Epidemiology, School of Public Health, Kerman University of Medical Sciences, Kerman, Iran

4- Associate Professor, Department of Endocrinology, Physiology Research Center, Institute of Neuropharmacology, Kerman University of Medical Sciences, Kerman, Iran

5- Professor, Department of Biochemistry, School of Medicine, Kerman University of Medical Sciences, Kerman, Iran

Correspondence to: Bahareh Hosseini DDS, MSc

Email: bhd_1362@yahoo.com

carbohydrates; in addition, this fluid is readily available.³ Glucose is a small molecule that easily penetrates via vessels and is transported from serum to gingival fluids and enters saliva.⁴

Investigations on salivary and blood glucose have shown varying results regarding the concentration of blood and salivary glucose between DM patients and healthy individuals.³⁻⁷ Several studies have not shown an association between blood and salivary glucose,^{3,4} whereas others have shown a statistically significant association between blood and salivary glucose.⁵⁻⁷ Most investigations on salivary glucose have focused on its relationship with the blood glucose concentration as well as its association with oral manifestations in patients with DM. None of the previous investigations has reported an association between either blood or salivary glucose and a higher number of tooth cavities and other oral manifestations in healthy individuals. Therefore, the aim of the present study was to investigate blood glucose levels in healthy subjects and patients with DM as well as healthy individuals and determine if there is any association between higher oral glucose concentrations with oral manifestations, such as tooth cavities, periodontal diseases, candidiasis, lichenoid reaction and xerostomia.

Methods

The subjects consisted of 260 individuals in two separate groups. The first group consisted of 128 patients suffering from DM, referring to the Diabetes Clinic of Bahonar Hospital for routine check-ups. The second group (132 persons) were selected from those who referred to two laboratory centers in Kerman, Iran (Razi Laboratory and Besat Clinical Laboratory) for their annual medical check-ups with no history of DM.

Subjects with no history of smoking, a minimum age of 20, and 8 h of fasting before collecting their blood and salivary samples were selected for the study. We also made

sure that the healthy group with fasting blood sugar (FBS) lower than 100 mg/dl had no systemic diseases and did not take medications influencing either the secretion or the glucose level of the saliva.⁴ All the volunteers were asked to clean their teeth and mouth at least 90 min before sampling and were also asked to present themselves for sampling at 7:30-9 am.

The criteria for diagnosis of DM in the first group consisted of:

Glycated hemoglobin (HbA_{1c}) equal or greater than 6.5%; fasting plasma glucose ≥ 126 mg/dl; 2 h plasma glucose ≥ 200 mg/dl or in patients with the classic symptoms of hyperglycemia and crisis hyperglycemia and one accidental plasma glucose ≥ 200 mg/dl.⁸

After the objectives and procedures had been explained, the subjects signed informed consent forms. A trained post graduate student completed an information checklist containing age, gender, type of diabetes and the last medical examinations including FBS and HbA_{1c}. The oral mucosa was examined for any oral abnormalities, including ulcers, white and red plaques, lichenoid reaction, hyperplastic candidiasis, erythematous candidiasis, thrush, angular cheilitis, denture stomatitis, and median rhomboid glossitis⁹ and the characteristics of the lesions and their location.

In order to check the condition of the teeth in terms of the presence of cavities, the World Health Organization guidelines were used to calculate index of the sum of decayed teeth, absent teeth due to decayed missing filled teeth (DMFT).¹⁰ Tissues supporting the teeth were examined with the aid of periodontal disease index (PDI) and 6 specific teeth, namely central and upper left first premolar, upper right first molar, lower left first molar and central and lower right first premolar were examined.¹¹ Xerostomia was evaluated based on Fox questionnaire.¹² In the present study, all the individuals were asked about any complaint of mouth soreness.

Unstimulated salivary samples were collected by the spitting method.³ The

patients were asked, after some rest, to keep their mouth closed and not swallow their saliva for a few minutes; then they held their head above the saliva collecting container and poured their saliva (1-2 ml) into it. The sampling container was frozen at -20 °C and sent to the laboratory (3). The saliva glucose concentration was measured by glucose oxidase enzyme method using a special kit (Pars Azmun Co., Tehran, Iran) and an autoanalyzer machine (Tecknicon Co., RA-1000, USA).

This analytical and cross-sectional study was approved by the Ethics Committee (KA/90-521) of Kerman University of Medical Sciences. Data were analyzed using independent t-test and Pearson correlation test.

Results

A total of 260 individuals, including DM patients (35 males and 93 females) and healthy individuals (51 males and 81 females), were examined. Age of the participants ranged between 20 and 83 with an average of 47.06 years. There was no significant difference in salivary glucose between the two groups in terms of age but salivary glucose concentration in healthy males was significantly higher than that in females (Table 1).

Patients with DM whose HbA_{1c} results were available had higher salivary glucose concentration ($P < 0.001$) (Table 1). The means of salivary glucose concentrations in the healthy and diabetic groups were 8.98 (± 0.76) and 10.05 (± 0.84) mg/dl, respectively, with no significant difference between the two groups ($P = 0.310$) (Table 1).

In healthy individuals no significant association was found between FBS and salivary glucose concentration ($P = 0.420$, $r = 0.07$), in contrast to the diabetics group in which there was a significant association between blood and salivary glucose concentrations ($P = 0.040$, $r = 0.70$). There was a significant association between HbA_{1c} and salivary glucose concentration ($P < 0.001$, $r = 0.62$) (Table 1).

In this study, there were significantly higher DMFT (10.95 vs. 7.25) and PDI (3.53 vs. 2.57) in DM patients compared to healthy individuals ($P < 0.001$). In addition, there was a significant association between high salivary glucose concentration and higher DMFT and PDI, irrespective of the presence of DM ($P < 0.001$) (Table 1). The prevalence of oral manifestations in the two healthy and diabetics groups as shown in table 2.

Two individuals from the healthy group and thirty patients from the diabetics group

Table 1. The correlation coefficient and P value between saliva glucose concentration and age, HbA_{1c}, FBS, DMFT and PDI

Salivary glucose	P, r				
	Age	HbA _{1c}	FBS	DMFT	PDI
Normal	0.870, -0.01	-	0.420, 0.07	*0.001, 0.47	*0.001, 0.32
Diabetic	0.300, 0.09	*0.001, 0.62	*0.040, 0.17	*0.001, 0.79	*0.004, 0.31
Total	0.250, 0.07	-	*0.020, 0.14	*0.001, 0.74	*0.001, 0.31

*P < 0.050 statistically significant

FBS: Fasting blood sugar; DMFT: Decayed missing filled teeth; PDI: Periodontal disease index

Table 2. The frequencies of oral manifestations in the two groups, healthy and Patients with DM

Lesion	Healthy group [n (%)]	Patients with DM [n (%)]	P
Candidiasis	6 (4.5)	23 (17.6)	0.001*
Lichenoid reaction	2 (1.5)	2 (1.5)	0.990
Frequent abscess	0 (0.0)	8 (6.2)	0.002*
Tongue blade sign	3 (2.3)	39 (30.4)	< 0.001*
Xerostomia	3 (2.3)	46 (35.9)	< 0.001*

*P < 0.050 statistically significant; DM: Diabetes mellitus

Table 3. Comparing the salivary glucose concentration in those with and without oral manifestation, classified by diabetes status

Oral manifestations	Total		Diabetic group		Healthy group	
	Mean of saliva Glucose (mg/dl) (SE)	P	Mean of saliva Glucose (mg/dl) (SE)	P	Mean of saliva Glucose (mg/dl) (SE)	P
Candida erythematous						
Yes	2 (0.00)	0.430	10.67 (5.23)	0.900	8.5 (4.29)	0.830
No	8.9 (0.76)		10.03 (0.85)		9.48 (5.70)	
Thrush						
Yes	3.5 (1.50)	0.380	10.67 (5.23)	0.520	10.25 (2.87)	0.800
No	8.9 (0.77)		10.03 (0.85)		9.44 (0.57)	
Median rhomboid glossitis						
Yes	-	-	12 (4.04)	0.720	12 (4.40)	0.630
No	8.89 (0.76)		10 (0.85)		9.43 (0.57)	
Denture stomatitis						
Yes	2.5 (0.50)	0.300	8.53 (1.88)	0.510	7.82 (1.72)	0.550
No	8.9 (0.77)		10.25 (0.92)		9.58 (0.59)	
Angular cheilitis						
Yes	4 (2.00)	0.420	13.75 (4.85)	0.440	11.8 (4.05)	0.560
No	8.9 (0.77)		9.2 (0.84)		9.37 (0.56)	
Lichenoid reaction						
Yes	8 (0.01)	0.240	5 (3.00)	0.450	6.5 (1.50)	0.130
No	8.9 (0.77)		10.3 (0.85)		9.51 (0.57)	
Frequent abscess						
Yes	-	-	14.63 (4.1)	0.160	14.63 (4.10)	0.100
No	8.89 (0.76)		9.74 (0.83)		9.3 (0.57)	
Tongue blade sign						
Yes	16.67 (6.17)	0.120	11.21 (1.50)	0.360	11.6 (1.41)	0.090*
No	8.71 (0.76)		9.54 (1.01)		9.05 (0.61)	
Xerostomia (Fox)						
Yes	16.67 (6.17)	0.120	11.04 (1.42)	0.370	11.39 (1.38)	0.100
No	8.71 (0.76)		9.49 (1.04)		9.01 (0.60)	

*P < 0.050 statistically significant; SE: Standard error

suffered from burning mouth syndrome. Oral examinations of all these subjects confirmed the presence of local factors, including Candida infection and xerostomia. There was no significant association between salivary glucose concentration and oral manifestations in healthy and diabetic groups ($P > 0.050$) (Table 3). Overall, there was no significant association between salivary glucose level and oral manifestations in all the participants ($P > 0.050$) (Table 3).

Discussion

Nowadays, many studies are trying to use saliva in diagnosis or even monitoring the level of control of the diseases. Saliva is a complex fluid that is produced in salivary glands and can take some substances from

the blood. Possibly, saliva component changes show some systemic diseases or cause changes on oral mucosa surface. Since Jurysta et al. reported no differences in glucose concentrations of in stimulated and non-stimulated salivary flow in normal and diabetic individuals, in present study unstimulated saliva was used.³

The present study showed that higher salivary glucose level is associated with higher DMFT and PDI, regardless of the individuals' health status. In addition, the present study showed no significant difference between high salivary glucose concentration and oral manifestations such as ulcers and Candida infections. One of the findings of the present study was higher salivary glucose concentrations in male

healthy patients compared to the female healthy ones, but there was no significant difference between two genders in diabetics group which the latter agrees with the findings of Panchbhai et al.¹³

This study showed that the concentration of salivary glucose in patients with DM was not significantly higher than that in healthy individuals ($P > 0.050$), consistent with the results of two previous studies^{1,14} and in contrast with those of some other studies.^{3,15,16} These differences of analysis results might be due to different methods of measurement of salivary glucose or collecting the samples. In addition, the level of maintaining oral hygiene and plaque on teeth can influence on salivary glucose. In this study, blood glucose did not show any significant association with salivary glucose in non- patients with DM ($P > 0.050$). Previous studies have shown the same results.^{4,17} However, in patients with DM this association was weakly significant, consistent with some previous studies.^{5-7,13,18,19}

In the present study, patients with DM with high HbA1C had higher salivary glucose concentrations ($P < 0.001$). This correlation was found in a study by Reuterving et al.¹⁸ but was in contrast with the results reported by Darwazeh et al.¹⁹ However, the previous studies had conflict on this matter.

In the present study, there was a significant association between salivary glucose and DMFT and PDI indices in normal and patients with DM. One may argue that oral hygiene has an influence on oral indices, and we could not evaluate the quality of oral cleanliness in the subjects, but this is one of the limitations of the present study. However, the PDI and DMFT indices were significantly higher in patients with DM in the present study ($P < 0.001$). Bakianian et al.¹ and Lopez et al.⁵ have reported similar results.

The increasing rate of dental caries and periodontal problems in patients with DM can be due to xerostomia, saliva protection

impairment related immune system, acidogenic microorganisms and poor oral hygiene and plaque accumulation.¹

In the present study, there was no significant relationship between the concentration of salivary glucose and Candida infection in patients with DM and non-diabetic individuals ($P > 0.050$), consistent with previous studies.^{20,21} However, these studies showed that high carrier state of Candida does not result in oral candidiasis and glucose concentration cannot predict the prevalence of such infections.^{20,21} The present study did not show any significant association between salivary glucose and oral manifestations in DM and non-DM patients ($P > 0.050$). Therefore, it can be assumed that other factors such as microvascular deterioration, immune system response and infection mediators influence oral manifestations in patients with DM.²²

This study had several limitations. For instance, we could not gather HbA_{1C} data in all the patients with DM; in addition, we could not match the participants based on gender and age and we were unable to control oral hygiene before sampling. We hope this preliminary study can pave the way for better designed research studies.

Conclusion

The present study showed that the salivary glucose concentration had a positive association with DMFT and PDI in patients with DM and non-diabetic. In this study, we found an association between salivary and blood glucose in patients with diabetes mellitus.

Conflict of Interests

Authors have no conflict of interest.

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References

1. Bakianian VP, Vahedi M, Mortazavi H, Abdollahzadeh S, Hajilooi M. Evaluation of salivary glucose, IgA and flow rate in diabetic patients: a case-control study. *J Dent (Tehran)* 2010; 7(1): 13-8.
2. Akintoye SO, Collins MT, Ship JA. Diabetes mellitus and endocrine disease. In: Burket LW, Editor. *Burket's oral medicine*. New York, NY: PMPH-USA; 2008. p. 509.
3. Jurysta C, Bulur N, Oguzhan B, Satman I, Yilmaz TM, Malaisse WJ, et al. Salivary glucose concentration and excretion in normal and diabetic subjects. *Journal of Biomedicine and Biotechnology* 2006; 2009: 6.
4. Soares MS, Batista-Filho MM, Pimentel MJ, Passos IA, Chimenos-Kustner E. Determination of salivary glucose in healthy adults. *Med Oral Patol Oral Cir Bucal* 2009; 14(10): e510-e513.
5. Lopez ME, Colloca ME, Paez RG, Schallmach JN, Koss MA, Chervonagura A. Salivary characteristics of diabetic children. *Braz Dent J* 2003; 14(1): 26-31.
6. Amer S, Yousuf M, Siddiqui PQ, Alam J. Salivary glucose concentrations in patients with diabetes mellitus-a minimally invasive technique for monitoring blood glucose levels. *Pak J Pharm Sci* 2001; 14(1): 33-7.
7. Singh N, Agrawal R, Nair PP, Sargaiyan V, Bhushan P, Radhika N. Comparison of Salivary and Plasma Glucose Level in Type II Diabetic Patients. *J Res Adv Dent* 2013; 3(1): 263-8.
8. American Diabetes Association. Diagnosis and classification of diabetes mellitus. *Diabetes Care* 2010; 33(Suppl 1): S62-S69.
9. Rad M, Hashemipour M, Karimi M. The relationship between oral manifestations in diabetes and duration of disease and glycemic control. *Iranian Journal of Diabetes and Metabolism* 2006; 6(2): 159-67. [In Persian].
10. World Health Organization. *Oral health surveys: basic methods*. 3rd ed. Geneva, Switzerland: World Health Organization; 1987.
11. Beck JD, Arbes SI. Epidemiology of gingival and periodontal disease. In: Newman MG, Takei HH, Carranza F, Editors. *Carranza's Clinical Periodontology*. 10th ed. Philadelphia, PA: Saunders Elsevier; 2006. p. 120-1.
12. Fox PC, Busch KA, Baum BJ. Subjective reports of xerostomia and objective measures of salivary gland performance. *J Am Dent Assoc* 1987; 115(4): 581-4.
13. Panchbhai AS, Degwekar SS, Bhowte RR. Estimation of salivary glucose, salivary amylase, salivary total protein and salivary flow rate in diabetics in India. *J Oral Sci* 2010; 52(3): 359-68.
14. Lalla RV, D'Ambrosio JA. Dental management considerations for the patient with diabetes mellitus. *J Am Dent Assoc* 2001; 132(10): 1425-32.
15. Belazi MA, Galli-Tsinopoulou A, Drakoulakos D, Fleva A, Papanayiotou PH. Salivary alterations in insulin-dependent diabetes mellitus. *Int J Paediatr Dent* 1998; 8(1): 29-33.
16. Aydin S. A comparison of ghrelin, glucose, alpha-amylase and protein levels in saliva from diabetics. *J Biochem Mol Biol* 2007; 40(1): 29-35.
17. Hashemipour M, Nekuii F, Amini M, Amini-roaya A, Rezvanian H, Kachoi A, et al. A study of the relationship between blood and saliva glucose levels in healthy population to find a non-invasive method for blood glucose measurement. *Int J Endocrinol Metab* 2000; 2(4): 221-6. [In Persian].
18. Reuterving CO, Reuterving G, Hagg E, Ericson T. Salivary flow rate and salivary glucose concentration in patients with diabetes mellitus influence of severity of diabetes. *Diabete Metab* 1987; 13(4): 457-62.
19. Darwazeh AM, MacFarlane TW, McCuish A, Lamey PJ. Mixed salivary glucose levels and candidal carriage in patients with diabetes mellitus. *J Oral Pathol Med* 1991; 20(6): 280-3.
20. Sashikumar R, Kannan R. Salivary glucose levels and oral candidal carriage in type II diabetics. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2010; 109(5): 706-11.
21. Borgnakke WS. Salivary glucose levels are unable to predict oral candidiasis or monitor diabetes. *J Evid Based Dent Pract* 2010; 10(4): 237-40.
22. Little JW, Falace D, Miller C, Rhodus NL. *Dental management of the medically compromised patient*. 7th ed. Philadelphia, PA: Elsevier Health Sciences; 2007. p. 212-32.

A comparative study of the cleaning effect of various ultrasonic cleaners on new, unused endodontic instruments

*Masoud Parirokh DMD, MS¹, Zeynab Kazemizadeh DMD, MS²,
Arash Shahravan DMD, MS³, Ghasem Sahranavard DMD, MS³,
Ali Akbar Haghdooost MD, PhD⁴*

Original Article

Abstract

BACKGROUND AND AIM: This study was carried out to compare three different ultrasonic cleaner devices in the cleaning process of endodontic instruments by scanning electron microscope (SEM).

METHODS: In this study, 120 unused brand new hand and rotary instruments were examined after removing from the sealed package. The instruments were randomly divided into six groups of 20 rotary or hand files each and observed by SEM before ultra-sonication. Then, every pair of hand and rotary instruments was cleaned using one of the ultrasonic cleaner brands. Again the instruments were examined by SEM and assessed in three different parts, tip, middle and distance 16 (D16). SEM data were analyzed by Kurskal–Wallis and Mann–Whitney tests.

RESULTS: The tip of the endodontic instruments was the most contaminated area before ultrasonic cleaning. Statistical analysis showed that all of the tested ultrasonic devices were significantly effective machines for debris removal from endodontic instruments. The hand and rotary instruments cleaned by one of the devices were significantly cleaner than the others ($P < 0.050$). There was a significant difference in cleaning of the separate parts of the instruments during ultra-sonication among ultrasonic cleaners. The tips of the instruments were significantly cleaner than the D16 parts ($P < 0.050$).

CONCLUSION: Various ultrasonic devices have different ability for cleaning of endodontic instruments.

KEYWORDS: Endodontic Instruments, Scanning Electron Microscope, Ultrasonic Cleaner

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Endodontic instruments have always been a matter of concern among clinicians because of special surface topography and the potential of transmitting antigens and prions such as various Creutzfeldt-Jakob disease from one patient to another.^{1,2} Researchers have found that both types of stainless steel and nickel-titanium (Ni-Ti) files even when withdrawn from sealed boxes have had metallic and nonmetallic debris and even defect on their

surface.³⁻⁹ Contamination on endodontic files possibly happens during either manufacturing and packaging process or cleaning procedure itself.¹⁰ As the endodontic instruments may come in contact with periapical tissue during root canal therapy, it has been emphasized that the instruments should be sterilized before use.¹¹

Many clinicians use endodontic files more than one time and therefore lack of complete cleaning of the endodontic instruments after

1- Professor, Neuroscience Research Center, Kerman University of Medical Sciences, Kerman, Iran

2- Assistant Professor, Department of Endodontic, School of Dentistry, Rafsanjan University of Medical Sciences, Rafsanjan, Iran

3- Associate Professor, Kerman Oral and Dental Disease Research Center AND Kerman Social Determinants on Oral Health Research Center, School of Dentistry, Kerman University of Medical Sciences, Kerman, Iran

4- Professor, Research Center for Modeling in Health, Kerman University of Medical Sciences, Kerman, Iran

Correspondence to: Masoud Parirokh DMD, MS

Email: m_parirokh@kmu.ac.ir

first usage may exchange debris, blood and antigens through instruments from one patient to another.¹ These materials are potentially infective and may produce serious problems for either patient or the dentist.¹²⁻¹⁴ Even unused instruments have a lot of organic and inorganic debris that may prevent complete sterilization before clinical use.⁸

Many methods were used for endodontic instrument cleaning such as hand scrubbing, ultra-sonication, and washer disinfectant.^{8,15-17} Previous studies on the effect of different methods and devices for cleaning of the endodontic instruments made conflicting results.^{4-7,18} Previous research studies show that even after ultrasonic cleaning and sterilization with dry heat or autoclave some residual debris may remain on endodontic instruments.^{5,8}

However, two other studies showed that ultrasonic cleaning is an efficient method for the removal of metallic particles from the surface of endodontic instruments.^{4,18} The difference between ultrasonic brands was addressed as one of the factors that may influence on removing debris from endodontic instruments after the ultrasonication.⁷

Several brands of ultrasonic cleaners have been introduced to the market with different frequencies and volume capacity, however, it has not been shown that the efficacy of those brands on endodontic instruments. Therefore, the purpose of this study was to determine the amount of debris on endodontic instruments before and after cleaning with different ultrasonic cleaners.

Methods

One hundred and twenty new, unused rotary and hand endodontic instruments were examined. The instruments consist of: 60 Ni-Ti rotary endodontic instruments tapering 2% size 20 of Flex master rotary instruments (VDW-Germany), and 60 K-file size 30 of stainless steel endodontic instruments (Mani-Japan).

The instruments were removed from their original packages and grasped by their

handle with a needle holder to avoid contamination. A mark was made on the instruments shaft in order to be sure about making the same image under scanning electron microscope (SEM) after each step. Then in the first step all of the instruments were directly observed using an SEM (XL30 Philips-The Netherlands) at 1 kV and $\times 150$ magnification. Instruments were observed at the tip, the middle, and the distance 16 (D16) (16 mm distance from the tip) of each file and an image from each part were taken. After that, each type of the hand and rotary instruments was randomly divided into three equal groups of 20 instruments. In the next step, each pair of rotary and hand instruments were randomly placed in a container and cleaned in one of the ultrasonic cleaners (Table 1). Each ultrasonic cleaner contained a disinfectant liquid (BIB Fort, Asia Chimi Teb Co., Tehran, Iran), which was prepared according to the manufacturer instructions. The liquid contains: tert. Alkylamine, trialkyloxy ammonium propionate, emulsifying agents, deionized water, tensides, and auxiliary agents. The ultrasonic devices were activated for 15 min. Afterwards, the instruments were rinsed by running tap water for 20 s and then their container was kept in an airtight coverage until the second evaluation by SEM. Evaluation of the amount of debris on endodontic instruments was assessed based on a modification of Filho et al.⁴ and Zmener and Spielberg¹⁸ studies by three endodontists. For each instrument if the score given by the examiners was not similar then they discuss it to each other until a unique opinion had been made. The following criteria were used for scoring residual debris on instruments:

- 0- No debris
- 1- A few debris could be detected
- 2- Moderate amount of debris could be detected
- 3- A lot of debris could be detected
- 4- A huge amount of debris could be detected.

Table 1. The ultrasonic devices which were used in this study

Abbreviation	Ultrasonic device
A	Sonica 1200 M (Soltec, Milan, Italy), 50 Hz
B	Sonica 2200 MH (Soltec, Milan, Italy), 50 Hz
C	Biosonic UC 50D (Coltene-Whaledent, Altstätten-Switzerland), 53 KHz

Since the amount of contamination was measured using an ordinal scale, we used non parametric tests of Kurskal-Wallis and Mann-Whitney to compare the three parts of rotary and hand instruments cleaned by the three bands of ultrasonic cleaners.

Results

The results of this study showed that all instruments before ultrasonic cleaning had contamination on their surfaces. Data analysis showed that the tip of the instruments was the most contaminated area in comparison with middle and D16 areas ($P < 0.001$).

A. comparison of debris removal of endodontic instruments after ultrasonic cleaning

All the instruments showed significant cleaning after ultra-sonication ($P < 0.001$) (Figure 1, A and B), however, the D16 area showed the least amount of cleaning and was not significantly cleaned in comparison with their images before ultra-sonication ($P > 0.050$).

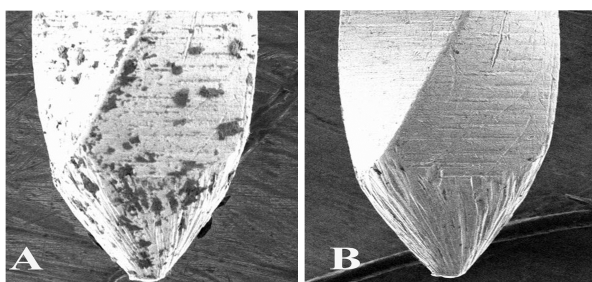


Figure 1. Hand instruments, (A) before cleaning and (B) after ultrasonic cleaning ($\times 150$)

B. comparison of debris removal between hand and rotary endodontic instruments after ultrasonic cleaning

The middle area of hand instruments was significantly cleaned in comparison with the middle area of rotary instruments ($P < 0.001$).

There was no significant difference between removing debris from hand and rotary instruments at the tip and D16 areas ($P > 0.050$).

C. Comparison of debris removal after ultrasonic cleaning with different brands of ultrasonic cleaner

After ultra-sonication by device C, all examined area of the rotary and only the tip of the hand instruments were significantly cleaner in comparison with device B ($P = 0.030$, $P = 0.006$, respectively). No significant difference was found in cleaning efficacy between devices A and C, as well as A and B (Figures 2 and 3).

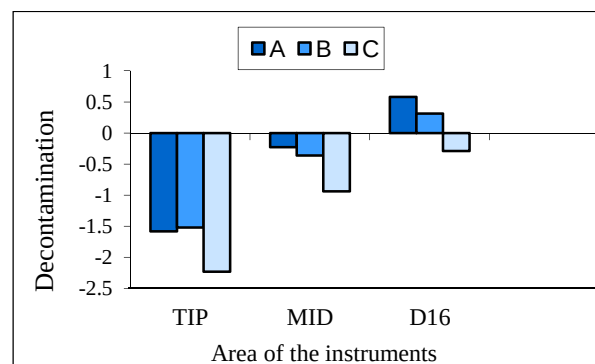


Figure 2. The mean difference of decontamination of the hand instruments after ultra-sonication in different ultrasonic devices A-C: The ultrasonic devices; TIP: Tip of the instruments; MID: Middle of the instruments; D16: 16 mm distance from the tip of the instruments

An interesting finding was the presence of more debris in D16 area following ultra-sonication when the instruments were placed in device A and B (Figures 4, A and B). A few instruments that were placed in device C show the same contamination at the D16 area following ultra-sonication.

No significant difference in cleaning was found in all examined parts of the rotary and hand instruments that were cleaned in device C, whereas in device A and B the middle part of rotary instruments was significantly cleaner than the tip and the D16 parts of the instruments ($P = 0.001$ and $P = 0.002$, respectively).

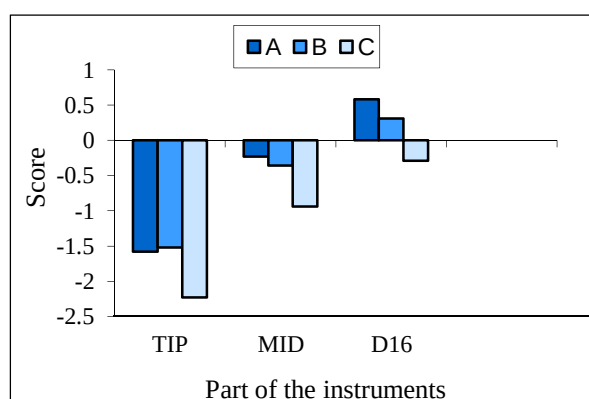


Figure 3. The mean difference of decontamination of the rotary instruments after ultra-sonication in different ultrasonic devices A-C: Ultrasonic devices; TIP: Tip of the instruments; MID: Middle of the instruments; D16: 16 mm distance from the tip of the instruments ($\times 150$)

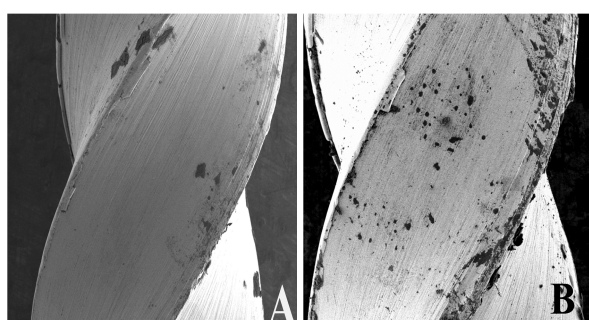


Figure 4. More contamination at D16 part of instrument after ultra-sonication (A) before cleaning (B) after ultrasonic cleaning ($\times 150$)

Discussion

The present study showed that various ultrasonic cleaners have had different efficacy on separate parts of the endodontic instruments. Although all of the instruments in this study were new and freshly unpacked both hand and rotary instruments showed debris on their surfaces. It was in accordance with previous research studies that report the presence of debris even on new unused instruments.^{3-8,10-12,19,20}

Several investigations have reported conflicting results after ultrasonic cleaning of endodontic instruments.^{4-8,12,18-23} Many of these studies employed light microscope²¹⁻²³ whereas others use SEM for assessment contamination.^{4,5,8} However, it is difficult to

directly compare these studies because they used different operating conditions under the SEM. Stowe et al.²⁴ in their study showed that using low accelerating voltage ($LAV < 3$ kV) and higher magnification are needed to see debris reliably. In this study, LAV was used (1 kV) to obtain more convenient results.

In the present study, the ultrasonic devices were activated for 15 min. Employing that period of time was based on a study that conducted by Parashos et al.⁶ They believe that employing longer time for ultrasonic cleaning may reposition debris on endodontic instruments Van Eldik et al.⁷ performed a study on debris removal from endodontic instruments when the endodontic instruments either loosely placed in an ultrasonic cleaner or in a perforated container. The results of their study have shown that placing the instruments in a baker during ultra-sonication is significantly improved the instruments cleaning in contrast with a previously published study that recommend the use of a perforated container for placing the endodontic instruments during ultrasonication.⁶ Van Eldik et al.⁷ attributed that difference to the several variations in the cleaning procedures such as whether the files were placed in a container or differing types of ultrasonic cleaners. The results of the present study showed that different ultrasonic cleaners might have different ability on endodontic instrument cleaning, and that might be another reason for the difference among previously performed investigations on cleaning endodontic instruments. Although Elmsallati et al.²² in a recently published study claimed that the flute design of the endodontic instruments is the determining factor for remaining debris after ultra-sonication.

Parashos et al. reported that employing a container for placing endodontic file in it during ultra-sonication produce cleaner file in comparison with the files that left in a baker.⁶ They stated that when ultrasonic device turning off after the device activation

the floating debris inside the ultrasonic liquid baker may recontaminate the instruments that left in the baker without a supporting basket. For that reason, in this study the instruments were placed in a container during ultra-sonication.

Recently, single use of endodontic instruments have been recommended based on concerns regarding transmitting infectious materials from one patient to another;²⁵ therefore, in the present study the cleaning of instruments were evaluated without using them for canal preparation.

Due to the magnification used in the present study, it was not possible to visualize all the cutting element of the file in one view. Therefore, the tip, the middle, and the D16 area were selected to evaluate separate areas of each file. The results of the present study showed that different parts of each file were variously cleaned in an ultrasonic cleaner, and it is very important to select different parts of each file for more precise evaluation.

The results of this study showed that the tip area of both hand and rotary instruments are the most contaminated area in comparison with the middle and the D16 area. The possibility of direct contact of the tip of an endodontic file with periapical tissues is much more than other area of the file. Therefore, it seems that the tip of the endodontic instrument is the most critical area for evaluating the efficacy of a cleaning procedure and needs more attention.

The results of Aasim et al.²¹ study showed the superior cleanliness of the tip in comparison with the shaft of the endodontic instruments. In this study, only the hand and the rotary files that were placed in one ultrasonic cleaner (device C) show no significant difference between instrument cleaning at the tip, the middle, and the D16 areas. However, significant difference between cleaning of the middle and the other parts of the files in both other devices (A and B) showed that all ultrasonic devices have not the same efficacy for debris

removal from endodontic files at different parts of the instruments.

Review of the literature shows that nowadays, rotary instruments are well accepted and more popular because of their exceptional ability to shape curved root canals.²⁶⁻²⁹ More contamination of the D16 area is a matter of concern. Contamination at the superior parts of the instruments after ultrasonic cleaning may be due to placing the instruments inside a container. A recent study shows that the tip of the endodontic instruments after employing ultrasonic cleaning is cleaner than the shaft of the instruments.²¹ The authors hypothesize that the superior cleanliness of the tip of the endodontic instruments may be due to the cavitation effect of an ultrasonic device on the instrument's tip. Therefore, placing the instruments inside a container may prevent or limit cavitation on the shaft of the instruments.

The different cleaning effect of various ultrasonic cleaners in the present study may be due to different frequencies of the employing ultrasonic devices that used in the present study. Device C has 53 KHz, however, the frequency of the both other ultrasonic cleaners are 50 Hz. Therefore, the various ultrasonic frequencies may explain their different cleaning ability on endodontic instruments. Jatzwauk et al.³⁰ emphasized that the influence of intensity and frequency of sonication and the effects of cavitation on endodontic instruments is not clear and should be clarified.

The present study did not completely followed clinical protocol of instrument sterilization in terms of presoaking because this step is recommended for residual proteins and nonorganic debris that may remain on the instruments following clinical use. A previous investigation have shown that debris on unused brand new instruments are mostly organic ones and, therefore, presoaking could not help instrument cleaning when brand new ones are used.⁸ The reason of using size 20 for rotary and 30 for

hand instruments was based on a preliminary study during our previous investigation⁸ that showed this size had more debris when removed from the manufacturer package. However, in the future using different size of instruments and use various types of container may improve information in those regards.

Conclusion

The result of this study showed that various ultrasonic devices have different ability for

cleaning hand and rotary endodontic instruments. More research studies should be performed to clear the effect of frequency on ultrasonic cleaner efficacy.

Conflict of Interests

Authors have no conflict of interest.

Acknowledgments

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References

1. Letters S, Smith AJ, McHugh S, Bagg J. A study of visual and blood contamination on reprocessed endodontic files from general dental practice. *Br Dent J* 2005; 199(8): 522-5.
2. Assaf M, Mellor AC, Qualtrough AJ. Cleaning endodontic files in a washer disinfectant. *Br Dent J* 2008; 204(10): E17-3.
3. Segall RO, del Rio CE, Brady JM, Ayer WA. Evaluation of endodontic instruments as received from the manufacturer: the demand for quality control. *Oral Surg Oral Med Oral Pathol* 1977; 44(3): 463-7.
4. Filho MT, Leonardo MR, Bonifacio KC, Dametto FR, Silva AB. The use of ultrasound for cleaning the surface of stainless steel and nickel-titanium endodontic instruments. *Int Endod J* 2001; 34(8): 581-5.
5. Martins RC, Bahia MG, Buono VT. Surface analysis of ProFile instruments by scanning electron microscopy and X-ray energy-dispersive spectroscopy: a preliminary study. *Int Endod J* 2002; 35(10): 848-53.
6. Parashos P, Linsuwanont P, Messer HH. A cleaning protocol for rotary nickel-titanium endodontic instruments. *Aust Dent J* 2004; 49(1): 20-7.
7. Van Eldik DA, Zilm PS, Rogers AH, Marin PD. A SEM evaluation of debris removal from endodontic files after cleaning and steam sterilization procedures. *Aust Dent J* 2004; 49(3): 128-35.
8. Parirokh M, Asgary S, Eghbal MJ. An energy-dispersive X-ray analysis and SEM study of debris remaining on endodontic instruments after ultrasonic cleaning and autoclave sterilization. *Aust Endod J* 2005; 31(2): 53-8.
9. Chianello G, Specian VL, Hardt LC, Raldi DP, Lage-Marques JL, Habitante SM. Surface finishing of unused rotary endodontic instruments: a SEM study. *Braz Dent J* 2008; 19(2): 109-13.
10. Linsuwanont P, Parashos P, Messer HH. Cleaning of rotary nickel-titanium endodontic instruments. *Int Endod J* 2004; 37(1): 19-28.
11. National Health and Medical Research Council. Infection control in the health care setting [Online]. [cited 1996 Apr]; Available from: URL: https://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/ic6.pdf
12. Ferreira Murgel CA, Walton RE, Rittman B, Pecora JD. A comparison of techniques for cleaning endodontic files after usage: a quantitative scanning electron microscopic study. *J Endod* 1990; 16(5): 214-7.
13. Smith A, Dickson M, Aitken J, Bagg J. Contaminated dental instruments. *J Hosp Infect* 2002; 51(3): 233-5.
14. Whittaker AG, Graham EM, Baxter RL, Jones AC, Richardson PR, Meek G, et al. Plasma cleaning of dental instruments. *J Hosp Infect* 2004; 56(1): 37-41.
15. Perakaki K, Mellor AC, Qualtrough AJ. Comparison of an ultrasonic cleaner and a washer disinfectant in the cleaning of endodontic files. *J Hosp Infect* 2007; 67(4): 355-9.
16. Walker JT, Dickinson J, Sutton JM, Raven ND, Marsh PD. Cleanability of dental instruments--implications of residual protein and risks from Creutzfeldt-Jakob disease. *Br Dent J* 2007; 203(7): 395-401.
17. Segall RO, del Rio CE, Brady JM, Ayer WA. Evaluation of debridement techniques for endodontic instruments. *Oral Surg Oral Med Oral Pathol* 1977; 44(5): 786-91.
18. Zmener O, Speilberg C. Cleaning of endodontic instruments before use. *Endod Dent Traumatol* 1995; 11(1): 10-4.
19. Marending M, Lutz F, Barbakow F. Scanning electron microscope appearances of Lightspeed instruments used clinically: a pilot study. *Int Endod J* 1998; 31(1): 57-62.
20. Eggert C, Peters O, Barbakow F. Wear of nickel-titanium lightspeed instruments evaluated by scanning electron microscopy. *J Endod* 1999; 25(7): 494-7.
21. Aasim SA, Mellor AC, Qualtrough AJ. The effect of pre-soaking and time in the ultrasonic cleaner on the cleanliness of sterilized endodontic files. *Int Endod J* 2006; 39(2): 143-9.

22. Elmsallati EA, Wadachi R, Ebrahim AK, Suda H. Debris retention and wear in three different nickel-titanium rotary instruments. *Aust Endod J* 2006; 32(3): 107-11.
23. Popovic J, Gasic J, Zivkovic S, Petrovic A, Radicevic G. Evaluation of biological debris on endodontic instruments after cleaning and sterilization procedures. *Int Endod J* 2010; 43(4): 336-41.
24. Stowe S, Parirokh M, Asgary S, Eghbal MJ. The benefits of using low accelerating voltage to assess endodontic instruments by scanning electron microscopy. *Aust Endod J* 2004; 30(1): 5-10.
25. PLY Tulsa Dental Specialties. Why "Single Use" of endodontic files makes sense – for you and your patients [Online]. [cited 2014 Oct 20]; Available from: URL: <http://www.dentsply.com/content/dam/dentsply/web/corporate/en/SterilizationProcedures/Single-Use-Endodontic-Files-grew04h-en-1308.pdf>
26. Barbakow F, Lutz F. The 'Lightspeed' preparation technique evaluated by Swiss clinicians after attending continuing education courses. *Int Endod J* 1997; 30(1): 46-50.
27. Spangberg L. The wonderful world of rotary root canal preparation. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2001; 92(5): 479.
28. Parashos P, Messer HH. Questionnaire survey on the use of rotary nickel-titanium endodontic instruments by Australian dentists. *Int Endod J* 2004; 37(4): 249-59.
29. Arbab-Chirani R, Vulcain JM. Undergraduate teaching and clinical use of rotary nickel-titanium endodontic instruments: a survey of French dental schools. *Int Endod J* 2004; 37(5): 320-4.
30. Jatzwauk L, Schöne H, Pietsch H. How to improve instrument disinfection by ultrasound. *Journal of Hospital Infection* 2001; 48(Suppl A): S80-S83.

Clinical characteristics of peripheral ossifying fibroma: A series of 20 cases

Mohammad Reza Zarei DDS, MD¹, Nader Navabi DDS, MD²,
Goli Chamani DDS, MD¹, Sepideh Pour-Monajemzadeh DDS³

Original Article

Abstract

BACKGROUND AND AIM: Peripheral ossifying fibroma (POF) is a reactive chronic localized hyperplastic gingival lesion. The present case-series was undertaken to determine the clinical variations in a series of different cases of oral POF.

METHODS: Demographic and clinical data including age, gender, location, color, clinical diagnosis, size, consistency and radiographic view of the lesions were studied among clinical records at school of dentistry in Kerman, Iran, from 1998 to 2012.

RESULTS: A total of 20 POF cases was subjected to clinical analyses, in equal numbers of men and women. The total frequency of POF was 2.5%, and 11 cases (55%) had occurred in the maxilla. POF showed a greater frequency of pink color (60%), anterior location (55%), firm consistency (85%) and a size of 1-1.5 cm (60%). Bone resorption and calcification were found in 35% and 25% of cases, respectively.

CONCLUSION: In comparison with previous studies, despite investigation of similar clinical features of POF in the present study, findings also showed that characteristics such as age, gender and location cannot help in the differential diagnosis of POF from pyogenic granuloma.

KEYWORDS: Peripheral Ossifying Fibroma, Fibroma, Gingiva, Oral Cavity

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Peripheral ossifying fibroma (POF) is a relatively uncommon fibrous lesion of the gingiva. The lesion have named differently by different authors, including fibrous epulis, calcifying fibroblastic granuloma or peripheral fibroma with calcification.¹ The etiology of the lesion, which is considered a non-neoplastic lesion of the gingival tissue, is attributed to irritation and trauma. Despite the fact that this lesion is thought to be relatively common, it accounts for less than 1% of all the oral biopsies.^{2,3}

POF is widely believed to originate from underneath the periodontium from the inflammatory hyperplasia of the periodontal ligament and due to locally irritating factors,

including subgingival accumulation of plaque and calculi, dental appliances, and tooth restorations which have low quality.¹⁻³ However, some investigators believe that hormones might have a role in the lesion because prepubertal patients are rarely affected, and the disease incidence decreases significantly after 30 years of age.²

POF appears as an exophytic lesion on the gingiva and enlarges slowly, most often measuring < 2 cm; however, some lesions might be larger. It occurs in the gingival interdental papilla, with a sessile or pedunculated base; the color might be similar to gingiva or somewhat reddish and the lesion surface might exhibit ulcerations.⁴⁻⁶ In the majority of the studies, the anterior

1- Associate Professor, Department of Oral Medicine, School of Dentistry, Kerman University of Medical Sciences, Kerman, Iran

2- Assistant Professor, Department of Oral Medicine, School of Dentistry, Kerman University of Medical Sciences, Kerman, Iran

3- General Dentist, Private Practice, Kerman, Iran

Correspondence to: Nader Navabi DDS, MD

Email: n_navabi@kmu.ac.ir

maxillary involvement was more than mandible.⁶ The lesion mainly affects women and has a predilection for the second decade of life.⁷ Treatment consists of surgical excision and laboratory examination to confirm the diagnosis.⁸

Review of the literature revealed that mostly of published articles about POF were reports of one case and only five studies in which more than one case have been reported (Table 1).¹⁻²⁷

Table 1. Published articles about reporting POF1-27

Authors	Number of case(s)
Moon et al. ¹	1
Dahiya et al. ²	1
Passos et al. ³	1
Chaudhari and Umarji ⁴	1
Silva et al. ⁵	1
Prasad et al. ⁶	1
Kumar et al. ⁷	1
Walters et al. ⁸	3
Pradeep et al. ⁹	1
Nazareth et al. ¹⁰	1
Sacks et al. ¹¹	1
Mishra et al. ¹²	1
Luvizuto et al. ¹³	1
Trasad et al. ¹⁴	1
Poonacha et al. ¹⁵	1
Das and Azher ¹⁶	1
Yadav and Gulati ¹⁷	1
Farquhar et al. ¹⁸	1
Garcia de marcos et al. ¹⁹	4
Shetty et al. ²⁰	22
Chaturvedy et al. ²¹	1
Barot et al. ²²	1
Khan et al. ²³	1
Childers et al. ²⁴	1
Rallan et al. ²⁵	1
Verma et al. ²⁶	4
Cuisia and Brannon ²⁷	134

POF: Peripheral ossifying fibroma

In study of Cuisia and Brannon,²⁷ a clinical evaluation was made for pediatric cases, and Garcia De Marcos et al.¹⁹ demonstrated immunohistochemical features of four cases of POF, however, it seems that in their study POF was analyzed only from histological point of view. In Iran, four research works carried out by Zarei et al.,²⁸ Ala et al.,²⁹ Amirchaghmaghi et al.³⁰ and Naderi et al.³¹

reported the frequencies of various types of reactive hyperplastic lesions of the oral cavity and none of them focused on POF in their researches.

The clinical behavior of POF is somehow varying from the other oral reactive hyperplastic lesions, for example its high percentage of recurrence after treatment and differential diagnosis of a serious malignancy which is called osteogenic sarcoma from POF must be considered. Moreover in the cases of delayed correct diagnosis, adjacent tooth loss and alveolar bone resorption would be the consequences. Therefore, dentists should be informed about POF, which clinically poses a dilemma for the diagnosis among reactive gingival hyperplastic lesions, especially pyogenic granuloma.^{3,32} Increasing knowledge about the specialized epidemiologic data would be a practical tool for better diagnosis, and this study is the first case series for illustration of clinical features of POF in Iran.

Methods

The present study is a case series. The materials included all the biopsy specimen records of the department of oral medicine, school of dentistry, Kerman University of medical sciences, Kerman, Iran, between 1998 and 2012. The records were reviewed for demographic data and clinical data including sex, age, patient chief complaints, the type, size, location, duration, diagnosis, and histological characteristics of the lesions. To minimize recurrence, excisional biopsy down to the bone had been carried out for all the lesions; hence, the medical charts of patients with confirmed histopathological diagnosis of POF were selected. The paraffin blocks of all the 20 cases were separately analyzed by two oral pathologists again for re-confirmation of the initial diagnoses. The clinical and histopathological diagnoses of POF were made based on the Modified World Health Organization classification.²⁶

At the end, the session was held between

the two pathologists and those cases, which they had a disagreement on diagnosis were determined. Then an agreement was reached regarding these cases after discussion and consultation with another expert pathologist. We also selected the blocks of cases with the final diagnosis of pyogenic granuloma and giant cell granuloma from the mentioned academic archive and these blocks also were reviewed by the two pathologists because of differential diagnosis with POF. Radiologic evaluation for the presence of calcification within the lesions was also confirmed by one oral and maxillofacial radiologist. Data were evaluated by means of descriptive statistics. Patient's data were all kept confidential.

Results

A total of 20 conclusive cases of POF was diagnosed in patients during the research period out of 800 total lesions, clinical and histopathologically diagnosed. The total frequency of POF in this study was 2.5%. Of all the 20 cases of POF studied, half of the cases had occurred in females and half in males. The age range of the patients diagnosed with POF was 11-49 years (Table 2); the mean age was 28.85 years with a standard deviation of ± 12.874 . Of all the patients with POF, the prevalence of POF was similar between the patients under 30 and over 30 years of age; 11 cases had occurred in the maxilla and 11 cases had appeared in the region anterior to canines. The surface of 12 lesions (60%) was smooth, and the remainders had ulcerated surfaces. According to the documented histories, in 13 cases (65%) bleeding occurred during meal or when they brushed their teeth. Majority of lesions (80%) had a sessile bases, 10% were polypoid and justly 2 lesions presented as nodules. Radiographic assessment revealed 7 views of subjacent alveolar bone resorption and also 5 views of calcification. On the whole, 11 cases had had the lesions for more than 1 year. A tendency to bleed during clinical examination was seen only in 4 cases,

Table 2. The patient demographics and statistical data obtained in this study

Variable	Category	n (%)
Age (year)	< 30	10 (50)
	≥ 30	10 (50)
Gender	Male	10 (50)
	Female	10 (50)
Jaw	Maxilla	11 (55)
	Mandible	9 (45)
Location	Anterior	11 (55)
	Posterior	9 (45)
Color	Pink	12 (60)
	Red	8 (40)
Clinical diagnosis	POF	10 (50)
	PG	8 (40)
	Irritation fibroma	1 (5)
	GCG	1 (5)
Adjacent teeth	Mobility	9 (45)
	Diastema	7 (35)
	Both	2 (10)
Size (cm)	< 1	4 (20)
	1-1.5	12 (60)
	> 1.5	4 (20)
Consistency	Firm	17 (85)
	Bony hard	2 (10)
	Rubbery	1 (5)
Radiographic view	Bone resorption	7 (35)
	Calcification	5 (25)
	Both	3 (15)

POF: Peripheral ossifying fibroma; PG: Pyogenic granuloma; GCG: Giant cell granuloma

and a history of rapid growth was reported from only 1 patient.

All the cases were followed up for 2 years after the surgical treatment; hence three cases reported that their lesion had recurred in this period. Almost all the patients were systemically healthy and only three patients were medically compromised (one ischemic heart disease case, one diabetes mellitus case and one asthma case).

In one of our cases, 29-year-old male, intraoral examination showed a sessile, bony hard, non-tender, pinkish lump in gingiva, extended from the second permanent premolar to the second permanent mandibular left molar, occupied entire left buccal vestibule. The lesion was 4 cm $\times$ 3 cm (Figure 1). Occlusal radiographic view of the involved region showed calcification within the soft tissue mass (Figure 2). Histological

picture of the lesions revealed the islands of odontogenic epithelium and focal areas of calcified tissue within the area of highly cellular fibrous connective tissue showing collagen fibers and proliferating plump fibroblasts. Subepithelial connective tissue was infiltrated with chronic inflammatory cells (Figure 3).



Figure 1. Clinical Presentation of one of the cases

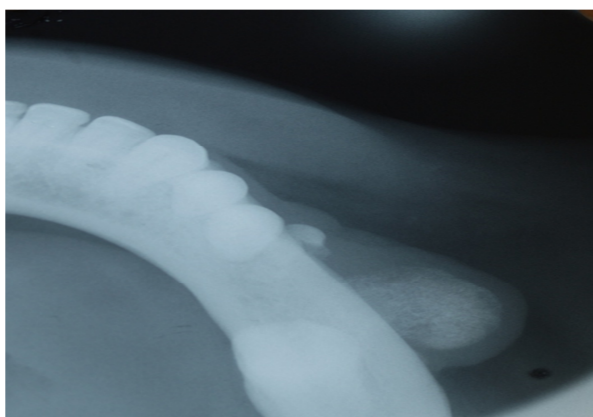


Figure 2. Radiographic view of the same case

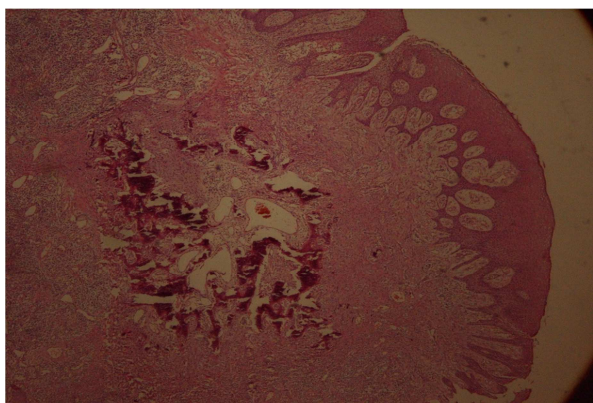


Figure 3. Histopathologic view of the same case

Discussion

The most frequent lesions in the oral cavity are exophytic lesions of the gingiva; however, almost all the documented POF cases in the literature are case reports.^{1-18,32} Shetty et al., in a review of 22 cases reported a number of clinical and pathological manifestations of POF.²⁰ Therefore, it seems that the present study is the second review in the literature with considerable sample size for clinical analysis of POF.

The reported rate of POF among total lesions of the oral mucosa (2.5%) is higher in the present study than that reported before (< 1%).^{2,3} This difference may be due to the some etiologic factors especially poor oral hygiene. In the present investigation, significant number of POF lesions exhibited long evolution periods and lasted much longer than similar lesions, such as pyogenic granuloma and peripheral giant cell granuloma, which is consistent with the report made by Salum et al.³³

A tendency to bleed and bony hard consistency, which are all important clinical keys to make a distinction between pyogenic granuloma and POF, were seen in a small number of cases in the present study. Due to lack of distinguishing clinical manifestations in the group of cases, it is not possible to distinguish between pyogenic granuloma and POF peculiarly based on clinical symptoms. Similarly, Pradeep et al. believe that POF might be easily confused with a pyogenic granuloma and calcification, which is considered its most important histopathologic feature, might finally help make a distinction between it and other fibrous lesions.⁹

We described diagnostic radiographic views of POF in almost 12 of our cases, which is consistent with the report made by Shetty et al. In other words, those researchers reported that almost 90% of the lesions did not exhibit any radiographic manifestations.²⁰ The technique used was periapical for all the cases; however, several researchers have

reported CT and MRI findings of very large POF lesions.¹⁴

The size of the majority of cases in the present study was 1-1.5 cm, which was remarkable, consistent with the results of a study carried out by Shetty et al.,²⁰ however, in the reported case of Nazareth et al. the size was significantly larger than the average lesion.¹⁰ Sacks et al. described a "gigantiform" POF measuring 10.5 cm in an edentulous patient, resulting in gross facial asymmetry and occupying most of the oral cavity.¹¹

In the present study, 7 cases out of 20 showed the dislocation of one or two adjacent teeth. Mishra et al. reported a POF in a 45-year-old female patient, with displacement of almost all the mandibular anterior teeth (centrals, lateral incisors, and canines). This pattern of adjacent teeth displacement reported by Mishra et al. is very rare in POF.¹² All the patients in the present study had been treated by traditional excisional biopsy; however, Luvizuto et al. reported a clinical case in which a POF lesion underwent excisional biopsy, with a subepithelial connective tissue graft placed to satisfactorily repair the defect after biopsy.¹³

The post-operative recurrence rate for POF was 15% in this study. All these recurrences had happened in a mean period of 1 year after first surgery while Trasad et al. reported one POF that exhibited recurrence 2 months after

the surgical treatment.¹⁴ A similar recurrence rate of 16–20% has been reported in the other studies, which is believed to be high for a benign reactive lesion. Different reasons have been reported for recurrence, including: (a) partial surgical removal of the nodule; (b) persistence of local irritating factors; and (c) lack of adequate access to POF lesions in interdental areas. Deep excision is advocated because of the high recurrence rate.^{9,10}

In the present study, POF showed no gender and age predilection and POF was distributed with minor differences between the two jaws. These results differ from those of other studies; for example Shetty et al. reported a higher incidence in females (73%), and the majority of lesions had occurred in the second and third decades of life and in the maxillary anterior region.²⁰

Conclusion

Further studies are necessary to determine whether the discrepancies above can be explained by geographic factors and/or different sample sizes in different studies.

Conflict of Interests

Authors have no conflict of interest.

Acknowledgments

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References

1. Moon WJ, Choi SY, Chung EC, Kwon KH, Chae SW. Peripheral ossifying fibroma in the oral cavity: CT and MR findings. *Dentomaxillofac Radiol* 2007; 36(3): 180-2.
2. Dahiya P, Kamal R, Saini G, Agarwal S. Peripheral ossifying fibroma. *J Nat Sci Biol Med* 2012; 3(1): 94-6.
3. Passos M, Azevedo R, Janini ME, Maia LC. Peripheral cemento-ossifying fibroma in a child: a case report. *J Clin Pediatr Dent* 2007; 32(1): 57-9.
4. Chaudhari S, Umarji HR. Peripheral ossifying fibroma in the oral cavity: MRI findings. *Case Rep Dent* 2011; 2011: 190592.
5. Silva CO, Sallum AW, do Couto-Filho CE, Costa Pereira AA, Hanemann JA, Tatakis DN. Localized gingival enlargement associated with alveolar process expansion: peripheral ossifying fibroma coincident with central odontogenic fibroma. *J Periodontol* 2007; 78(7): 1354-9.
6. Prasad S, Reddy SB, Patil SR, Kalburgi NB, Puranik RS. Peripheral ossifying fibroma and pyogenic granuloma. Are they interrelated? *N Y State Dent J* 2008; 74(2): 50-2.
7. Kumar SK, Ram S, Jorgensen MG, Shuler CF, Sedghizadeh PP. Multicentric peripheral ossifying fibroma. *J Oral Sci* 2006; 48(4): 239-43.
8. Walters JD, Will JK, Hatfield RD, Cacchillo DA, Raabe DA. Excision and repair of the peripheral ossifying fibroma: a report of 3 cases. *J Periodontol* 2001; 72(7): 939-44.

9. Pradeep AR, Guruprasad CN, Agarwal E. Peripheral ossifying fibroma: case report. *N Y State Dent J* 2012; 78(4): 52-5.
10. Nazareth B, Arya H, Mohanty R. Peripheral Ossifying fibroma: a clinical report. *J Calif Dent Assoc* 2012; 40(9): 749-51.
11. Sacks HG, Amrani S, Anderson K. "Gigantiform" peripheral ossifying fibroma: report of a case. *J Oral Maxillofac Surg* 2012; 70(11): 2610-3.
12. Mishra MB, Bhishen KA, Mishra S. Peripheral ossifying fibroma. *J Oral Maxillofac Pathol* 2011; 15(1): 65-8.
13. Luvizuto ER, Da Silva JB, Luvizuto GC, Pereira FP, Faco EF, Sedlacek P, et al. Peripheral ossifying fibroma. *J Craniofac Surg* 2012; 23(1): e7-10.
14. Trasad VA, Devarsa GM, Subba Reddy VV, Shashikiran ND. Peripheral ossifying fibroma in the maxillary arch. *J Indian Soc Pedod Prev Dent* 2011; 29(3): 255-9.
15. Poonacha KS, Shigli AL, Shirol D. Peripheral ossifying fibroma: A clinical report. *Contemp Clin Dent* 2010; 1(1): 54-6.
16. Das UM, Azher U. Peripheral ossifying fibroma. *J Indian Soc Pedod Prev Dent* 2009; 27(1): 49-51.
17. Yadav R, Gulati A. Peripheral ossifying fibroma: a case report. *J Oral Sci* 2009; 51(1): 151-4.
18. Farquhar T, MacLellan J, Dymment H, Anderson RD. Peripheral Ossifying Fibroma: A Case Report. *JADC* 2008; 74(9): 809-13.
19. Garcia de Marcos JA, Garcia de Marcos MJ, Arroyo RS, Chiarri RJ, Poblet E. Peripheral ossifying fibroma: a clinical and immunohistochemical study of four cases. *J Oral Sci* 2010; 52(1): 95-9.
20. Shetty DC, Urs AB, Ahuja P, Sahu A, Manchanda A, Sirohi Y. Mineralized components and their interpretation in the histogenesis of peripheral ossifying fibroma. *Indian J Dent Res* 2011; 22(1): 56-61.
21. Chaturvedy V, Gupta AK, Gupta HL, Chaturvedy S. Peripheral ossifying fibroma, some rare findings. *J Indian Soc Periodontol* 2014; 18(1): 88-91.
22. Barot VJ, Chandran S, Vishnoi SL. Peripheral ossifying fibroma: A case report. *J Indian Soc Periodontol* 2013; 17(6): 819-22.
23. Khan FY, Jan SM, Mushtaq M. Multicentric peripheral ossifying fibroma: A case report and review of the literature. *J Indian Soc Periodontol* 2013; 17(5): 648-52.
24. Childers EL, Morton I, Fryer CE, Shokrani B. Giant peripheral ossifying fibroma: a case report and clinicopathologic review of 10 cases from the literature. *Head Neck Pathol* 2013; 7(4): 356-60.
25. Rallan M, Pathivada L, Rallan NS, Grover N. Peripheral ossifying fibroma. *BMJ Case Reports* 2013; 2013.
26. Verma E, Bhimashankar Chakki A, Chandrashekar Nagaral S, Kumar Ganji K. Erratum to: "Peripheral Cemento-Ossifying Fibroma: Case Series Literature Review". *Case Rep Dent* 2013; 2013.
27. Cuisia ZE, Brannon RB. Peripheral ossifying fibroma--a clinical evaluation of 134 pediatric cases. *Pediatr Dent* 2001; 23(3): 245-8.
28. Zarei MR, Chamani G, Amanpoor S. Reactive hyperplasia of the oral cavity in Kerman province, Iran: a review of 172 cases. *Br J Oral Maxillofac Surg* 2007; 45(4): 288-92.
29. Ala AA, Vosough HS, Harasi B, Janani M, Mahmoudi SM. Reactive hyperplasia of the oral cavity: a survey of 197 cases in Tabriz, northwest Iran. *J Dent Res Dent Clin Dent Prospects* 2010; 4(3): 87-9.
30. Amirchaghmaghi M, Mohtasham N, Mosannen Mozafari P, Dalirsani Z. Survey of Reactive Hyperplastic Lesions of the Oral Cavity in Mashhad, Northeast Iran. *J Dent Res Dent Clin Dent Prospect* 2011; 5(4): 128-31.
31. Naderi NJ, Eshghyar N, Esfahanian H. Reactive lesions of the oral cavity: A retrospective study on 2068 cases. *Dent Res J (Isfahan)* 2012; 9(3): 251-5.
32. T R C, Singh AP, Jathar PN, Kulkarni AU. Peripheral ossifying fibroma: dilemma in diagnosis. *BMJ Case Rep* 2012; 2012.
33. Salum FG, Yurgel LS, Cherubini K, De Figueiredo MA, Medeiros IC, Nicola FS. Pyogenic granuloma, peripheral giant cell granuloma and peripheral ossifying fibroma: retrospective analysis of 138 cases. *Minerva Stomatol* 2008; 57(5): 227-32.

