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1. Hori A, Poureslami HR, Parirokh M, Mirzazadeh A, Abbott PV. The ability of diagnostic sensibility tests to evaluate pulp vitality in primary teeth. Inter J Paedia Dent 2011; 21(6):441-5.

Chapter in a Book

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

Book

Neville BW, Damm DD, Allen CM, Bouquot JE. Oral and maxillofacial pathology. 2nd ed. Philadelphia: W.B Saunders Co.; 2002. pp. 533-87.

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ProRootMTA safety data sheet. Available at: http://store.maillefer.com/lit2/pdfs/MTA-MSDS-W_01-02C.pdf. Accessed November 27, 2009.

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A systematic review of questionnaires used on oral health knowledge, attitude, and practice in 12-year-olds

Maryam Rad DDS, MSc¹, Arash Shahravan DDS, MSc²,
Ali Akbar Haghdoost MD, PhD³

Review Article

Abstract

BACKGROUND AND AIM: National oral health knowledge, attitude, and practice (KAP) data among 12-year-old children need nation-wide programs to help promote oral health. In most countries, oral epidemiologic data are collected by self-administered structured questionnaires. The aim of this study was to undertake a systematic review of the existing literature about questionnaires used for analyzing the oral health knowledge, attitude, and behavior profile of the 12-year-old children.

METHODS: The search was conducted in PubMed and Google Scholar search engines. The Medical Subject Heading (MeSH) search was performed applying singularly and by combining the following terms retrieved from the MeSH browser provided by MEDLINE: “Knowledge, awareness, attitude, practice, behavior, 12-year-old children, oral health.”

RESULTS: Of 176 records found, 29 evaluated oral health KAP in 12-year-old children by structured questionnaires. The most important questions on knowledge (23 of 29 questionnaires) included some items which are focused on the importance of preserving natural teeth, effects of brushing, and sweets and soft drinks on the dentition. The most common questions on practice (28 questionnaires) were brushing activity and dental visits. The attitudes were evaluated by questions about fear of dental treatment, opinion about dentists and dental care (10 questionnaires).

CONCLUSION: Considering differences in the available questionnaires showed that despite the importance of promotion of oral health by increasing knowledge, and improving attitudes and practice in 12-year-old children, more work is needed to form a standard questionnaire.

KEYWORDS: Oral Health; Knowledge; Attitude; Behavior; Review

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Dental caries and gum disease are the most common diseases in human populations that affecting over 80% of school children in some countries.^{1,2} During the past decades, the common consensus from many reports was that prevalence of dental caries in children and adolescents had declined significantly in developed countries in contrast to developing countries.^{3,4} There are, however, recent studies

that clearly indicates a marked increase in the prevalence of dental caries in many countries. It appears that the main reasons for this global increase are unhealthy dietary habits, and inadequate oral hygiene practices.⁵

To prevent and control oral diseases, improvements in knowledge, attitudes, and behaviors related to oral health among school children have been recommended by the World Health Organization (WHO).⁶ The

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12-year age group is especially important as it is the age at which all the permanent teeth, except the third molars, have erupted. Therefore, this age has been selected as the global monitoring age for caries for international comparisons and future planning of oral health programs.⁷

To promotion of the oral health, the planning and assessing of school-based oral health programs would be needed. For planning these programs, analysis of the oral health situation including information on oral health knowledge, attitude, and practice (KAP), would be essential.⁸ Despite the high rate of dental caries in 12-year-old,⁹ socio-epidemiologic data about oral health behavior of children are not available at national level. Therefore, KAP studies to collect such information and the assessment of oral health in children and adolescents are considered to be an essential prerequisite.

In most countries, oral epidemiologic data about KAP were collected by self-administered structured questionnaires.^{6,8} In some studies, the construction of questionnaires has been based on experiences gained from surveys carried out by the WHO. These questionnaires vary widely in terms of the number of items and format of questions and responses. Therefore, there is a need for a standard questionnaire. The aim of this study was to carry out a systematic review of the existing literature on these questionnaires. This report is a part of a study with the aim of designing an appropriate questionnaire for the analysis of oral health behavior profile of 12-year-old children.

Methods

A computerized search was conducted using PubMed, Google Scholar between January 01, 2002, and August 31, 2013. The Medline search uses a complex search strategy, including Medical Subject Heading (MeSH). After initial evaluations, main keywords (knowledge, attitude, behavior, practice, oral health, questionnaire, and 12-year-old children) in

both singular and combined types were determined by MESH system. "OR" between the synonyms and "AND" between the main keywords were used to import the keyword combinations in the reviewed sites.

In addition, a search was conducted on Google Scholar with the same keywords and relevant studies cited in the reference lists of the selected papers were considered. First, the exclusion criteria of the irrelevant articles were applied in the three steps of title, abstract, and the full-text. The full-texts of all the related studies were assessed by one author. If there was any doubt or question, there was consultation with corresponding author/epidemiologist and statistical advisor. After that all the full-texts of the relevant articles were reviewed carefully, and the references of all selected articles were reviewed to identify any additional studies. A guideline for conducting a KAP study was used to evaluate the quality of articles.¹⁰ Based on this guideline, steps in the preparation of a KAP study are: (1) domain identification, (2) question preparation, and (3) validation of questions. Validation of questions should be aimed at assessing their ease of comprehension, relevance to their intended topics, effectiveness in providing useful information, and the degree to which the questions are interpreted and understood by different individuals.

Unpublished studies and abstracts were not considered for inclusion in this systematic review. Full-text of three studies was not available and in spite of attempts to contact the authors, this not achieved, so these studies were excluded from the study. Finally, 29 out of 496 articles remained at the end of these steps (Figure 1).

All items in knowledge, practice, and attitudes areas were determined, and the number of items and format of questions and responses were reviewed. Finally, the questions were categorized based on different items in three areas of knowledge, practice or behavior, and attitudes.

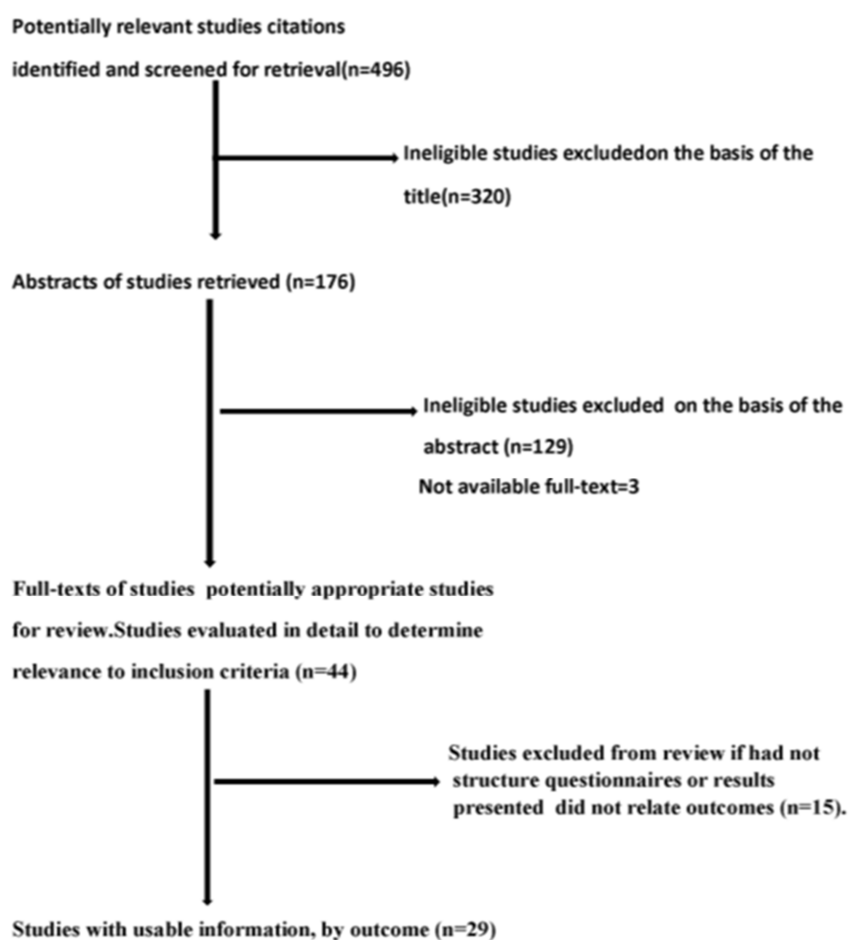


Figure 1. Flow diagram of studies of knowledge, attitude, and practice on oral health among 12-year-old children consisted for inclusion

Results

First, we identified 496 citations meeting our search criteria. From these articles, 29 evaluated oral health in 12-year-old children by structured questionnaires.^{3,4,6,8,11-35} Table 1 shows information about the name of the first author, country, year of publication, the age of subjects, and sample size of each study. In the most studies, the survey instrument was an administered pre-tested questionnaire. Knowledge questions have been asked in 23 of 29 articles. The characteristics of questionnaires have been shown by figure 2. Figure 2 indicates that only 48.3% of articles have reported on the validity and reliability of structured questionnaires, and the number and form of questions and responses were highly variable.

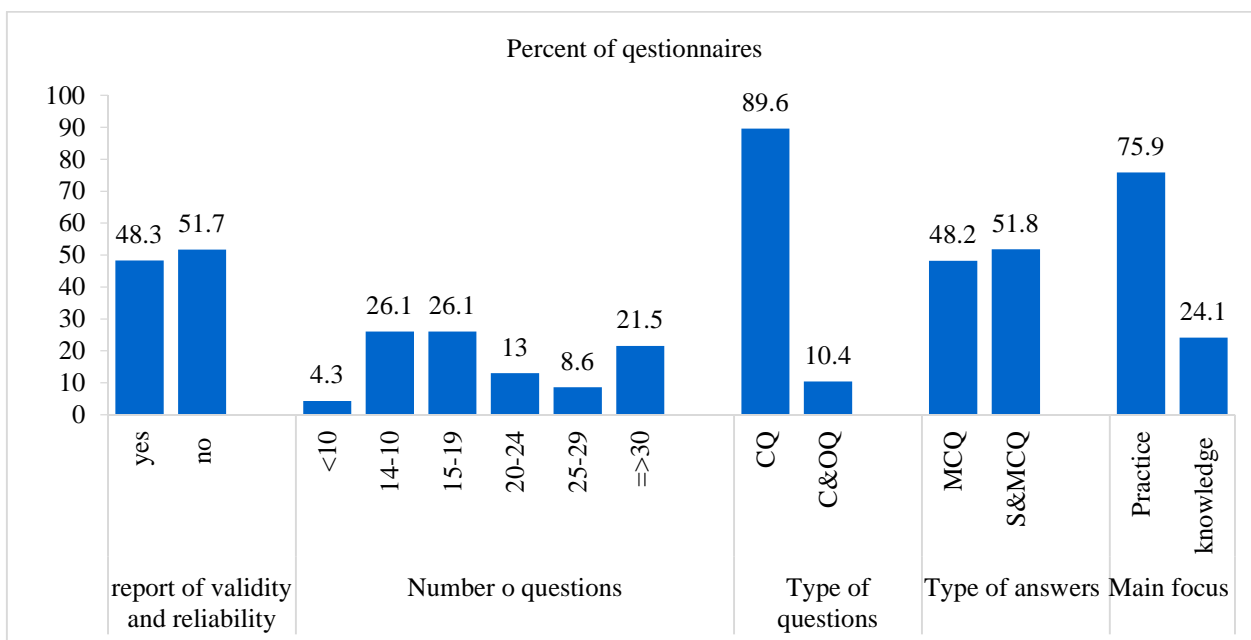
Knowledge area

The most important questions on knowledge included items on the importance of preserving natural teeth, effects of brushing and using fluoridated toothpaste, the meaning of bleeding gums and caries and how to protect against it, and the effects of sweets and soft drinks on the dentition. Table 2 shows the importance of keeping natural teeth of knowledge area (7 different formats) and knowledge of sweet and soft drink effects on the dentition (3 different formats).

One important and common aspect of knowledge questions was about the role of fluoride in oral health, which were addressed in five formats, but the dominant one was: "The use of fluoride prevents tooth decay; true/false/do not know."

Table 1. Characteristics of studies included in review

First author	Country	Age (year)	Sample size (n)
Rajab et al. ²²	Jordan	6-16	1556
de Almeida et al. ¹¹	Portugal	6 and 12	800 (12-year-old)
Zhu et al. ⁴	China	12-18	4400
Varenne et al. ³¹	Burkina Faso	12	505
Al-Omiri et al. ³⁵	North Jordan	10-16	557
Ahmed et al. ³⁴	Iraq	12	392
Grewal and Kaur ¹⁵	India	11-16	200
Singh ¹⁷	India	5-12	377
Smyth et al. ¹²	Spain	12	1105
Harikiran et al. ⁸	India	11-12	212
Kawamura et al. ²⁴	Japan	4-12	1584
Ouma and Martha ³²	Soweto	6-12	336
Petersen et al. ²¹	Chin	11-15	2662
Jürgensen and Petersen ²⁸	Laos	12	621
Granville-Garcia et al. ²⁷	Brazil	10-19	679
Hysi et al. ²⁵	Albania	12	372
Lian et al. ²³	Sarawak	12	209
Prasad et al. ³⁰	India	12-15	652
Shenoy and Sequeira ¹⁸	India	12-13	415
Diwan et al. ¹³	India	3-19	798
Vakani et al. ¹⁶	Pakistan	11-12	300
Gathecha et al. ²⁶	Kenya	12	639
Haleem et al. ¹⁴	Pakistan	10-12	1517
Mehta and Kaur ⁶	India	12	440
Mafuvadze et al. ³³	Zimbabwe	12	205
Prasai et al. ¹⁹	Nepal	5-16	361
Sharada et al. ²⁰	India	12-13	514
de Silva-Sanigorski et al. ²⁹	Australia	5-6 and 11-12	377
Suprabha et al. ³	India	11-13	858

**Figure 2.** The characteristics of questionnaires

CQ: Closed question; C and OQ: Closed and open question; MCQ: Multiple choice question; S and MCQ: Combination short and multiple choice question

Table 2. The item “importance of keeping natural teeth” and “effects of sweets and soft drinks on the dentition” of knowledge questions

Questions	Questionnaires
1. Keeping natural teeth is important for general well-being a. True b. False c. Do not know	India-Mangalore ³ Mofolo, Soweto ³¹ India-Mangalore ¹⁷
2. Do you think keeping your mouth clean and healthy is good for health? a. Yes b. No c. Do not know	Panchkula, India ⁶ China ⁴ Karachi ¹⁵ India ¹⁶
3. General body health has a relationship to oral health and dental diseases a. True b. False	Kuching, Sarawak ²² Jordan ³⁴
4. Keeping natural teeth is not that important a. Agree b. Disagree c. Do not know	India-Bangalore ⁸ Burkina Faso-Africa ³⁰
5. Teeth are an important part of your body a. Agree b. Disagree c. Do not know	Panchkula, India ⁶ Japan ²³
6. Natural teeth are better than false teeth a. True b. False c. Do not know	India-Mangalore ³
7. Keeping natural teeth is not that important a. Agree b. Disagree c. Do not know	Burkina Faso-Africa ³⁰
8. Sugar causes tooth decay a. A lot b. Quite a lot c. Not much d. Not at all	India-Mangalore ³ India-Mangalore ¹⁷ Kuching, Sarawak ²² Zimbabwe ³² Nepal ¹⁸ India ¹⁹ Jordan ³⁴
9. Eating and drinking sweet food does not cause decay a. True b. False c. Do not know	India-Mangalore ³ India-Bangalore ⁸ Panchkula, India ⁶
10. Do you know which of the following food items is/are the main cause of tooth decay? a. Sweets/chocolates/biscuits/cakes/chips/waffers b. Fresh fruits c. Raw vegetables d. Do not know	Karachi ¹⁵ India ¹⁶ Australia ²⁸

Attitude area

Attitude questions had been asked by 10 articles. The attitudes toward oral health have been evaluated by questions on the importance of natural teeth (Table 3), fear of dental treatment, feelings regarding the treatment, thoughts about involvement in the dental treatment, opinion about and attitudes toward dentists

and dental care and regular dental visits.

Questions on the importance of natural teeth were asked in several ways. The most common questions in this item were:

1. Decay makes my teeth look bad:
 - a. Fully agree
 - b. Agree
 - c. Disagree

Table 3. The items of attitude question about importance of natural teeth

Questions	Questionnaires
1. It is important to take care of my teeth a. Fully agree b. Agree c. Disagree d. Fully disagree e. No opinion	Spain ¹¹
2. You care about your teeth as much as any part of your body a. Yes/no	Jordan ³⁴
3. Decay makes my teeth look bad a. Fully agree b. Agree c. Disagree d. Fully disagree e. No opinion	India-Bangalore ⁸ Spain ¹¹ India ¹⁶ 13-Jordan ³⁴
4. Dental problems can cause other health problems a. Fully agree b. Agree c. Disagree d. Fully disagree e. No opinion	Japan ²³
5. Dental problem can be serious a. Fully agree b. Agree c. Disagree d. Fully disagree e. No opinion	Japan ²³
6. Dental disease is less important than other health problems a. Fully agree b. Agree c. Disagree d. Fully disagree e. No opinion	Japan ²³
7. It is natural for people to lose all their teeth in old age a. Fully agree b. Agree c. Disagree d. Fully disagree e. No opinion	Japan ²³
8. Milk teeth are not important because they fall out soon a. Fully agree b. Agree c. Disagree d. Fully disagree e. No opinion	Japan ²³
9. I am able to prevent my teeth from decaying a. Fully agree b. Agree c. Disagree d. Fully disagree e. No opinion	Japan ²³

- d. Fully disagree
- e. No opinion.

Practice area

The practice of 12-year-old children has been assessed by 28 articles. The most common questions about the practice were tooth brushing habits (TBH) (such as frequency, duration, and brushing aides) (Table 4), the frequency of sugar consumption and drinking soft drinks, and dental visits (such as regularity, reasons behind the visits and the effect of pain on the first visit). Questions in some of the items had almost the same form. Table 3 shows the item TBH of practice

questions. In this item although questions were asked almost the same format, but the number of questions was different. In some studies, the details of brushing activity such as time of brushing, type of toothpaste, and frequency in a change of toothbrush were determined. The most common question in this item was:

2. How often do you brush your teeth?
 - a. Less than once a week
 - b. Once a week
 - c. 2-3 times a week
 - d. Twice or more a day
- Every day do not know/no answer.

Table 4. The item of brushing activity of practice questions

Questions	Questionnaires
1. How often you brush your teeth? a. Less than once a week b. Once a week c. 2-3 times a week d. Every day e. Twice or more a day f. Do not know/no answer	China ⁴ Panchkula, India ⁶ India-Bangalore ⁸ Uttarakhand-India ¹² Amristar, India ¹⁴ Kuching, Sarawak ²² Albania ²⁴ Kenya ²⁵ Laos ²⁷ Australia ²⁸ Mofolo, Soweto ³¹ Jordan ³⁴
2. How many times you brush daily? a. Less than once per day b. Once per day c. Twice per day d. More than twice per day	India-Mangalore ³ Portugal ¹⁰ Pakistan ¹³ Karachi ¹⁵ India ¹⁶ India-Mangalore ¹⁷ Nepal ¹⁸ Brazil ²⁶ Zimbabwe ³² Iraq ³³ Spain ¹¹
3. The last time I brushed my teeth was a. Today/yesterday/day b. Before yesterday/more than 2 days ago	
4. Type of brush a. Plastic toothbrush b. Charcoal/chew sticks c. Miswak/wooden d. Plastic toothpicks/finger/brush e. Finger/do not know/no	India-Mangalore ³ Uttarakhand-India ¹² Thiruchengode-India ²⁹

Table 4. The item of brushing activity of practice questions (Continue)

Questions	Questionnaires
5. Which of the following do you use for cleaning your teeth? a. Toothbrush b. Finger c. Chew stick/miswak	India-Mangalore ³ Panchkula- India ⁶ India-Bangalore ⁸ Uttarakhand-India ¹² Pakistan ¹³ Amristar, India ¹⁴ India ¹⁶ Nepal ¹⁸ Kenya ²⁵ Mofolo, Soweto ³¹ Jordan ³⁴
6. Type of toothpaste a. Fluoridated b. Non-fluoridated c. Do not know	India-Mangalore ³ China ⁴ India-Bangalore ⁸ Amristar, India ¹⁴
Started brushing teeth: Before schooling when attending primary school after completing primary school	China ⁴ Mofolo, Soweto ³¹
7. Rinse your mouth after each meal a. Yes b. No	India ¹⁶ India-Mangalore ¹⁷ Thiruchengode-India ²⁹
8. Time of brushing a. Morning only b. Morning and night c. Night only d. After every meals	India-Mangalore ³ China ⁴ Jordan ³⁴
9. When will you change your toothbrush? a. 1-3 months b. 4-6months c. 1 year d. Above/after bristles e. Splayed/do not know	India-Mangalore ³ India ¹⁶ India-Mangalore ¹⁷ Thiruchengode-India ²⁹
10. Do you use any other oral hygiene aids? a. Dental floss b. Interdental brush c. Toothpicks d. Mouthwash e. None f. Do not know	Amristar, India ¹⁴ India ¹⁶

Discussion

Based on strong evidence, in developing countries, oral hygiene is one of the main health considerations.^{4,36} Therefore, repeated KAP studies is highly recommended to monitor trends; however, a valid and culturally adapted questionnaire is one of the main pre-requisites. This systematic

review showed that despite the importance of the 12-year age group, there is not a standardized questionnaire for evaluating oral health knowledge, attitude, and behavior in these children.

In the majority of studies (51.7%), there was not a report on validity and reliability of questionnaires. Furthermore, these tools vary

widely in terms of the number of items and format of questions and responses. However, there was the high similarity between the content of questionnaires. The most similarity was between practice questions, and the least one was between attitude questions. The most common format of questions was a combination of multiple choices and yes-no answers, and the most of the questions were asked in closed-ended format. The number of questions had a wide range. The most common number of questions was 10-14 and 15-19. Perhaps the reason is some studies that have assessed only one or two areas. It seems that an appropriate and comprehensive questionnaire that evaluate KAP (different domains such as brushing habits, diet, and dental visits), should contain 30 questions. The further questions could be boring for children, and they may not respond properly and accurately to all questions and with fewer questions may not adequately assess all aspects of KAP on oral health. In most studies, knowledge questions were asked before the others,^{16,17} but in some studies, there was not a regular sequence to ask questions.³² It seems reasonable that the level of knowledge was measured first and then the practice and attitude on oral health.

In a suitable questionnaire, the knowledge questions should be included some items on the effects of sweets and soft drinks on the dentition, the importance of preserving natural teeth, the effect of brushing, using fluoridated toothpaste, and the importance of flossing. It is better to response the knowledge questions with both short (yes or no or true or false) and multiple choice forms depending on the type of question. The results of this review showed that despite the importance of flossing to prevent tooth decay, only a limited number of studies have asked about knowledge on using dental floss. Furthermore, in some of studies, knowledge and attitude questions were mixed together without logical procedure.³²

As mentioned earlier in this review,

knowledge questions were asked in several ways. The most important questions were about knowledge of diet effect on tooth caries. It seems that the best form of question was:

3. Do you know which of the following food items is/are the main cause of tooth decay?

- a. Sweets/chocolates/biscuits/cakes/chips/wafers
- b. Fresh fruits
- c. Raw vegetables
- d. Do not know

Although this form of the question was only used by three studies, but because the answers were multiple choice and include a variety of snacks, it appears to be more acceptable for children.

It obvious that an appropriate questionnaire should be included more questions with multiple choice answers in the area of practice. Because this area measures different domains such as brushing habits, the frequency of sugar consumption and drinking soft drinks, and dental visits. In this systematic review, some of the articles only evaluated the practice of children (7 article), and the most of other studies have focused on the practice of oral health in comparison with knowledge and attitude. It seems that the reason of this emphasis on practice is that most of the studies have been shown that the practice is not fully explained by knowledge and attitude, and the oral healthcare practice is influenced by socioeconomic factors, especially mother's education level and location where the children live (urban and rural).^{3,12} In this review, the most studies measured the TBH with questions about the frequency, duration, and brushing aides; in only two articles type of cleaning of teeth and type of brushing have been evaluated. The most important question about TBH was about the correct number of brushing. It seems that the best form of question about this subject was:

4. How often do you brush your teeth? (13 studies)

- a. Less than once a week
- b. Once a week
- c. 2-3 times a week
- d. Every day
- e. Twice or more a day
- f. Do not know/no answer.

Answers of this question were more complete and included a wider range of time than other forms of questions.

Furthermore, in a perfect questionnaire, the attitude questions should be included items about the importance of natural teeth, and fear of dental treatment and opinions about and attitudes toward dentists and dental care. It is better to response these questions as three Likert-scale questions (agree, disagree, no opinion). In this review, the attitudes of 12-year-old have been evaluated in 10 articles. It seems that although attitude about fear of the dentist and experience on a dental visit could be effective on oral health practice, less emphasis has been placed on this topic. This, may be due to the fact that, oral health attitude does not necessarily relate to better health behavior.^{12,13}

Although there are studies in Portugal, Japan, and Spain, but most studies have been conducted in developing countries. However, it can be due to effective networking within the schools, and appropriate and comprehensive school-based educational programs in developed countries. In developing countries, it appears that even in a community, for example, India that many studies have been conducted about this subject,^{3,6,8,17,19} there was not a standard questionnaire and researchers collected data by self-administered structured questionnaires.

According to the above stated, the importance of knowledge on oral health and the role of improving knowledge as a prerequisite for oral health perception and behavior, a standard questionnaire, particularly in the area of knowledge and attitude, is an urgent need. This questionnaire must be comprehensive and

should include different items in each area, but it appears that this issue has not been considered by researchers even in the different area of one country.

Therefore, it is recommended that further countrywide intensive studies should be carried out to compare national and international oral health knowledge, practice, and attitude in this age group. These studies should use an appropriate and accurate questionnaire-based on the culture of their country. Results of this systematic review can help researchers to select the best version of questions in each item and to design an appropriate questionnaire for this group.

Before drawing any conclusion, limitations of this study are worth mentioning. In this study, there was the lack of access to some of the full-text articles and in spite of attempts to contact the authors, this not achieved, so these studies were excluded from the study. Moreover, in some full-text articles, the questionnaires were not available, and the results were presented in the tables. We tried to contact the authors and get the questionnaires but did not receive a response, so the questions were extracted from the tables. Another limitation of this study was that we just searched for studies in English, and we did not have access to non-English studies.

Conclusion

It seems that, despite the importance of promotion of oral health by improving KAP in 12-year-old children, there is not a standard questionnaire. Therefore, it is absolutely necessary to design a standard questionnaire to evaluate KAP in this age group of children.

Conflict of Interests

Authors have no conflict of interest.

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The frequency of using different types of pacifier and bottle nipple among 1-24 months old children

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Original Article

Abstract

BACKGROUND AND AIM: Sucking of some types of a pacifier may be a risk factor for mal-development of orofacial structures and malocclusion. This study assessed the prevalence of using of different types of pacifier and bottle nipple among 1-24 months old children in Kerman, Iran.

METHODS: In this cross-sectional study, a total of 300 mothers interviewed at 20 specialized private pediatric offices in Kerman. The mothers had 1-24 months old children. A checklist includes items about pacifier sucking, bottle feeding habits, as well as mothers' ability to recognize different kinds of available pacifier and bottle nipple was used.

RESULTS: The rate of pacifier-sucking was 37.3%, and use of bottle feeding was 42.3%, and among of the users, 24.0 and 35.7% were used orthodontic (functional) types of pacifier and bottle nipple respectively. However, only 28.7% of mothers had adequate ability to recognize orthodontic pacifier and bottle nipple.

CONCLUSION: The rates of using orthodontic kind of pacifier and bottle nipple were low, and a few mothers had adequate ability to recognize their differences.

KEYWORDS: Pacifier; Bottle Feeding; Bottle Nipple; Breast Feeding; Sucking Habits

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Sucking habit is an action that starts in the beginning of life and normally stop until 3.5 years old. Sucking habit is generally in two forms: Nutritive and non-nutritive.¹ Non-nutritive sucking is a natural reflex for infants and newborns. Babies with limited breastfeeding satisfy their instinct sucking with a pacifier or other habits such as finger sucking.^{1,2} Among non-nutritive habits, using a pacifier is very common. It was reported by a prevalence of 75-79% in industrialized western countries in recent decades. Hence, nutritive and non-nutritive sucking habit seem to be associated with cultural and economic factors that affect

the population.³

According to different studies, using of a pacifier can be profitable until 6 month year olds. The some of its advantages include: Analgesic and relaxation effects, shorter hospital stay for preterm fetus, reduction in the risk of sudden infant death syndrome, pain relief in newborns and fetus undergoing minor procedures in the emergency department.²

Disadvantages of pacifier use especially for long-term include: negative effect on breastfeeding, ear disorders (otitis media) and dental malocclusion. The studies have shown the most substantial malocclusions

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occurred in children who continued sucking habits more than 48 months and include: Anterior openbite, increased overjet, induce class II canine relationship and cross bite.^{2,4}

Another potential disadvantage is accidents such as airway obstruction. However, the association of pacifier use and lower intelligence quotient (IQ) is controversial. A few studies have shown that pacifier use is also positively associated with oral candidiasis.⁵

According to these effects of the pacifier, a new design of pacifier and bottle nipple were introduced, known as the functional (orthodontic) nursing nipple and orthodontic pacifier/exerciser. This design was improved as encouraging muscular movements, that more closely similar to those used by an infant during breastfeeding, consequently leading to more normal dental arch development.⁵ Some benefits of using an orthodontic pacifier are infant lip comfort, good adaptation, better nose breathing, and better labial seal.¹

Due to the importance of the issue, and lack of any previous study to determine the frequency of pacifier use in Iran, this study was designed to verify the frequency of using different types of pacifier and bottle nipple among 1-24 months old children in Kerman, Iran, year 2013-2014.

Methods

In this cross-sectional study, a total of 300 mothers interviewed at 20 specialized private pediatric offices in Kerman. In this formula, the sample size was calculated based on the formula for estimating a proportion (prevalence). We assumed $P = 0.50$ and $Z_{(1-\alpha/2)} = 1.96$ in the formula. We calculated $n = 257$ and finally we increased it to 300.

The mothers were selected by multistage stratified sampling procedure. They had 1-24 months old children. The information was presented to mothers about aim and method of the study and was taken their consent. A questionnaire includes items about pacifier sucking, bottle feeding habits, and their kinds

as well as mothers ability to recognize different kinds of available pacifier and bottle nipple was used during the interview. In the end of interview, some information about advantage and disadvantage of pacifier use and their kinds were given to the mothers by a resident of pediatric dentistry. $P < 0.05$ was considered as significant. Data were analyzed using Stata software (version 11.2, Stata Corporation, College Station, TX, USA) and a chi-square test was used.

Results

Sample distribution according to age and sex displayed in table 1. The frequency of the different kinds of pacifiers and bottle nipples are showed in table 2. The results demonstrated that the majority of children (57.7%) had breastfeeding. The frequency of pacifier use and its type is showed in table 2. The majority of children (62.7%) did not use any pacifier. The rate of current or previous pacifier-sucking was 37.3% and among the users, 24.0% were used orthodontic type.

Table 1. Sample distribution according to the children age and sex

Variables	n (%)
Sex	
Female	158 (52.7)
Male	142 (47.0)
Age (month)	
0-5	59 (19.1)
6-11	85 (28.0)
12-17	75 (25.0)
18-24	81 (27.0)

According to children gender, there was no statistically significant difference ($P = 0.90$). Only 28.7% of mothers had sufficient ability to recognize functional (orthodontic) pacifier as well as functional bottle nipple.

Discussion

Results of the current study demonstrated that the majority of children (57.7%) had breastfeeding. In the present study, the frequency of pacifier sucking was 37.3. The

Table 2. Frequency of children according to type of feeding, type of used bottle nipple and type of pacifier

Type of feeding	n (%)	95% CI
Breast feeding	173(57.7)	51.86-63.32
Bottle feeding	22 (7.3)	4.65-10.89
Both breast and bottle feeding	105 (35.0)	26.61-40.69
Type of bottle nipple		
Conventional	177 (59.0)	53.20-64.62
Functional	107 (35.7)	30.25-41.37
Not buying	16 (5.3)	3.08-8.52
Use of pacifier		
Yes	112 (37.3)	31.84-43.08
No	188 (62.7)	56.92-68.16
Type of pacifier		
Conventional	40 (13.3)	9.60-17.71
Functional	72 (24.0)	19.28-29.24
Not use of pacifier	188 (62.7)	56.92-68.16

CI: Confidence interval

prevalence of pacifier use among varies countries is different from 12.5 to 71.0%. Some countries such as Japan (12.5%), New Zealand (14.0%) and China (16.0%) had the lowest rates of pacifier use.⁶ In European countries pacifier use varied from 36.0 to 71.0%.⁵ Jahanbin et al.⁷ evaluated the association between socio-demographic factors and nutritive and non-nutritive sucking habits and found that the prevalence of pacifier use among girls children in Mashhad, Iran, was 26.0% that is lower than that reported by some investigator: 40.0, 37.0 and 40.0 percent in the United State of America, Norway and Saudi Arabia, respectively.

There is little information as to the reasons for such wide variation between countries. It seems cultural and socio-economic differences among the countries are one of the reasons. Some studies reported that some factors such as parents educational level, child's birth rank and number of sibling had a significant effect on the prevalence of pacifier use. They claimed that children of lower socio-economic status demonstrated pacifier use a more frequent.⁸

Farsi and Salama⁸ found pacifier use to be the more prevalence among the children of

parents with higher educational levels. It is unclear why less educated parents were less likely than others to have children with a pacifier-sucking habit; however it could be due to the more time that educated mothers spend working outside the home for working.⁷

According to the study of Warren et al.,⁹ older maternal age and higher maternal education level as well as having no older siblings were the most important factors in children developing prolonged non-nutritive sucking habits. And children whose birth rank was the 4th or more were significantly less likely to have a pacifier-sucking habit (7.8%) than those who were the 1st child (45.7%) and 2nd or 3rd child (46.6%).⁹

In the present study, the frequency of using conventional pacifier and orthodontic pacifier were 13.3 and 24.0%, respectively. Adair et al.¹⁰ reported the prevalence of using conventional pacifier 17.4% and orthodontic pacifier 37.0%. Although the prevalence of pacifier use in that study was more than current study but in both studies orthodontic pacifier was twice as prevalence as a conventional pacifier.

At first of the study, the mothers were uncooperative so it took a long time to

convince them to participate in the study.

Conclusion

The frequencies of using orthodontic kind of pacifier and bottle nipple were low, and a few mothers had adequate ability to recognize their differences.

Conflict of Interests

Authors have no conflict of interest.

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Awareness and attitude of parents toward pediatric dental treatment under general anesthesia

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Original Article

Abstract

BACKGROUND AND AIM: Dental treatment under general anesthesia is critical for non-cooperative, low aged, and special needs' children. This study aimed to investigate the knowledge and attitude of parents about pediatric dental treatment under general anesthesia.

METHODS: This was a cross-sectional study among 100 parents of children who were referred to Babol School of Dentistry (Roohani Hospital) and Babol clinic Hospital, Iran, in 2012-2013 for dental treatment under general anesthesia. The questionnaire contained questions assessing the reasons for choosing dental treatment under general anesthesia, and the advantages and disadvantages of this method of treatment and parental satisfaction. The form was completed by the parents. Data were reported using descriptive statistics and analyzed by the Spearman correlation coefficient.

RESULTS: In this study, a questionnaire survey showed that the majority of parents were concerned about the health of their children and despite having some degree of awareness about side effects of general anesthesia and its high cost, they expressed a positive view toward that. A reduction of fear and anxiety and the possibility of performing several treatments in one session are among the benefits of this method. Non-cooperative children of low age with a high number of dental caries are the main recipients of this treatment method. This method was introduced to the majority of parents by the dentist treating their children.

CONCLUSION: This study showed parents accepted the costs and risks of this approach to maintain the oral health of their children after it was recommended by the pediatrician. Therefore, with sufficient awareness of society toward this treatment option, we can improve children's oral health and performance.

KEYWORDS: General Anesthesia, Parental Attitudes, Parental Awareness, Pediatric Dental Treatment

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Patients' behavior management is among the major issues in pediatric dentistry. Since many children are unable to sufficiently cooperate for dental treatment, their treatments are postponed. It causes the experience of severe pain and sometimes leads to loss of teeth.

The dental treatment under general anesthesia is one of the recommended treatment methods for such patients.¹ It should be noted that this method is not used for healthy cooperative patients with minimal dental treatment needs as well as

patients who the use of general anesthesia are prohibited for them.² Various studies have proved the value of this method in the dental treatment of children with special needs due to the vast nature of their needs, their limited cooperation power or particular medical condition.²⁻⁶

Several advantages are mentioned for the treatment of such children under general anesthesia including the treatment is completed in one session, the patient is pain-free and most importantly, it does not need child's cooperation.⁷⁻⁹ It seems that

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dental treatment of children under general anesthesia has a positive psychological impact on treated children and reinforces positive views of parents and children about oral health.¹⁰⁻¹⁴ This therapy also appears to bring some degree of changes in a child's life and behavior including increased frequency of brushing and reduced consumption of foods high in sugar.¹⁵

In this cross-sectional study, views of parents toward their child's dental treatment under general anesthetic technique was determined, and the causes and concerns about prescribing this type of treatment, its advantages and disadvantages and methods of avoiding the need to re-approach to this method have been discussed.

Methods

In this cross-sectional study of descriptive - analytic type, 100 parents of children who received dental treatment under general anesthesia in Roohani Hospital affiliated with the Babol Dental School and Babol Clinic Hospital, Iran, over a year were selected. All of the parents participated voluntarily, and there was no compulsion to participate in this study. To this end, a four-part questionnaire was used. In the first part of the questionnaire, data about children are including sex, age, history of systemic disease, type of systemic disease and parent information including age, education and location were asked. In the second part, the background questions about the history of parents undergoing general anesthesia, the reason for this treatment, side effects, the way this method was introduced to them, positive and negative changes in behavior and health of children after anesthesia and proposed strategies for parents to prevent their children need for re-treatment by this method was evaluated. In the third part of the questionnaire, the questions about awareness were replaced. The definition of general anesthesia according to parents and its difference with conscious sedation,

advantages and problems of this type of treatment and the duration and appropriate place for this method was evaluated from the parents' perspective. The fourth part contains the attitudinal questions.

The ideas and views on the need for awareness of parents about the issue of general anesthesia before treatment, cause of parental concerns, assessment of their willingness to repeat this procedure in the case of need, parents opinion about the medication before general anesthesia, treatment costs and the lack of understanding and willingness of parents for this approach was questioned. It was valid in terms of content and outline. The used questionnaire was designed and prepared after referring to articles and authoritative sources and by the help of the experts in the field of pediatric dentistry, anesthesiology and statistics and correction of proposed reviews. The parents were contacted by phone, and they answered a series of questions. In the studied population, there is enough variety and the opportunity for participation of individuals from any group in terms of gender, age groups and health status of children as well as age groups, parental education level, and living area. Before the main study, a pilot study was performed using a questionnaire conducted on 10 patients and strengths and weaknesses were identified.

Given the experimental nature of these samples, the 10 individuals were not involved in the original study. Furthermore, to assess the reliability of questionnaire, 10% of samples were selected randomly and their answers were again collected 2 weeks after the end of phone conversation. The evaluation of questionnaire findings indicates that the minimum kappa in twice evaluation of questions was between 0.74 and 0.94 that has an appropriate reliability. No standard questionnaires were found in this area. After collecting the information (about a year), the descriptive statistical method and were used for statistical analysis. $P \leq 0.05$ is considered

as significant in this study.

Results

In the present study, 100 cases of parents with fathers mean age of 35.26 ± 5.79 years and mothers mean age of 30.14 ± 5.29 years were participated. 49% of fathers and 55% of mothers had a high school diploma, and rest of them had diploma and above. 88% were urban and 12% were living in rural area. 28% of fathers and 41% mothers themselves had undergone general anesthesia. The mean age of children was 43.85 ± 11.46 months. The mean decay, missing, filling, teeth of children was calculated. Out of 100 children, 12 had systemic disease and 2 patients were mentally retarded. 92% of parents had acted on the advice of the dentist. The main reasons for choosing this method of therapy along with relevant statistical results are shown in figure 1.

About 74% of parents reported that no complication occurred to their children after general anesthesia. Tongue and lip swelling (11%) and sore throat (7%) were the most common reported side effects. Disobedience (7%) was the largest negative change in behavior and willingness to comply with

hygiene and brushing (8%) was the most positive change in children's behavior. Parents reported the advantages and disadvantages of the general anesthesia in pediatric dental treatment that are shown in figures 2 and 3.

About 98% of parents were anxious about the treatment under general anesthesia that the greatest concern (68% of them) happened prior to the treatment. To avoid the need for re-treatment of children, parents suggested better maintenance of oral health (26%), regular visits to the dentist (24%) and diet control (3%). 24% of parents were aware of the proper meaning of general anesthesia that was a controlled level of consciousness and 55% of parents knew it synonymous with conscious and non-conscious sedation. 77% of parents agreed with the repeat of this treatment for their child if required. 73% of them suggested this method of treatment to their closed ones who had similar problems. 83% of parents considered sedative medication necessary before deciding to use general anesthesia. Overall, parents had a positive view toward this treatment method. The satisfaction rate is shown in the following figure 4.

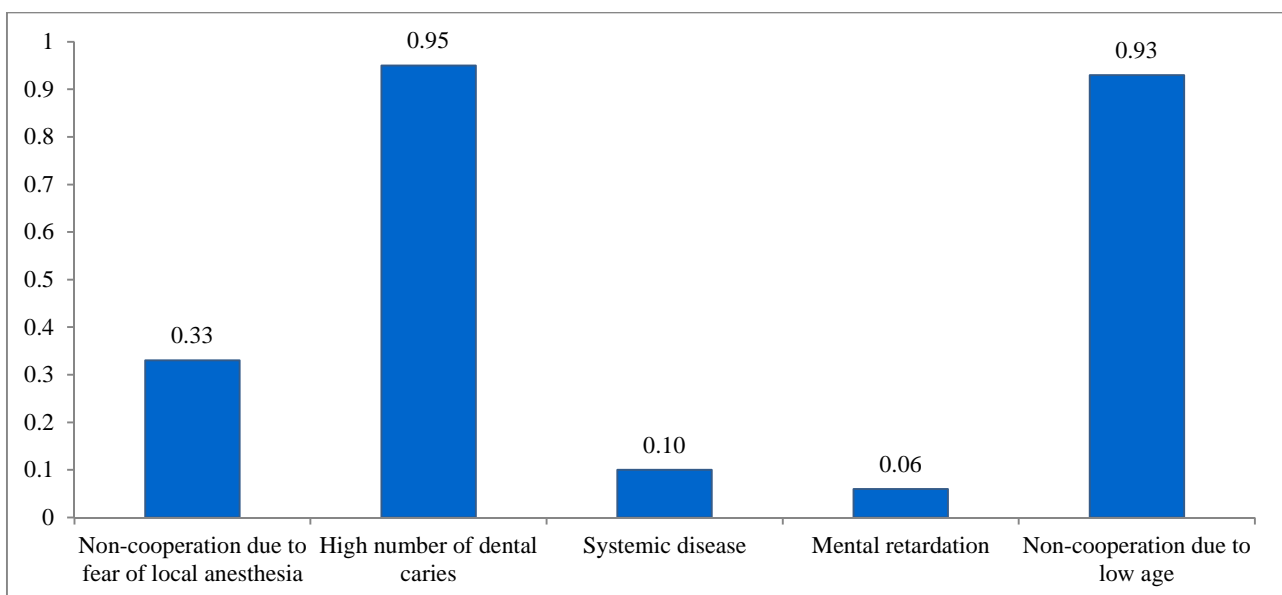


Figure 1. Frequency of parents of children based on cause of referral for pediatric dental treatment under general anesthesia (GA)

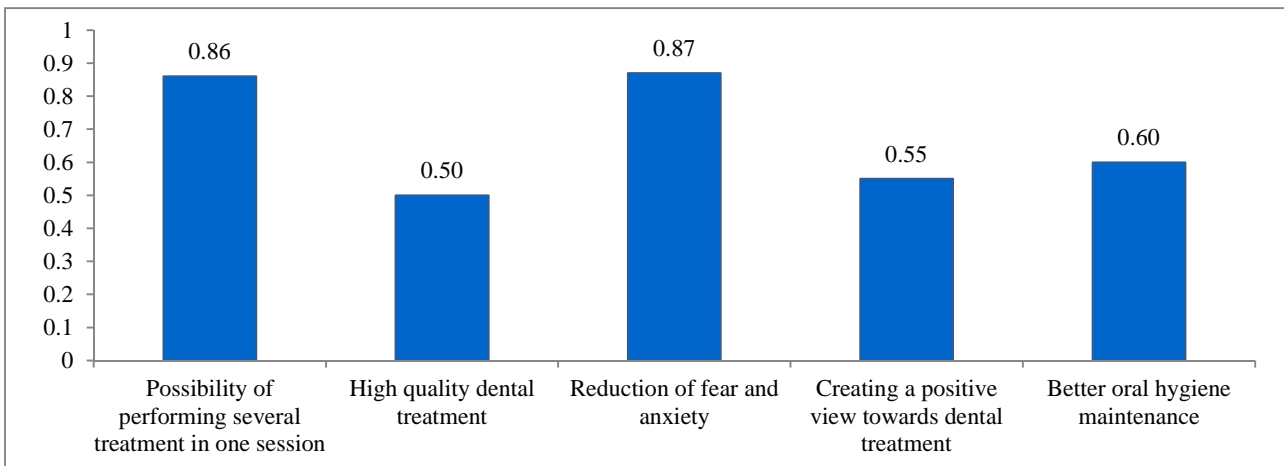


Figure 2. Frequency of parents on their attitudes about the benefits of dental treatment under general anesthesia (GA) in pediatric dental treatment

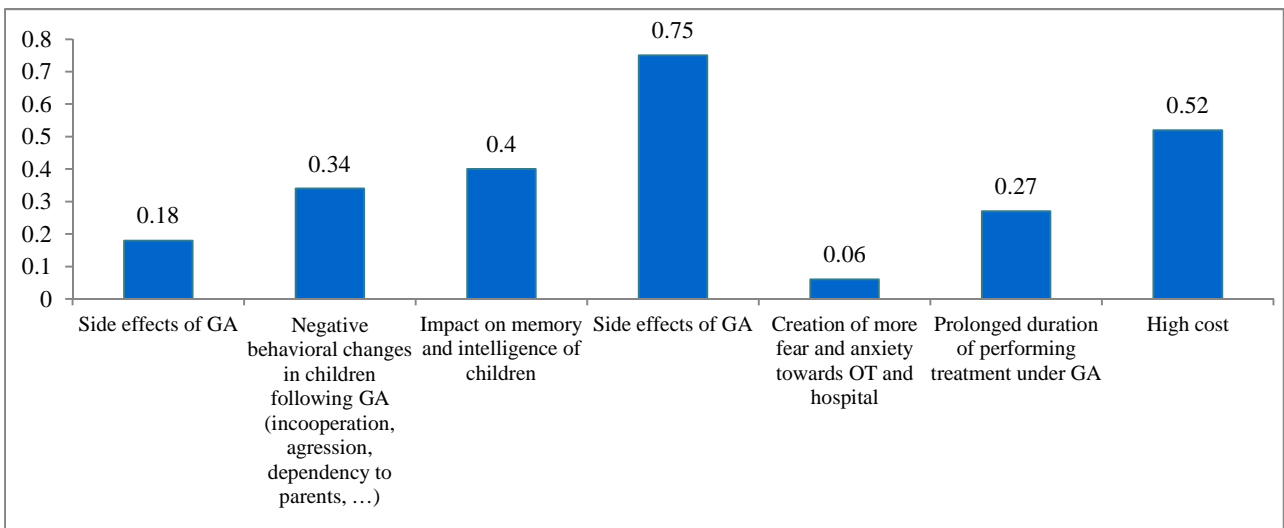


Figure 3. Frequency of parents on their attitudes about the disadvantages of general anesthesia in dental treatment for children
GA: General anesthesia

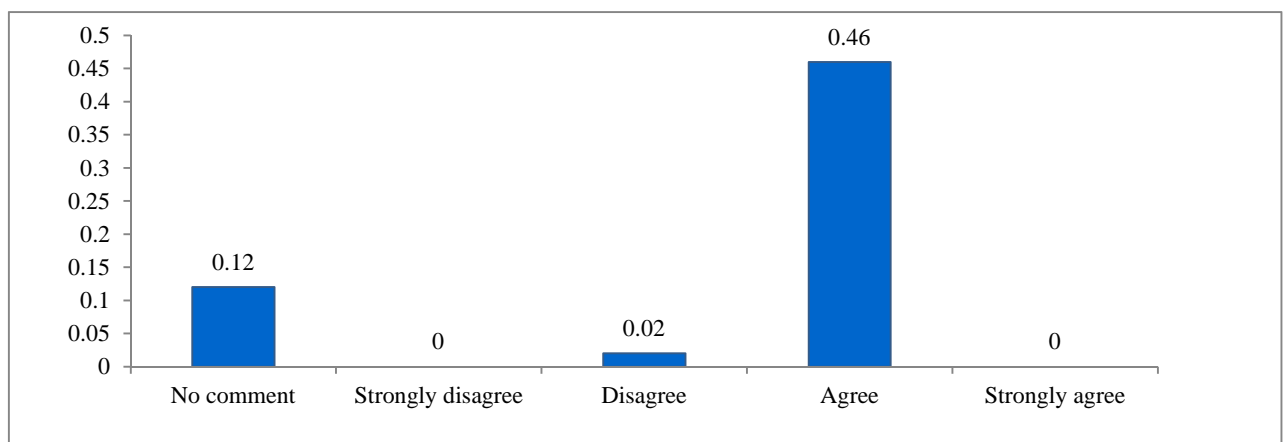


Figure 4. Frequency of parents who considered general anesthesia (GA) necessary in pediatric dental treatment

Discussion

Parents participating in this study had an optimal level of awareness about the advantages and disadvantages of various aspects of anesthetic techniques in pediatric dental treatment and to some degree, almost all of parents (98% of them) were concerned about their children. However, the view of the majority of them was positive about the use of this method when necessary.

Based on the results obtained in this study, regardless of the difficulties and complications of general anesthesia and the high cost of treatment, parents were generally satisfied with the dental treatment under general anesthesia. This was consistent with previous studies such as the study performed by Ansari et al.¹⁶ at Mofid Hospital of Tehran, Iran. The statistical results obtained by assessment of causes of approach to this method of treatment indicated that the inability of low age children to cooperate and the high number of dental caries are among the major causes to choose this treatment method.

The similar results were obtained by Ansari et al.¹⁶ and Gharavi and Sohani,¹⁷ Albadri et al.¹⁸ reported extensive decay and pain in more than two quadrants as the most common cause of referral of patients. The post-operative complications of anesthesia include swelling of lips and tongue and sore throat from intubation during surgery. It is consistent with the results of Ansari et al. study,¹⁶ but it contradicts with the Gharavi and Sohani¹⁷ study that listed vomiting and restlessness as the most common complications. According to Farsi et al.¹⁹ study performed in Jeddah Hospital, Saudi Arabia major complications are pain and bleeding. This conclusion was different from the results of our study.

This study determined that disobedience was the most negative changes in child behavior and more inclination to use a toothbrush, was the most positive change in child behavior after anesthesia. In the study

performed by Ansari et al.¹⁶ aggression and solving the problem of non-cooperation besides anxiety reduction and in the study performed by Golpayegani²⁰ anger, excitation and improvement of appetite, were in the order mentioned as the most negative and positive behavioral changes in children. The results of this study were not similar to our results. This study indicates that according to parents, fear and anxiety reduction besides the possibility of performing several treatments in one session are the main advantages and post-operative complications are the main disadvantages of this treatment method. This is similar to the results of Ansari et al.¹⁶ and Eshghi et al. studies.²¹

In our study, no significant relationship was observed between age, education and place of residence of parents with their knowledge and attitudes about dental treatment under general anesthesia in pediatric dental treatment. It was in accord with the statistical results obtained by Ansari et al.¹⁶ But in their study, a significant relationship was found between mothers' age and their views about the advantages of this method. Parents from Tehran and other cities expressed different percentages of acceptance toward different methods of behavior management. This result is not consistent with our results. Likely reason for this difference was the special situation of our study area. Babol city is surrounded by several villages. They have better facilities, amenities, and information than other rural areas of the country. Therefore due to the blend of urban and rural and cultural similarities of people of these regions, no apparent difference was observed in parental knowledge and attitudes between urban and rural areas.

Further research to identify barriers and problems that exist in the field of parental acceptance toward anesthesia, can eventually lead to the establishment of good oral health behaviors in children.

Conclusion

The present study showed that the majority

of parents were informed about this method by the dentists treating their children. Practitioners' role in this field is essential. This method of treatment can accelerate and progress the process of health care and oral health in uncooperative children. Consequently, with sufficient awareness about such treatment options, children's oral health and performance can improve.

Conflict of Interests

Authors have no conflict of interest.

Acknowledgments

Special thanks to the personnel and staff members of Department of Pedodontics, School of Dentistry, Babol University of Medical Sciences and Health Services and Dr. Nafiseh Ghasemi for their extensive support. This study was a part of thesis belonged to Fatemeh Nazeran and research project No. 9236012 which was supported and funded by Babol University of Medical Sciences.

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Awareness and method of oral health care among people living with human immunodeficiency virus infection and acquired immune deficiency syndrome attending Federal Medical Centre, Abeokuta, Nigeria

Princess Christina Campbell MD, MA¹, Dada Sheriff MSc²

Original Article

Abstract

BACKGROUND AND AIM: Oral health knowledge and oral health seeking behavior among people living with human immunodeficiency virus infection and acquired immune deficiency syndrome (HIV/AIDS) (PLWHA) have been found to be very low. The importance of education to improve awareness and oral health practices cannot be overemphasized. The study determined the level of awareness, perceived oral status and practices of oral health care among PLWHA attending Federal Medical Centre Abeokuta (FMCA), Nigeria.

METHODS: This descriptive cross-sectional study recruited 204 participants using systematic random sampling technique. The self-designed, pre-tested questionnaire was interviewer-administered by trained research assistants in October 2014 for 4 weeks. All research protocols were strictly adhered to. The data were analyzed with SPSS, chi-square, ANOVA, Fischer's exact test and P value was calculated.

RESULTS: Out of 204 patients, 191, predominantly females 100 (52.4%); married 120 (62.8%), participated, with a response rate of 93.6%. The age range was 18-69 years with a mean of 37.64 ± 11.30 years. Oral health awareness was low 47 (24.6%), but 138 (72.3%) were aware of the role of fluoride toothpaste. Awareness on oral health was statistically significant with the level of education ($P < 0.050$). The majority 189 (99.0%); 168 (88.9%) used toothbrush, fluoride toothpaste, respectively, 69 (36.1%) brushed at least twice daily, none used dental floss, 14 (7.3%) had visited the dentist within 6 months, and 123 (64.4%) never received dental care.

CONCLUSION: The limited awareness on oral health and its practices can be improved by oral health information and education among the respondents, and further help reduce the severity of some further complications.

KEYWORDS: Oral Health; Awareness; Method; PLWHA

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Oral health remains a problem in many communities around the world particularly among underprivileged groups in developed and developing countries.¹ Some oral problems occur almost exclusively among people living with human immunodeficiency virus infection and acquired immune deficiency syndrome (HIV/AIDS) (PLWHA) while other oral problems have been found to be more severe

among PLWHA.² A recent study found, the prevalence of oral manifestations associated with HIV to be 30-48%.³

Poor oral hygiene increases the risk of oral complications of HIV disease which may result in poorer physical and mental health status.⁴ Out of 174 million, about 2.9 million people in Nigeria are estimated to be living with HIV and AIDS.⁵ Oral health knowledge and oral health seeking behavior among PLWHA have been found to be very low,⁶

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and poor oral health can significantly affect one's physical and emotional wellbeing.⁷ Immune suppressive nature of the disease makes PLWHA a more susceptible to tooth decay and oral manifestations. Oral health awareness and practice were found to be considerably high in studies done in the developed countries.^{8,9} Whereas, in Jordan a lower than acceptable level of awareness of periodontal diseases was found among adults;¹⁰ adequate level of knowledge was recorded among a high proportion of Tanzanian students,¹¹ and among pregnant women in Nigeria.¹² Oral health education is believed to be a cost-effective method for promoting awareness and practice of oral health care.¹³ The study determined the level of awareness, perceived oral health status, method of oral healthcare among PLWHA and factors that affect utilization of oral healthcare services.

Methods

Federal Medical Centre Abeokuta (FMCA), a 250-bedded regional specialist hospital is located in one of the 15 wards, Idi-Aba, Akoka South Local Government Area of Ogun State, Nigeria.¹⁴ The Department of Community Medicine and Primary Care (CMPC) offers affordable health services including HIV/AIDS, treatment and control of pulmonary and extrapulmonary tuberculosis through community outreach programs, in collaboration with governmental and non-governmental organizations.¹⁴

As at September 1st 2014, registered PLWHA was 2063, comprising of: 1924 adults and 139 children. Approximately, an average number of patients seen monthly, weekly and daily were 1000, 250, and 50 patients, respectively.

The descriptive cross-sectional survey of registered PLWHA, 18 years and above attending FMCA, recruited 204 eligible, consenting respondents based on calculated minimum sample size.¹⁵ Ethical clearance was

obtained from the Health Research and Ethics Committee of the Lagos University Teaching Hospital (ADM/DCST/HREC/APP/2049). All other research protocols were strictly adhered to and confidentiality of respondents assured.

Based on the daily sample frame a clinic day, a systematic random sampling technique was used to administer the self-designed (aided by literature search), pre-tested interviewer-administered study tool by trained research assistants in October 2014 for a period of 4-week.

Data obtained were analyzed using SPSS software (version 17, SPSS Inc., Chicago, IL, USA), frequency, percentage, mean, chi-square, Fischer's exact, ANOVA, and probability were calculated. The questions on awareness were multiple-choice, the answers were dichotomised, and score of one (1) was given to correct response and score of 0 was given to wrong response. Respondents with 0-4 correct responses were regarded to have inadequate awareness while respondents with 5-10 correct responses were regarded to have adequate awareness on the oral health.

Results

A total of 204 participants were recruited into the study with a response rate of 93.6%, and were predominantly female 100 (52.4%) and married 120 (62.8%). The age range was 18-69 years with a mean of 37.64 ± 11.30 years. Almost half 84 (44.0%); 85 (44.5%) and 87 (45.5%) were self-employed; had secondary and tertiary education, respectively (Table 1).

Up to 82 (42.93%) and 73 (38.2%) knew sugar is changed by bacteria into acid which harms the tooth and sugar directly harms tooth enamel, respectively. Concerning plaque, 77 (40.3%) and 67 (35.1%) recognized it as germ containing substance and a harmless substance that can be removed completely with brushing, respectively. Up to 138 (72.3%) were aware of the importance of fluoride in toothpaste, regular flossing 37 (19.4%) but 59 (30.9%) did not know what flossing is. A low proportion of the

respondents correctly cited gingivitis as gum inflammation 58 (30.4%); the most-friendly time to eat sugary treat was along with a meal 36 (18.9%); removal of food and germs as goal of brushing 86 (45.0%); and brushing twice daily and flossing once a day as the two most important dental habits 13 (6.8%). However, 117 (61.3%) could not link gum diseases with associated diseases. The overall perception was low as only 47 (24.6%) demonstrated adequate awareness (Table 2).

Table 1. Distribution of socio-demographic characteristics of respondents

Variable	n (%)
Age (year)	
≤ 20	5 (2.6)
21-30	53 (27.8)
31-40	68 (35.6)
41-50	29 (15.2)
51-60	30 (15.7)
61-70	6 (3.1)
Gender	
Male	91 (47.6)
Female	100 (52.4)
Marital status	
Married	120 (62.8)
Single	49 (25.7)
Separated	7 (3.7)
Divorced/widow	15 (7.8)
Employment status	
Employed	72 (37.7)
Self employed	84 (44.0)
Unemployed	2 (1.0)
Retired	5 (2.6)
Student	28 (14.7)
Level of education	
No formal education	4 (2.1)
Primary school	8 (4.2)
Secondary	85 (44.5)
College/university	87 (45.5)
Postgraduate	7 (3.7)
Total	191 (100)

A large proportion of the respondents 175 (91.6%); 165 (86.4%) and 160 (83.8%); perceived they had 20 or more natural teeth; believed their teeth and gums were above average as it pertains to oral health status. Concerning dentures, 9 (4.7%), 5 (2.6%), and 5 (2.6%) alleged they had partial, full upper and full lower dentures, respectively.

Methods of oral healthcare adopted were a clean mouth with toothbrush and paste 189 (99.0%); use fluoride toothpaste 168 (88.9%); and none used dental floss. More than half 109 (57.1%) of the respondents brushed their mouth once a day and 69 (36.1%) twice or more per day. Nearly, two-thirds 123 (64.4%) never received dental care, 14 (7.3%) had visited the dentist within the last 6 months. Reasons for visit were dental problems, treatment and consultation/routine check-up, 24 (35.3%), 10 (14.7%) and 8 (11.8%), respectively (Table 3).

Concerning factors affecting utilization of oral health care, 144 (75.4%) did not access needed dental care. Main reasons for not utilizing needed care were: None affordability of services 17 (11.8%), perceived self-resolution of dental problems 21 (14.6%) and unable to take time off work 7 (4.9%) (Figures 1 and 2).

There was no significant association between oral health awareness and socio-demographics except for the level of education ($P = 0.028$) (Table 4). Using ANOVA, the mean awareness level was 3.380 ± 1.591 (from the maximum score of 10). A statistically significant relationship was observed between oral health awareness and level of education ($P = 0.002$). The highest mean awareness on oral health was found among respondents that never cleaned their mouth (5.00) and those that cleaned their mouth only once a week (5.00). Mean awareness was the highest among participants that had visited the dentist within 1-2 years (4.29) followed by those that had visited within the last 6 months (4.14). Participants with a higher education were most aware of oral health when compared with respondents with secondary and primary education for post-hoc test (Table 5).

Discussion

Overall oral health awareness in this study of 47 (24.6%) is lower than 45.5% reported in India,¹⁶ Pakistan (34.5%)¹⁷ but slightly higher than in Nigeria (15.7%).¹⁸ The mean score of

awareness of oral health of the participants was 3.38 (from a maximum score of 10) which is in contrast to the 5.2 (from a maximum score of 8) and 7.2 (from a maximum score of 12) in studies done in Iran,¹⁹ and Peshawar Pakistan,¹⁷ respectively. This difference could be attributed to the study population of these studies which were students. No statistically

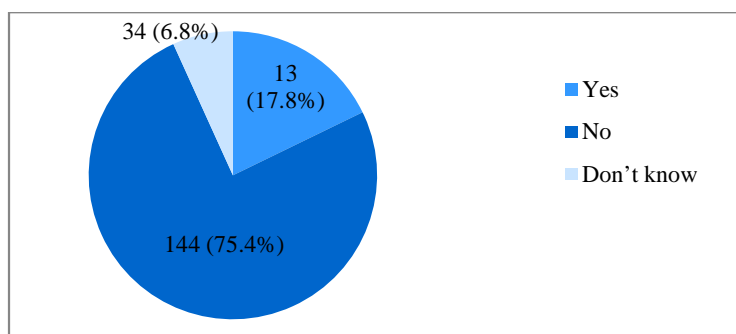
significant relationship was observed between level of awareness of oral health and age of participants of this study ($P = 0.060$), in consonance with studies done in Kuwait ($P = 0.120$),²⁰ Tanga Tanzania ($P < 0.050$)¹¹ and Nigeria ($P = 0.573$),¹⁸ between the awareness on oral health and the gender ($P = 0.838$) in line with Nigeria ($P = 0.108$)¹⁸ and Pakistan.¹⁷

Table 2. Respondents' oral health awareness

Variable (n = 191)	n (%)
Sugar contribute to tooth decay because	
Sugar directly harm tooth enamel	73 (38.2)
Sugar combines with proteins in saliva to create hard layer on teeth	36 (18.9)
Sugar is changed by bacteria into acid that harms tooth surface	82 (42.9)
Plaque	
The protective coat that naturally occurs on teeth	23 (12.0)
Harmless substance removable by brushing	67 (35.1)
A germ-containing substance on the surface of teeth	77 (40.3)
A whitening substance that makes the teeth shine	24 (12.6)
Flossing	
Regular flossing is an important part of your dental health routine	37 (19.4)
Don't know what flossing is	59 (30.9)
Flossing is bad for your teeth	30 (15.7)
It is ok to floss but must stop if gum bleeds	65 (34.0)
Gingivitis	
Poor support of the bone that supports the teeth	7 (3.7)
A condition where the teeth stain	21 (11.0)
Inflammation of the gums that involves swelling and bleeding !	58 (30.4)
Don't know	105 (54.9)
Most tooth-friendly time to eat sugary treat	
First thing in the morning or last thing at night	53 (27.7)
Along with a meal!	36 (18.9)
As a snack on its own	27 (14.1)
Any time, no difference	75 (39.3)
Goal for tooth brushing	
To remove germ (bacteria) from all tooth surfaces	75 (39.3)
To remove food from tooth surface	9 (4.7)
Not necessarily to remove germ and food	21 (11.0)
To remove germs and to remove food!	86 (45.0)
Link with gum disease	
Low birth weight babies (premature babies)	10 (5.2)
Diabetes	12 (6.3)
Heart disease and stroke	20 (10.5)
None of the above	117 (61.3)
All of the above!	32 (16.7)
The two most important dental health habits	
Brushing twice daily and rising with mouthwash after each brushing	139 (72.8)
Brushing after every meal and using a water-pick device daily	25 (13.1)
Brushing twice daily and flossing once a day !	13 (6.8)
Flossing every day and rising with mouthwash after each flossing	14 (7.3)
Fluoride in toothpaste makes a difference to the health of your teeth	
No it isn't safe	14 (7.3)
Yes improves oral health by decreasing cavities	138 (72.3)
Toothpaste without fluoride is just as effective at preventing cavities	15 (7.9)
Nobody really knows	24 (12.6)

Table 3. Respondents' perceived oral health status and method of oral care

Perceived oral health status	n (%)
Number of natural teeth	
No natural teeth	10 (5.3)
< 20 teeth	6 (3.1)
20 teeth or more	175 (91.6)
Pain or discomfort in the mouth in the past 12 months	
Yes	69 (36.1)
No	122 (63.9)
Teeth status	
Above average	165 (86.4)
Average	22 (11.5)
Poor	9 (4.7)
Type of dentures	
Partial denture	9 (4.7)
Full upper denture	5 (6.2)
Full lower denture	5 (6.2)
Method of oral care	
Frequency of cleaning the mouth	
Never	3 (1.6)
Once a month	4 (2.1)
Once a week	2 (1.0)
2-6 times a week	4 (2.1)
Once a day	109 (57.1)
Twice or more a day	69 (36.1)
Material used to clean the mouth (multiple responses)	
Tooth brush	189 (99.0)
Wooden tooth picks	31 (16.2)
Plastic toothpicks	6 (3.1)
Dental floss	0 (0.0)
Charcoal	3 (1.6)
Chewing stick	17 (8.9)
Use of toothpaste to clean mouth	
Yes	189 (99.0)
No	2 (1.0)
Use of fluoride toothpaste	
Yes	168 (88.9)
No	16 (8.5)
Don't know	5 (2.6)
Last dental visit	
< 6 months	14 (7.3)
6-12 months	4 (2.1)
> 12 months	11 (5.8)
Never	123 (64.4)
Reason for last visit (multiple responses) (n = 68)	
Consultation/advice	8 (11.8)
Treatment	34 (50.0)
Routine check-up	8 (11.8)

**Figure 1.** Need for oral health services

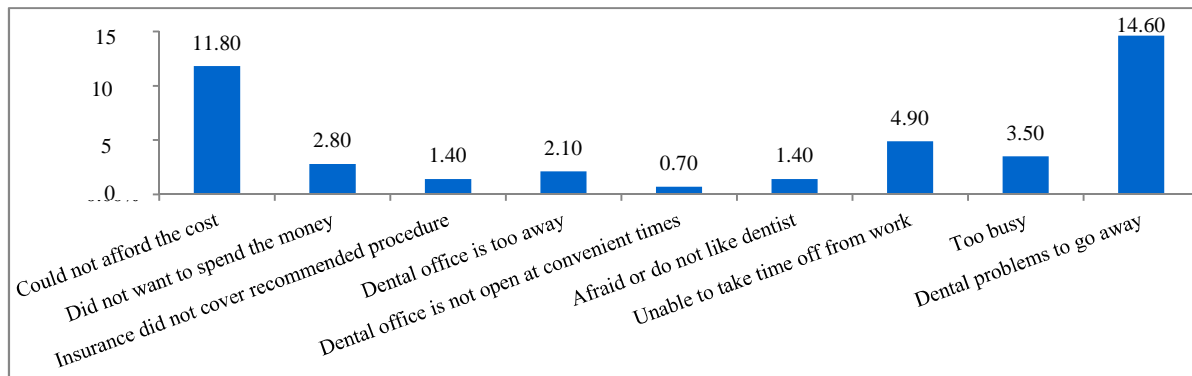


Figure 2. Reasons for not utilizing oral health services

Table 4. Association of level of oral health awareness with some variables

Variable	Awareness [n (%)]		Total [n (%)]	P
	Inadequate	Adequate		
Age group (year)				
≤ 20	5 (100.0)	0 (0.0)	5 (100)	0.060*
21-30	34 (64.2)	19 (35.8)	53 (100)	
31-40	49 (72.1)	19 (27.9)	68 (100)	
41-50	26 (89.7)	3 (10.3)	29 (100)	
51-60	24 (80.0)	6 (20.0)	30 (100)	
61-70	6 (100)	0 (0.0)	6 (100)	
Sex				
Male	68 (74.7)	23 (25.3)	91 (100)	0.838**
Female	76 (76.0)	24 (24.0)	100 (100)	
Employment status				
Employed	52 (72.2)	20 (27.8)	72 (100)	0.306*
Self-employed	67 (79.8)	17 (20.2)	84 (100)	
Unemployed	2 (100)	0 (0.0)	2 (100)	
Retired	5 (100)	0 (0.0)	5 (0)	
Student	18 (64.3)	10 (35.7)	28 (100)	
Level of education				
No formal education	4 (100)	0 (0.0)	4 (100)	0.028*†
Primary school	6 (75.0)	2 (25.0)	8 (100)	
Secondary school	72 (84.7)	13 (15.3)	85 (100)	
College/University	58 (66.7)	29 (33.3)	87 (100)	
Postgraduate	4 (57.1)	3 (42.9)	7 (100)	
Cleaning mouth with toothpaste				
Yes	143 (75.7)	46 (24.3)	189 (100)	0.433*
No	1 (50.0)	1 (50.0)	2 (100)	
Use of fluoride toothpaste				
Yes	125 (74.4)	43 (25.6)	168 (100)	0.597*
No	14 (87.5)	2 (12.5)	16(100)	
Last dental visit				
< 6 months	6 (42.9)	8 (57.1)	14 (100)	0.058*
6-12 months	3 (75.0)	1 (25.0)	4 (100)	
1-2 years	5 (71.4)	2 (28.6)	7 (100)	
2-5 years	10 (83.3)	2 (16.7)	12 (100)	
> 5 years	27 (87.1)	4 (12.9)	31 (100)	
Never	93 (75.6)	30 (24.4)	123 (100)	
Materials used to clean the mouth (multiple responses)				
Toothbrush	143 (75.7)	46 (24.3)		0.001*†
Wooden toothpicks	20 (10.5)	11 (5.8)		
Plastic toothpicks	2 (1.0)	4 (2.1)		
Charcoal	3 (1.6)	0 (0.0)		
Chewing stick	9 (4.7)	8 (4.2)		
Total	144 (75.4)	47 (24.6)	191 (100)	

*Fisher's exact P value, **Chi-square P value, †Statistically significant

Table 5. Analysis of variance of oral health awareness and some variables

Variable	n	Mean ± SD	F	P
Age (year)				
≤ 20	5	2.20 ± 0.447	2.243	0.052
21-30	53	3.83 ± 1.707		
31-40	68	3.46 ± 1.501		
41-50	29	2.97 ± 1.210		
51-60	30	3.17 ± 1.895		
61-70	6	2.67 ± 1.033		
Gender				
Male	91	3.41 ± 1.619	0.041	0.840
Female	100	3.36 ± 1.573		
Marital status				
Married	120	3.31 ± 1.494	1.695	0.170
Single	49	3.55 ± 1.803		
Separated	7	4.43 ± 1.397		
Widowed	15	2.93 ± 1.580		
Employment status				
Employed	72	3.57 ± 1.471	1.161	0.329
Self-employed	84	3.12 ± 1.609		
Unemployed	2	3.00 ± 0.000		
Retired	5	3.40 ± 1.342		
Student	28	3.71 ± 1.863		
Level of education				
No formal education	4	1.00 ± 1.155*	4.458	0.002 [†]
Primary school	8	2.75 ± 1.753**		
Secondary school	85	3.16 ± 1.454**		
College/University	87	3.71 ± 1.606***		
Postgraduate	7	4.00 ± 1.528***		
Frequency of cleaning mouth				
Never	3	5.00 ± 1.000	2.192	0.057
2-3 times a month	4	4.00 ± 2.309		
Once a week	2	5.00 ± 0.000		
2-6 times a week	4	3.50 ± 1.000		
Once a day	109	3.52 ± 1.507		
Twice or more a day	69	3.00 ± 1.663		
Use of toothpaste				
Yes	189	3.37 ± 1.595	0.997	0.319
No	2	4.50 ± 0.707		
Use of fluoride toothpaste				
Yes	168	3.48 ± 1.555	3.057	0.050
No	16	2.50 ± 1.506		
Don't know	7	3.00 ± 2.160		
Dental visit				
< 6 months	14	4.14 ± 1.703	1.958	0.0870
6-12 months	4	3.25 ± 1.893		
1-2 years	7	4.29 ± 1.254		
2-5 years	12	3.42 ± 1.084		
> 5 years	31	2.81 ± 1.833		
Never	123	3.39 ± 1.529		
Total	191	3.38 ± 1.591		

*, **, *** not significant different at 0.05. [†]ANOVA P value, participants with higher education were most aware of oral health when compared with respondents with secondary and primary education

Almost three-quarter of the study population 138 (72.2%) were aware of the importance of fluoride in toothpaste, slightly less than the 92.3% observed in the study done in Kuwait²⁰ but far greater than the 5.0% in China.²¹ Almost half (46.0%) of the respondents of an Indian study were aware of dental flossing²² which is higher compared to the 37 (19.4%) that were aware of dental flossing in this study. The difference can be attributed to the level of dental health services and awareness in study locations.

Less than half 82 (42.9%) of the participants were aware of the harmful effect of sugar on the teeth when converted by bacteria to acid, compared to 62.3% reported in the Belarus study,²³ which consisted of school teachers and mothers, who perhaps better informed with up to date oral health information. The proportion of participants 77 (40.3%) that recognized plaque as a germ containing substance that collects on the surface of the teeth, is in line with the study done in Kuwait (40.6%)²⁰ but much higher than China (16.0%)²¹ and North Jordan (14.9%).²⁴ The observed difference could be attributed to a greater sample size in these studies (577 in the North Jordan study and 4398 in the Chinese study). Again, less than half 86 (45.0%) of the respondents were aware of the goal of tooth brushing, which may be a reflection of the low level of dental care services and client education when compared with 89.0% reported in a study in the United States.²⁵ In the United States study, only 22.0% were aware of the most "tooth friendly" time to take sugar or sugar treat,²⁵ almost at par with this study 36 (18.8%). The best ways to perform oral hygiene were recognized by only 13 (6.8%) of the respondents, and this is a pointer to the very low awareness when compared to the Brazilian study with 95.0%.²⁶

The slightly higher proportion of respondents that were aware of gingivitis in Batangas City, Philippines (48.4%)²⁷ compared to 58 (30.4%) in this study may be

due to better oral health awareness/client education. A lot more needs to be done, as only 32 (16.8%) of the study population could link low birth weight, heart diseases and diabetes with gum disease, compared with the United States of America study with 37.0%,²⁵ which perceivably is also considering the higher level of oral health services, awareness and education.

The majority of participants 163 (86.4%) perceived the condition of their teeth as above average, this is slightly higher than India, (66.0%)²⁸ but lower still (36.8%) in the United States.²⁹ This difference may be due to dietary differentials and larger sample sizes. More than half 109 (57.1%) brushed their teeth once a day comparable with the Iranian study (55.0%).¹⁹ One-third 69 (36.1%) brushed their mouth twice or more a day as generally recommended in consonance with studies in India²⁰ and Kuwait.²⁸ However, the higher figure found in the Saudi Arabian study (66.5%)³⁰ may be attributed to better awareness and higher level of dental services; India (81.9%)¹⁶ may be due to the urban community, and the Philippines (75.2%)²⁷ was due to assess to the Dental Health Program of a dental school. The use of toothbrush 189 (99.0%) and fluoride toothpaste 168 (88.9%) was a gold standard for cleaning the mouth by the respondents, in line with the Iranian study with (92.3%).¹⁹ None of the respondents had ever used dental floss and its underutilization was reported in North Jordan (2.0%)²⁴ and China (4.0%)³¹ as well. A high proportion 123 (64.4%) of the respondents had never visited the dentist for dental care, as reported in a Nigerian study.³² Among those that visited, only 14 (7.3%) visited the dentist within the last 6 months, a big disparity with Pakistan (42.5%);²⁰ obviously due to a better dental practice and awareness.

Up to 34 (17.8%) of the respondents did not have access to needed oral health services which is in line with the 11.8% in North Jordan,²⁴ the reason of which high cost of

dental treatment was cited by 17 (11.8%) of the participants in this study, in consonance again with North Jordan²⁴ and Philippines²⁷ (11.7 and 12.9%), respectively. There was no statistically significant relationship observed between oral health awareness and dental visits, cleaning the mouth and use of toothpaste; which are similar with studies done in Pakistan,²⁰ India¹⁶ and Nigeria,³³ respectively.

Conclusion

Oral health awareness was low. However, 138 (72.3%) of the respondents were aware of the importance of fluoride toothpaste, 168 (88.9%) used fluoride toothpaste, only 69 (36.1%) brushed at least twice daily, and none

of the participants used dental floss. Utilization of dental service was low. Comprehensive oral health education program for all PLWHAs and wider dental care coverage by health insurance are programs for improvement.

Conflict of Interests

Authors have no conflict of interest.

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Clinical efficacy of two manual toothbrushes on plaque and bleeding indices

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Original Article

Abstract

BACKGROUND AND AIM: The mechanical removal of plaque by tooth brushing is the most effective way for prevention of caries and periodontal diseases. Some studies indicate that the design and shape of toothbrush could be the effective for this point. The aim of this study was to compare the efficacy of a Classic toothbrush with a Superbrush toothbrush in controlling plaque and gingival bleeding over a 2-week period of brushing.

METHODS: This study was a crossover clinical trial, involving 30 healthy individuals who were dental students of both sexes, randomly divided equally into two groups with simple method: group A (Classic Toothbrush; Soft, Tepe, Sweden) and group B (Superbrush Toothbrush; Soft, Dentaco AS, Haukeland, Norway). After taking an informed consent, the baseline O'Leary plaque index (PI) and bleeding point index (BPI) was recorded, and the subjects were given common toothpaste (Crest). A prophylaxis was performed to achieve the PI of zero and then the demonstration of Bass technique was given to each subject. Each group started the experiment with a different type of toothbrush for 1 week which followed by 1 week of wash-out. After that, each group switched to the next type of toothbrush for 1 week. All subjects had to refrain from other oral hygiene procedures for the duration of the study. The results were analyzed statistically by independent t-test and paired t-test. A statistical significance was set at the 95% confidence level ($P < 0.050$).

RESULTS: Superbrush showed a significant reduction of both PI ($P = 0.050$, $P < 0.050$) and BPI ($P = 0.001$) at 7 and 14th days with respect to the baseline. The analysis revealed that the Superbrush was significantly a more effective in removing plaque as compared to the Classic toothbrush ($P < 0.010$), while according to the BPI, there were no statistically significant differences between the two brushes ($P = 0.185$, $P > 0.050$).

CONCLUSION: The results showed the efficacy of Superbrush toothbrush in a significant reduction of PI and BPI, so it can be suggested to patients as an alternative to the Classic toothbrush.

KEYWORDS: Dental Plaque Index; Bleeding Point Index; Tooth Brushing

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It has been known for many years that dental caries and plaque-induced periodontal diseases are the two most common oral diseases caused by microorganisms, which colonize the tooth surface and dental plaque deposits on the tooth surface.^{1,2} Dental plaque is an essential etiological factor of caries and gingivitis.^{2,3} Microbial plaque growth occurs within hours, and it must be completely removed at least once every 48 hours in the

experimental study with periodontally healthy subjects to prevent inflammation.^{4,5}

The normal tooth brushing practices adequately performed by anyone could be sufficient to control bacterial plaque. However, several tooth brushing methods have been proposed which the most used are: Bass, Modified Stillman, Stillman, Scrub, Roll, Charter and etcetera., the Bass technique and the roll method being two of the most common recommended techniques in dental

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practices. The Bass technique is claimed to be the method of choice for cleaning lingual surfaces of mandibular molars and premolars⁶ and is superior to the Roll method in cleaning the tooth tissue adjacent to the gingival tissue, the gingival margins, and the sulcus.⁷

A study evaluated the role of brushing technique and toothbrush design in plaque removal and concluded that the plaque removing ability was greater when the Bass technique was used together with the V-shaped toothbrush on linguo-distal and linguo-mesial surfaces, especially when interproximal areas did not show any periodontal tissue breakdown.⁸

Toothbrush manufacturers have made great effort in considering many different aspects when designing new models to meet the challenge of enhancing plaque biofilm removal through improved tooth brushing efficacy.⁹ These and similar breakthroughs have led to the emergence of numerous types of specially-designed manual toothbrushes to improve dental health. This motivated the researchers to make a comparison between different brands and types of toothbrushes and to identify and recommend the best designs.^{8,10-14} Narang et al.³ in a study consisted of 100 non-clinical dental students compared the plaque removing efficiency of two branded toothbrushes with different brush head design and bristle arrangement in routine oral hygiene practice. They concluded that the arrangement of bristles plays a convincing role in reduction of plaque besides the manual dexterity of an individual.

One of the new developments is a manual triple-headed brush (so-called Superbrush) which is intended to clean the lingual, buccal and occlusal surfaces of the teeth at one time. Levin et al.¹³ evaluated the effect of toothbrush design on brushing skills and plaque removal among young healthy adults and they found that the triple-headed toothbrush promote easier tooth brushing and plaque removal both before and after

receiving tooth brushing instructions. Oliveira et al.¹⁵ in a study on 20 children aged 4 years old, with sound and complete primary dentition, showed that effective biofilm removal was achieved with both Classic and triple-headed toothbrushes; however, the triple-headed type had a better performance on surfaces when the mother brushed the teeth of the child. Thus, the present clinical study sought to evaluate the effectiveness of plaque removal and gingival bleeding point index (BPI) by using the triple-headed toothbrush compared to a Classic manual toothbrush.

Methods

This study was a crossover, single-blind clinical trial, involving 30 healthy individuals who were dental students of both sexes (half of them were female and half were male). This study was conducted in the Department of Periodontology of Kerman Dental College in Iran and was approved by the Ethics Committee of Kerman University of Medical Sciences (No. K/92/178). The trial was registered in Iranian Registry of Clinical Trials (IRCT), No. IRCT2015051517619N3. Convenience sampling was performed for enrolling the subjects in the study. Assigning the subjects to the Classic (Soft, Tepe, Sweden) and Superbrush (Soft, Dentaco AS, Haukeland, Norway) brushing (Figure 1) groups was done randomly with simple method. In simple random sampling, the most primitive and mechanical method would be the lottery method. Each member of the population is assigned a unique number. Each number is placed in a bowl and mixed thoroughly. The blind-folded researcher then picks half of the numbered tags from the bowl. All the individuals bearing the numbers picked by the researcher will be assigned to the first group.

An informed consent was obtained from the participants. A screening questionnaire was assigned to all subjects who participated to the study for recording the plaque and

bleeding point indices. All subjects received a baseline plaque assessment, and they were given common toothpaste (Crest). The inclusion criteria were as follows:

All the selected subjects met with the following criteria: minimum of 20 natural teeth, the absence of underlying systemic disease with a detrimental effect on the periodontal condition, lack of caries. The exclusion criteria were as follow: pregnancy, history of drug/alcohol abuse, smoking or chewing tobacco, use of any medication and presence of: orthodontic appliances or implants, crowding of the teeth, restorations with overhangs, extensive restorations; partial prosthetic rehabilitation or/and bridges, deep pockets, severe periodontal disease and mouth-breathing.^{14,16}



Figure 1. From left to right: Classic toothbrush and Superbrush

The amount of plaque was recorded using the O'Leary plaque index (PI)⁷ and then a prophylaxis was performed to achieve the PI of zero.^{14,16} All the subjects were demonstrated Bass method of brushing at each visit with its assigned toothbrushes:

Superbrush or Classic toothbrush. All subjects were requested not to do any oral hygiene procedures for 48 hours prior to the baseline records.^{17,18} After that, their plaque and bleeding point indices were assessed and recorded (Figure 2).

Subjects were given their first randomly assigned toothbrush to use twice each day and to put aside all other oral hygiene products (i.e., inter-dental cleaning products, mouth rinses and etcetera) for the duration of the study. Subjects used brushes for 1 week, and they were reminded to abstain from all oral hygiene for 24 hours prior to their visit and to bring their toothbrush with them. The procedure was the same at the next visit. After 1 week of application, the O'Leary PI and the BPI were used to assess the effectiveness of the two brushes on the mentioned parameters. This was followed by 1 week of wash-out.^{16,19} Afterward subjects were given the next toothbrush and instructed again. The total duration of the study was 3 weeks. The PI and BPI were recorded at the end of each brushing session. The results were analyzed statistically by independent t-test between groups and by paired t-test within groups.

Results

This study was designed to compare the ability of both Classic and Superbrush toothbrush on plaque and gingival bleeding point indices reduction. All the subjects

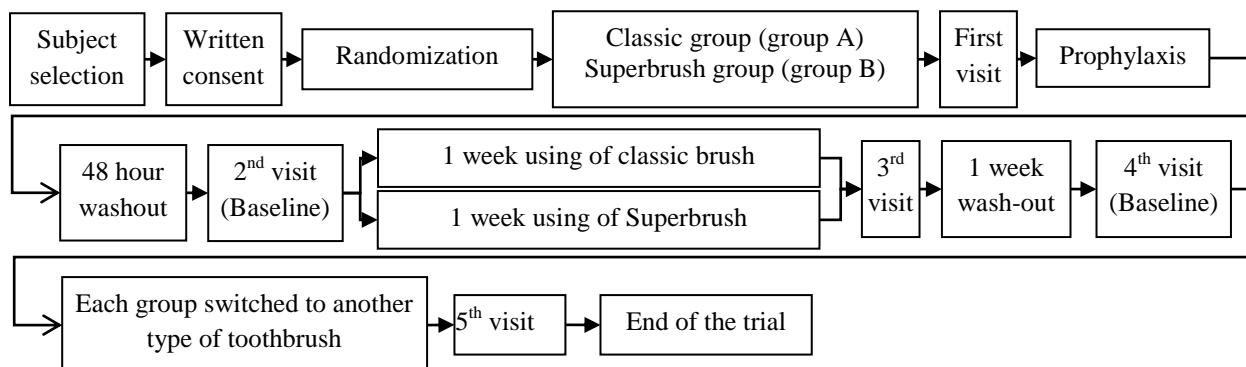


Figure 2. Flowchart of the study

successfully completed the study period of 2-week, none dropped out, and all the subjects maintained their recall appointments. Bleeding point and plaque indices of all participants both before and after a period of 1-week of brushing with each brush were measured. Therefore, during the study, the indices of every subject were measured 4 times and registered in their individual form.

The mean O'Leary PI at the first visit was 46.28 ± 6.51 (range from 36.61 to 59.82; median: 45.54) that by prophylaxis were set to zero. The following 48 hours of no oral hygiene and second visit (baseline) it reached on average 31.07 ± 3.90 and 30.12 ± 3.87 , which was reduced to 19.28 ± 2.59 and 16.48 ± 2.61 for the Classic and Superbrush group, respectively, at the end of the study. Mean BPI were 8.14 ± 1.24 and 7.84 ± 1.84 for both groups which decreased to 7.46 ± 1.22 and 6.79 ± 1.73 respectively at the end of the study.

Mean percentage changes of variables for both Classic and Superbrush groups in case of PI were 37.65 ± 7.15 and 46.51 ± 8.84 and in the case of BPI were 1.79 ± 0.84 and 1.28 ± 0.48 , respectively. The amount of reduction in the PI for both toothbrushes was statistically significant at 7 and 14th days with respect to baseline (Table 1). Moreover, in terms of the PI, the Superbrush toothbrush was significantly more effective compared to the Classic toothbrush (Table 1) while according to the BPI there were no statistically significant differences between the two brushes. No significant differences in the BPI in Classic toothbrush

($P = 0.052$) was observed. The analysis revealed that PI for the Superbrush were significantly lower as compared to the Classic toothbrush ($P = 0.050$, $P < 0.050$) while, it was not significant for the BPI ($P = 0.185$, $P > 0.050$).

Discussion

The study showed that within the limitations of the 2-days non-brushing design, a significant difference was found both within and between the groups by considering PI, but in the case of BPI, the significant difference was related to Superbrush group ($P = 0.001$). Both brushes significantly reduced the plaque accumulation, though to different degrees. Moreover, from the different studies it can be concluded that different types of brushes significantly reduces the PI albeit the differences between the groups will not be significant if it is done by skilled subjects or over a longer period of time.

Zimmer et al.²⁰ In a single-blind crossover study found that a Superbrush toothbrush was significantly better at removing plaque than a Classic brush, the results of the present study demonstrated better cleaning effects by the Superbrush as compared to a Classic toothbrush which is in accordance with the findings of the study of Zimmer et al.²⁰ As compared to a Classic toothbrush, the Superbrush was of similar effectiveness in BPI ($P = 0.185$). In the current study, there was relatively large plaque accumulation after the first 24 hours wash-out, which reduced significantly in both groups.

Table 1. Paired t-test and independent t-test for each variable

Variable	Differences (mean \pm SD)	95% CID		P
		Lower	Upper	
PI				
Classic	11.78 ± 3.02	10.65	12.91	< 0.001
Superbrush	14.58 ± 3.79	13.16	15.99	< 0.001
BPI				
Classic	0.67 ± 1.82	-0.01	1.57	0.052
Superbrush	1.05 ± 1.61	0.529	1.91	0.001
PI				
Classic versus Superbrush	8.86 ± 7.08	4.706	13.02	< 0.001
BPI				
Classic versus Superbrush	5.30 ± 4.19	-2.59	15.45	0.185

PI: Plaque index; BPI: Bleeding point index; CID: Confidence interval distributions; SD: Standard deviation

Parizi et al.²¹ found that PI decreased significantly in all groups, except Oral-B. They reported a significant 53% reduction in the PI in the Panbehriz Classic group (from 20.92 to 9.91, $P = 0.007$). Oliveira et al.¹⁵ in their study showed that statistically significant difference was observed on biofilm removal on occlusal and smooth surfaces, regardless of the toothbrush used or who performed the brushing ($P < 0.001$). Levin et al.¹³ have showed that the triple-headed toothbrush will promote easier tooth brushing and plaque removal both before and after receiving tooth brushing instructions. The aforementioned results were in agreement with the prevailing literature on this respect^{16,18} as all toothbrushes significantly decreased the PI, which is identical with our results. Finally, our results showed that both designs are safe enough to decrease PI and BPI.

Conclusion

On basis of the results of this study, both

Classic and Superbrush toothbrushes had well performance during the 2 weeks of twice daily use in reduction of PI and BPI. However, the Superbrush was significantly more effective than the Classic toothbrush in a reducing dental plaque after 2 weeks of product use so the handling of the Superbrush seems to be easy. Furthermore, it seemed that the bristle design affects the plaque removal efficacy of the toothbrush and decreasing the BPI besides the manual dexterity of an individual. Accordingly, the use of Superbrush could be suggested for patients.

Conflict of Interests

Authors have no conflict of interest.

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Is there association between severe early childhood caries and weight at 25-28 weeks of fetal life? A longitudinal pilot study

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Original Article

Abstract

BACKGROUND AND AIM: Severe early dental caries in childhood is one of the health problems. This study was performed to determine the association between weight at 25 and 28 weeks of fetal life and severe early childhood caries (S-ECC) at 1.5-2 years of age among some of children in Kerman, Iran.

METHODS: In this longitudinal study, 100 pregnant mothers and their newborns examined via sonography for fetus weight and clinically for dental caries, using International Caries Detection and Assessment System (ICDAS) criteria. Variables, including fetus weight and presence or absence of signs of S-ECC, were recorded in a checklist. Data were analyzed using t-test.

RESULTS: The mean fetal weight of 10 children with signs of S-ECC at 25-28 weeks of fetal life was 752.4 g. However, this mean was 898.05 g for 35 children, who did not have any signs of S-ECC. The difference between the two groups was statistically significant.

CONCLUSION: It appears there is an association between the rate of changes in fetal weight at 25-28 weeks of gestational age and occurrence S-ECC. Due to the fetal weight can be effective on thickness as and hardness of enamel developed on deciduous maxillary incisors, therefore, the fetal weight can be associate to the occurrence of S-ECC in these teeth after birth.

KEYWORDS: Fetal Life; Severe Early Childhood Caries; Weight

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Severe early childhood caries (S-ECC) is defined as a condition in which the maxillary deciduous incisors become carious in children < 3 years of age, with different severity, ranging from decalcification of enamel to destruction of enamel and cavitation. Any sign of caries among children older 3-year-old until 6-year-old considered as ECC. In the majority of children, the condition begins as a

discoloration in the middle third and/or in the incisal third of the labial surface enamel of central incisors and lateral incisors.

Several studies have been carried out on the etiology of this condition, and several factors have been reported as affecting factors, including transfer of *Streptococcus mutans* (*S. mutans*) bacterial species from the mother's or the baby-career's oral cavity into the newborn's oral cavity and early

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colonization of these bacteria in the newborn's oral cavity, childbirth through the caesarean section, the habit of feeding the newborn with milk or sweetened liquids during sleep, inadequate or inefficient salivary flow in the newborn's oral cavity, iron deficiency anemia in the newborn, low birth weight, and poor quality of newborn's tooth enamel.^{1,2}

Despite the resulted data,^{1,2} there are children that have had some of the conditions above but have not been affected by S-ECC. Therefore, it appears other factors, too, may be effective in the occurrence of S-ECC that has not been identified yet. In other words, S-ECC in very young children is considered a multifactorial condition, similar to dental caries in adults and is affected by factors such as cariogenic bacteria and a diet rich in carbohydrates. However, although all the children under 3 years of age drink milk up to approximately 2 years of age and consume other sweetened drinks in addition to milk, and usually, there is vertical (mother to infant) and horizontal transfer (career, father and/or siblings to infant) of *S. mutans* into the oral cavities of all these children, only some of them are affected by S-ECC. For example, studies in Kerman, Iran, have shown that only approximately 40% of children < 3 years of age are affected by S-ECC and the others have sound teeth.² Therefore, it is believed that other factor(s) have a role in the initiation of S-ECC in children < 3 years of age.

Based on a pediatric medicine textbook, in a normal fetus, weight is almost 460 g at a gestational age of 20 weeks, and the weight increases to 900 g at week 25 which is the beginning of the third trimester of fetal life. The fetus weighs almost 1300 g at the 28th week of fetal life, i.e., there is a sharp increase in weight and size of the fetus during the 25th week, which continues up to 28th week and continues at a high rate thereafter.³ On the other hand, based on the pediatric dentistry textbook, the enamel of maxillary central and

lateral incisors begins to form during the 14 and 16th weeks of fetal life, respectively, with five sixth of the enamel of central incisors and two-third of the enamel of lateral incisors having formed at birth (42nd week). At 22-25 weeks of fetal life approximately half of the enamel of maxillary central incisors and the incisal edges up to one-third of the enamel of maxillary lateral incisors has already formed.^{3,4}

Since in the majority of cases of S-ECC in the first stage decalcification and discoloration of enamel is evident as a round band on the middle third of the labial surfaces of maxillary central incisors and the incisal thirds of the labial surface enamel of maxillary lateral incisors, it might be hypothesized that an increase in weight from week 21 to week 28 during the fetal life might have a relationship with the quantity and quality of the enamel formed during the same period (i.e., in the middle third and the incisal third of the crowns of central and lateral incisors). In other words, an adequate increase in the weight of the fetus during weeks 21-28 might affect the quality and quantity of the enamel formed during the same period and weaker enamel might exhibit less resistance against the destructive activity of *S. mutans* in the presence of milk and other sweetened drinks. Therefore, S-ECC might originate from weak enamel; in the other words, the weak enamel will act as a half-open gate for acid attack by bacteria. As a result, E-ECC might be observed in some young children with the habit of drinking milk during sleep and might not be observed with such a habit in some others.

Given this hypothesis and in an attempt to help resolve the mystery of the occurrence and prevalence of S-ECC, the present longitudinal pilot study was undertaken to evaluate the association between the fetal weight from week 25 to week 28 of fetal life and the occurrence of S-ECC on the enamel surfaces of maxillary incisors at 1.5-2 years of age. Such a study was the first of its kind and

at present no such study is available.

Methods

The present longitudinal study was approved by the Ethics Committee, Deputy Dean of Research, Kerman University of Medical Sciences, with Ethical code K/92./340. A total of 100 healthy pregnant women with an age range of 18-45 years and with a gestational age of 21-28 weeks were included in the study; the subjects were selected from those referring to two obstetricians for periodic examinations. All of the women were employee in governmental offices in Kerman. They had received sufficient information and instructions about desirable nutrition as well as about physical and mental resting during pregnancy period from the obstetricians in their first visit.

They received an ultrasonic examination based on their own desire or a request by their physician. The sample size was determined based on a 40% prevalence rate of S-ECC in children < 3 years of age in Kerman,² using the formula specifically used to determine sample sizes. The subjects received sufficient explanation about the study procedures in the offices of the obstetricians and signed informed consent forms to be included in the study. The subjects referred to a radiology and ultrasound clinic with a written request issued by the obstetrician in charge for an ultrasound examination of the fetus in 2013 and underwent the ultrasound examination (General Electric, Logic 200, USA). The fetal weights determined by the ultrasonic examination were registered in the checklist of each subject. The checklist consisted of demographic data, including mother's age, address, phone number, cell phone number, as well as the weight of the fetus, gestational age (in weeks) and the health status of maxillary deciduous incisors at an age of 1.5-2 years based on International Caries Detection and Assessment System (ICDAS) index:⁵

Code 0

- Sound tooth surface
Code 1
- First visual change in enamel (after drying teeth for 5 seconds)
Code 2
- Distinct visual change in enamel
Code 3
- Localized enamel breakdown
Code 4
- Underlying dentinal shadow (not cavitated into dentine)
Code 5
- Distinct cavity with visible dentine
Code 6
- Extensive distinct cavity with visible dentine

The third author examined the babies' mouth. She was trained for examination according to ICDAS Index. After the ultrasonic examination, each subject (mother) received nutritional recommendations as well as oral hygiene instructions, for the babies after their birth, including: (1) Inhibition of extended and/or excessive frequency of feeding times (from the breast or bottle) especially at afternoon nap time and/or at night, (2) cleaning the gum pads and erupted teeth by the moisture pads or by the finger toothbrushes. Furthermore was asked of them to take the babies to the Department of Pediatric Dentistry, Kerman Faculty of Dentistry when the baby was 1.5-2 years of age for the examination of maxillary incisors and evaluation of absence or presence of S-ECC. After that the results of examination was recorded in the relevant checklist. Data were analyzed using t-test.

Results

Of 100 mothers included in the study, only 4 people were omitted for bring their 1.5-2-year-old children for dental examinations because they had low birth weight (< 2500 g). Therefore, finally the sample size decreased to 96.

A total of 22 children aged 1.5-2 years exhibited S-ECC signs in maxillary incisors (codes 1-5 of ICDAS Index) and 74 children

Table 1. Frequency distributions of children with and without early childhood caries (ECC) in terms of the time their mothers underwent ultrasound examinations

Children	Mothers referring for ultrasound examination from week 21 to week 24 of pregnancy [n (%)]	Mothers referring for ultrasound examination from week 25 to week 28 of pregnancy [n (%)]	Total [n (%)]
Without caries	39 (40.62)	35 (36.46)	74 (77.08)
With caries	12 (12.50)	10 (10.42)	22 (22.92)
Total	51 (53.12)	45 (46.88)	96 (100)

had no visible signs (code 0 of ICDAS Index). The evaluation of the checklists revealed that the mean fetal weight of 10 children with signs of S-ECC at 25-28 weeks of fetal life was 752.4 g. However, this mean was 898.05 g for 35 children who did not have any signs of S-ECC. The difference between the two groups was statistically significant (Tables 1 and 2).

Discussion

Based on the results of the present study, of 96 children which evaluated during their fetal life, approximately 23% (22 children) exhibited signs of S-ECC at 1.5-2 years of age. Previous cross-sectional studies in Iran have reported a prevalence rate of 13-44% for S-ECC and/or ECC in children.² In other countries, a prevalence rate of 8.4-72% has been reported.⁶ American Dental Association (ADA) has reported a 5-fold prevalence rate for S-ECC and ECC compared to that of asthma in children.⁷ The prevalence rate of S-ECC in the present study is consistent with the mean prevalence rate of this dental condition in Iran.

A study has shown that hypoplastic or hypocalcified enamel (with different severities) can be a predisposing factor for S-ECC;⁸ however, no longitudinal researches until this time have studied the possible relationship between hypoplastic or hypocalcified enamel with fetal weight at a

time when enamel is developing during the fetal life. The current study is the first such study. Some researchers have studied the relationship between low birth weight (< 2500 g) and occurrence S-ECC, but could not find any statistically significant relation between of them. Low birth weight babies have had equal or less experience of dental caries in comparison to normal birth weight babies.⁹⁻¹¹ Those researches stated the results are based on a very limited evidence and further studies, particularly prospective studies, are needed to confirm that there is indeed no association between birth conditions and dental caries in children.⁹⁻¹¹

A researcher has stated high dose of antibiotics which have described by pediatricians for low birth weight infants suppress early colonization of *S. mutans* and resulted low occurrence S-ECC.¹² Numerous of fetuses who do not experience sharp increase in weight during the 25th week, in later weeks in the three trimester compensate the weight deficit and will have normal weight at birth time but after eruption deciduous teeth will experience dental caries because enamel of their teeth is weak. The current study showed this issue. However, this study had some limitations and should be considered a pilot study. These limitations include the sample size and

Table 2. Comparison of fetal weights in mothers undergoing ultrasound examinations at weeks 25-28 of gestational age and whether the children were affected by early childhood caries (ECC) or not

Children	Mothers referring for ultrasound examination from week 25 to week 28 of pregnancy (%)	The mean weight of the fetuses (g)	SD	P
Without caries	35	898.05	138.5089	0.014
With caries	10	752.40	218.1122	
Total	45	865.68	168.2429	

SD: Standard deviation

the time the mothers underwent ultrasound examinations. In other words, approximately 100 mothers (finally 96 mothers) voluntarily participated in this study and due to ethical considerations they underwent ultrasound examination only once based on their own request or based on a request by the physician in charge for specific considerations. Therefore, the mothers did not undergo ultrasound examinations solely for the purpose of this study.

From a scientific point of view, ultrasound examinations should be carried out 3 times during the whole pregnancy period. The first examination is carried out from week 6 to week 13 of gestational age to confirm pregnancy and determine the thickness of the fetal neck. The second examination is carried out from week 18 to week 22 to evaluate fetal anomalies, and the third is carried out during the third semester to evaluate proper growth and development and the amniotic fluid.¹³ In the present study, almost half of the mothers (51 mothers) had referred for an ultrasound examination from week 21 to week 24. If these 51 mothers had referred at week 25-28 or if they had undergone second ultrasound examination from week 25 to week 28, the fetus of 12 persons of them, which later

affected by ECC, showed a weight that could possibly reveal a stronger association between fetal weight at 25 and 28 weeks and the occurrence of ECC. Therefore, it is suggested that studies be carried out with larger sample sizes with ultrasound examinations at 25-28 weeks of gestational age.

Conclusion

Based on the results, it seems there is an association between the rate of changes in fetal weight at 25-28 weeks of gestational age and occurrence S-ECC. Due to the fetal weight can be effective on thickness as and hardness of enamel developed on deciduous maxillary incisors, therefore, the fetal weight can be associate to the occurrence of S-ECC in these teeth after birth.

Conflict of Interests

Authors have no conflict of interest.

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Correction of severe tooth rotation by using two different orthodontic appliances: Report of two cases

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Case Report

Abstract

BACKGROUND AND AIM: Severe rotation of tooth is one of the most common problems in orthodontics and considered as a developmental phenomenon. These rotations can cause cosmetic problems, gingival recession, and traumatic occlusion. By using removable appliances, severe rotations can be treated. Furthermore, gingival damage, tooth attrition, and transposition of other teeth could be prevented. Early treatment of these rotated teeth could improve dental aesthetic affecting on child's behavior and enhanced self-confidence. This case report presents two treated cases using the removable appliance in severe tooth rotations.

CASE REPORT: Case 1: The severe rotation of right upper central incisor in a 9-year-old girl is corrected with removable orthodontic appliance and whip spring. Case 2: The severe rotation of left lower lateral incisor in an 8-year-old girl is corrected with a force couple and elastic anchored on the removable orthodontic appliance.

CONCLUSION: In this paper, it was revealed that to correction the problem, in the first case a removable appliance with a whip spring was used and in the second case, a removable appliance in combination with bracket and elastic was efficient to prevent from a complicated orthodontic treatment in the future.

KEYWORDS: Rotation; Removable Orthodontic Appliance; Correction

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Crowding is the most common dental malocclusion and associated with a reduction in the size of the jaws. The role of crowding in the development of dental caries and periodontal disease has been confirmed.¹ A rotated central incisor creates numerous aesthetic and psychological problems for a patient. Tooth rotation is considered as observable mesiolingual or distolingual intra-alveolar displacement of the tooth around its longitudinal axis.² The exact etiology of tooth rotation is unknown, but it seems to be a developmental phenomenon. Displacement of dental follicle

and path of tooth eruption can create tooth rotations.^{1,3} If there are multiple rotations of teeth, comprehensive orthodontic treatment with fixed appliances are used. But in cases with a single severe tooth rotation, it can be used removable appliances, for correction of rotated teeth.^{4,5}

When a fixed orthodontic appliance is used to correct only some of the teeth in the mixed dentition, arch wire spans are longer, the wire is springier and large movements are easily possible. However, it may be difficult to use fixed appliances correctly during the mixed dentition period since the available permanent

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teeth are grouped into anterior (incisor) and posterior (molar) segments. In addition, anchorage control becomes difficult as only the first permanent molars serve as an anchorage in the posterior segment of the arch.

The whip appliance was introduced by Houston and Isaacson in 1980. The original appliance has been mildly modified to better satisfy the therapeutic needs. This appliance consists of a removable orthodontic plate, a cantilever spring and a bracket or bonded tube that enables effective correction of severely rotated anterior teeth in a short period of time. Better anchorage control, relatively simple force system, easier oral hygiene management, and less critical patient cooperation are the advantages of the appliance.⁶ Correction of the rotated teeth in early ages also prevents from irreparable injuries to the supporting tissues, and dental follicle transposition.⁷ Canine-lateral transposition can be problematic in laterally mandibular movements.⁸ In addition, avoiding of tooth eruption in a rotated position can reduce the relapse of treatment.⁹ The early treatment of these rotated teeth could improve dental aesthetic affecting on child's behavior and enhanced self-confidence. Researchers have also found that an attractive appearance and social acceptance can assist the individual in achieving social success.¹⁰ In this report, two different methods for correction of severe tooth rotation by means of removable orthodontic appliances offered.

In the first case, severe rotation of right maxillary central incisor in a 9-year-old girl corrected by whip spring and removable orthodontic appliance and in the latter one, severe rotation of lower left lateral incisor in an 8-year-old girl corrected by a force couple and elastic anchored on the removable orthodontic appliance.

Case Report

Case 1

The 9-year-old girl was referred to the private

practice with the chief complain of severe rotation of the upper anterior tooth (Figure 1). Her medical history revealed no problems. Clinical examination showed a slightly convex facial profile and symmetric face. The soft tissue of the lips, chin, and nose were evaluated. Intraoral examination revealed class I malocclusion, but over jet and overbite was reduced. In panoramic radiography, severe rotation of the upper right central incisor was observed. The device included a removable orthodontic appliance, a whip spring and a bonded tube (Figure 2).



Figure 1. Central incisor with 90° rotation



Figure 2. Removable appliance, whip spring and bonded tube

The removable appliance consists of acrylic base plate, circumferential clasps on the maxillary first permanent molars and a labial arch on the upper primary canines.

Molar Adams clasps and labial arch were made of 28 mil (0.7 mm) stainless steel wire (Dentaurum, Germany). A bonded tube (Dentaurum, Germany) was bonded on the 1/3 incisal area of the labial surface of central incisor with light-cured composite resin (Trans Bond XT, 3M Unitek, USA). To increase flexibility, the range of motion and easier insertion of coil springs, whip spring was made with a segment of 0.4 mm stainless steel orthodontic wire (Dentaurum GmbH & Co. KG TurnstraBe 31, 75228 Inspringen-Germany) and a length of 20 mm. The mesial end of the spring was inserted into the tube slot and bent toward the gingiva, and the hook located in the distal end of the wire was engaged to the labial arch. The patient was monitored monthly and during 4 months the upper right central incisor was repositioned to its normal position (Figure 3). The induction force of flexibility of the wire corrected the rotated tooth. After over correcting the tooth rotation, the appliance was removed, and retention begins using a modified Hawley retainer. Circumferential supra crestal fiberotomy surgery was not performed because no satisfaction of her parents.



Figure 3. Correction of the rotated tooth

Case 2

The 8-year-old girl was referred to the School of Dentistry of Shiraz University of Medical Sciences, Iran, with chief complain of severe rotation of the lower left lateral incisor. The medical history of the child revealed no

problems. In the clinical examination, normal growth pattern was seen. In the extra oral examination, the patient's profile was slightly convex and in front view was normal. Intraoral examination showed class II malocclusion with the severe rotation of the lower left lateral incisor and over jet was increased (Figures 4 and 5). Upper mid-line was deviated to right (1 mm) and lower midline was deviated to left (2 mm). Space analysis by using radiography revealed lack of space for the eruption of permanent teeth in the mandible and maxilla (7 and 4 mm, respectively).



Figure 4. Intra oral view of the patient



Figure 5. Lateral incisor with 90° rotation

In the panoramic radiograph, lateral incisor had a severe rotation, and the risk of impaction or incomplete transposition of canine-lateral in the same side due to superimposition of the canine crown on the

lateral incisor root was observed. The device included a removable orthodontic appliance, two brackets (Dentaurum, Germany) on lingual and labial surfaces of the rotated tooth and elastic 3/16 Median pull (American Orthodontics EC Certification Service GmbH Sandgasse7, A-9300 St. Veit/glan, Austria). The removable appliance consists of an acrylic base plate, circumferential clasps on the mandibular first permanent molar, first and second primary molars and a labial arch on the lower incisors. Labial arch included a double loop at equal distances from the brackets (Figure 6). Molar Adams clasps and labial arch were made of 28 mil (0.7 mm) stainless steel wire (Dentaurum, Germany). Two brackets were bonded on the lingual and labial surfaces of the left lower lateral incisor with light cure composite resin (Trans Bond XT, 3M Unitek, USA). Using two equal forces (a force couple) and elastic 3/16 by the medium pull from opposite sides of the tooth, lateral incisor was derotated well during 2 months (Figure 7).



Figure 6. Appliance design



Figure 7. Removable appliance, two brackets and elastic in oral cavity

Discussion

Severe tooth rotation can cause dental and gingival problems. It is also can create the inappropriate appearance and adverse psychological effects on the child's life. Although the etiology is clearly unknown, dental follicle displacement and path of tooth eruption can be the possible causes.¹ In two present cases, it seems to be the same causes. If these rotations cannot be modified, they cause a traumatic occlusion that it can cause gingival recession, root resorption in involved teeth. Since fixed orthodontic treatment in childhood and adolescence is not recommended, early correction of severe tooth rotations using removable devices or a combination of fixed and removable devices to reduce the injuries mentioned above could be very useful. Whip spring is an auxiliary spring and is usually placed in the molar band.⁴

Jalali and Bagherian¹¹ used whip spring joined to Adams clasp for correction of severe rotation of maxillary central incisor. They didn't observe any harmful side-effects on root development. They also mentioned, mobility and sensitivity to pain until 1 month after the active phase of treatment was normal. Mavragani et al.¹² mentioned that since root shortening due to apical resorption is one of the most serious side-effects of orthodontic treatment, it seems advisable to initiate orthodontic correction of the incisors at a young age during mixed dentition. Complications involving delayed treatment of a rotated permanent incisor include: Dilacerations of the developing roots, root resorption, loss of tooth vitality and compromised oral hygiene.² Whip appliance has many advantages for use in the mixed dentition as follows:

1. Offering a solution in the mixed dentition period, relatively in a short time
2. Providing increased vertical and horizontal anchorage due to palatal coverage
3. Anchorage control is less critical
4. Force system is relatively simple when

this appliance is used

5. Management of oral hygiene is easier

6. Patient compliance is less critical, because when removing the appliance, the damage of mucosa by wire leads to patient discomfort

7. Whip appliance can be used in emergency situations in the mixed dentition, such as traumatic occlusion of central incisors.¹³

In the first case, the spring was placed on the labial arch and the patient didn't have any limitation in wearing the removable appliance. After derotation of the tooth, the other appliance was used for retention. Mobility and mild pain were the natural complications of rotation correction, and these complications were observed in both patients. In treatment planning of the latter case, using the removable appliance and whip spring wasn't possible. Therefore, we used the combination of removable and fixed appliances to derotate the tooth. Rotation correction by using a light force in early stages of root development can lead to a stable outcome.

One of the problems with the use of whip appliance is that much attention should be considered not to activate it in the vertical plane, otherwise unwanted mesiodistal

crown and root movement may be occurred.⁴ Furthermore, this appliance can hurt the mucosa if not adjusted carefully.

It is mentioned that rotations are easy to treat but very difficult to retain. There is a high risk of relapse due to stretching of the supra-alveolar and transseptal gingival fibers, which slowly reposition. Therefore, it should be overcorrected and long-term retention period is needed to achieve the stability of treatment. Correction of single tooth severe rotation using orthodontic appliances or a combination of fixed and removable orthodontic appliances is affordable and secure way, and the possible need for future orthodontic complex treatment reduce. Timely correction of these rotations reduces the risk of damage to gingiva and teeth and also traumatic occlusion decrease. The early treatment of these rotated teeth could improve dental aesthetic affecting on child's behavior and enhanced self-confidence.

Conflict of Interests

Authors have no conflict of interest.

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Correction of sever rotation of central maxillary incisor with fixed-removable appliance in the mixed dentition stage: A case report

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Case Report

Abstract

BACKGROUND AND AIM: The aim of this case report is to present an approach used to correct severe rotation of anterior maxillary teeth in a pre-adolescent boy.

CASE REPORT: The patient was an 8-year-old boy in the mixed dentition stage and severe rotation of upper right central incisor. Whip appliance was consisted of a removable plate, a cantilever spring and a bonded molar tube on rotated tooth. After initial alignment and overcorrection of rotation during 6 months, circumferential supracrestal fiberotomy was performed. About 1 week after surgery, the device was removed and the retention period initiated.

CONCLUSION: He semi-fixed-removable appliance can be very effective for correcting severe rotation of anterior teeth.

KEYWORDS: Maxillary Incisor; Tooth Rotation; Whip Appliance

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Tooth rotation is defined as “a detectable distolingual or mesiolingual intra-alveolar displacement of the teeth around its longitudinal axis.”¹ The tooth rotation prevalence is 2.2-5.1% in general population.² The tooth rotation is classified into three categories according to Gupta et al.³ < 45°, 45-90° and > 90°. They reported rotation was the most common anomaly (prevalence 10.2%), and the majority of tooth rotations were between 45° and 90°. According to their study mandibular premolars and maxillary central incisors were the most prevalent rotated teeth.³

The most common factors contributing to the development of rotation include: a supernumerary tooth, severe tooth size arch size discrepancy, ectopic eruption of permanent teeth, abnormality in tooth bud position, class II division 2 malocclusion, cleft

palate, over-retained primary tooth, and genetic factors.^{4,5}

The aim of this case report is to introduce a combined fixed-removable appliance, which can be prescribed for patients with severe rotated anterior teeth.

Case Report

An 8-year-old boy was referred to the Orthodontic Department of Kerman Dental School, Iran, with the chief complaint of severe rotation of the upper right central incisor. The patient had no significant medical history. Extraoral examination revealed a straight facial profile and symmetric face. Intraoral examination showed class I malocclusion with anterior dental crossbite due to upright maxillary incisors and severe rotation of right central maxillary incisor (Figure 1). A class I skeletal

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pattern with no vertical discrepancy was confirmed by routine cephalometric analysis (Figure 2). Oral hygiene was poor as clinically evidenced by mild gingivitis and high-level of dental caries (Figure 3).

Since the patient refused to accept fixed orthodontic treatment, correction of rotation had to be done with the aim of a fixed-removable appliance named whip appliance. An alginate impression was taken of the upper jaw, and the removable appliance was constructed on upper jaw model. As figure 4 shows, the appliance is made of acrylic base plate, C clasps on the upper canines, Adams clasps on the upper second primary molars and left maxillary central incisor. All the clasps were made of orthodontic 28 mil (0.7 mm) stainless steel wires, except the 24 mil (0.6 mm) wires which were used for fabricating C clasps on primary canines. Whip spring was made with orthodontic 14 mil stainless steel wires by bending a vertical loop near the canine area and a posterior loop

perpendicular to the first one which was attached to the Adams clasp on the second primary molars (Figure 4).

A standard edgewise 18 mil molar tube (Dentaurum, Ispringen, Germany) was bonded on the labial surface of the central maxillary incisor by means of light cured composite (Master Dent, London, UK). The mesial end of the whip spring was inserted into the molar tube and cinched gingivally. The distal hook of spring was placed on the bridge of the upper primary second molars Adams clasp (Figure 5).

The guidance of how to place and remove the appliance was told to the patient and emphasized that he is free to remove only for tooth brushing. The patient visited every 4 weeks. After 6 months, the position of upper right central incisor was corrected (Figure 6). Because of the high probability of relapse, after over correcting the rotation of the tooth, circumferential supracrestal fiberotomy surgery was done.



Figure 1. Extraoral and intraoral examination and radiograph before treatment



Figure 2. Lateral cephalogram radiograph before treatment



Figure 5. Whip device for derotating tooth

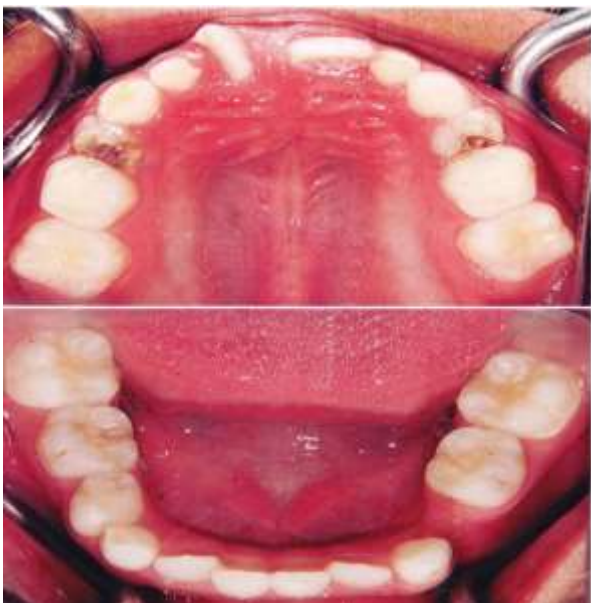


Figure 3. Tooth caries and premature missing of primary teeth before treatment



Figure 6. Overcorrected tooth



Figure 4. The design of removable appliance and whip spring

One week after fiberotomy, retention period was initiated using a modified Hawley retainer with Z-spring to increase the inclination of maxillary permanent incisors and correct anterior dental cross bite. Post-treatment records were taken and showed no significant changes or relapse within 6-month period of observation (Figure 7).

Table 1 shows the pre-treatment and post-treatment measurements of cephalometric variables. Cephalometric measurements confirmed increase upper incisors inclination.

Discussion

Several treatment options have been proposed for correcting tooth malpositions.⁶ The most used treatment option for teeth malpositions is a fixed "2 × 4 appliance" in

the mixed dentition stage (2 bands on the first molars and 4 brackets on incisors).⁷ Although this approach might correct all kinds of tooth rotations, but it has some limitations as well. With a fixed appliance just on molar tooth, arch wire spans become longer, so great moments are created, and the wire becomes more springy and weaker. Furthermore, because only the first permanent molar can be used as anchorage unit only limited movement can be done, and anchorage control is so critical. Therefore, breaking, distortion and displacement of the wire are expected.⁸ Despite the fact that fixed appliances seem simple, use of them in the

mixed dentition has complications that limit their usage. Another disadvantage of the fixed appliance is control of oral hygiene and increased the risk of decalcification of banded and bonded teeth.⁹

An alternative method for correction of tooth rotation is a removable orthodontic appliance with a labial bow and a palatal spring. In this appliance, the reactive forces are decreased, therefore, the problem of anchorage is resolved. This appliance might only modify mild rotations ($< 45^\circ$). Furthermore, treatment of rotations has a high chance of relapse so excellent patient compliance is needed in the usage of removable appliances.¹⁰



Figure 7. Final results of the treatment

Table 1. Cephalometric analysis of pre-treatment and post-treatment variables

Cephalometric index	Mean	Pre-treatment	Post-treatment
U1-SN	102	97	101
SNA	80	79	79
SNB	78	78	78
Man. Plan-SN	32	34	34

Because of the limitations of the mentioned methods, in this study, we introduce a removable appliance with fixed attachment for the treatment of the severe incisor rotation.

The advantages of whip appliance such as; simple force system, short duration of treatment, adequate anchorage due to palatal coverage and better management of oral hygiene, make it suitable for correction of tooth rotation in the mixed dentition.

As mentioned in previous articles good patient cooperation is a more probable in comparison to other removable appliance, since when patient removes the acrylic plate, the distal end of the whip spring penetrates into the buccal mucosa.^{11,12}

Complications that might arise during treatment phase are debonding of the attachment and distortion of the spring. A good level of compliance would minimize these

complications. Furthermore, the whip spring might wound the mucosa so, to deviate the wire from the vestibular mucosa some modification of the whip spring as mentioned by Parisay et al.,¹⁰ might be needed.

The whip appliance is a fixed-removable device which corrects severe rotation in the anterior teeth. By using this appliance, the clinician can correct tooth rotation in the early mixed dentition. This improves patient's self-confidence by improving smile esthetics in the preadolescent stage.

Conflict of Interests

Authors have no conflict of interest.

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