INSTRUCTION FOR AUTHORS

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- Manuscripts should be typed on one side only
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- All pages should be numbered consecutively in the top right-hand corner, beginning with the title page
- Submit 2 hard copies and 1 soft copy on a diskette/CD in Microsoft Word 2007 format
- Articles should be not more than 3000 words
- Arrange the paper in this order: (i) title page; (ii) abstract and keywords; (iii) text; (iv) acknowledgement; (v) references; (vi) tables; (vii) figures; and (viii) legends.

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The title page should include the title of the paper, full first name and surname of each author, name of authors' departments and institutions, correspondence address, telephone number, facsimile number, and e-mail address of the author who will be responsible for all correspondence regarding the manuscript.

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An abstract should not exceed 250 words in length and must state purpose, methodology, main findings and conclusion of the study. The abstract should not contain abbreviations and references. Five key words should be supplied below of the abstract.

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In the manuscript, use only System International (SI) Units and standard abbreviations. The full term for which an abbreviation stands should precede its first use in the text unless it is a standard unit of measurement.

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The Vancouver system of referencing should be used (examples and given below). In the text, references should be cited using superscript Arabic numerals in the order in which they appear. If cited in tables or figures legends, number according to the first identification of the table or figure in the text. In the reference list when there are more than six authors to a paper, cite the first three, then indicate et al. all citations mentioned in the text, tables or figures must be listed in the reference list. In general, abstracts are not acceptable as references. Limit to 30 references only.

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Generally, review articles intended to be focused on reviews of basic and clinical science related to all aspects of dentistry. Reviews should be no more than 10 Journal pages in length including figures, tables and references. They should contain the following sections: (i) abstract (350 words or less); (ii) introduction; (iii) body; and (iv) references.

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Case reports and clinical notes manuscripts will emphasize all aspects of clinical dentistry. They should describe: (i) unique cases; (ii) expected association of two or more diseases; (iii) adverse or unsuspected treatment response; (iv) any other clinical observation based upon well-documented cases that provides important new information; or (v) a new or revised clinical technique or procedure. They should be concise and occupy no more than three Journal pages.

Case reports and clinical notes should contain the following sections: (i) structured abstract consisting of no more than 250 words and four paragraphs (background, methods, results and conclusions); (ii) introduction; (iii) case description and results; (iv) discussion; and (v) references.

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Greetings from Prof. XU Tao, Editor in Chief.

Dear Colleagues:

It is my great pleasure to present to you the 2014 and 2015 issues of the International Journal of Oral Health (IJOH) – a peer-reviewed official journal published by the Asian Academy of Preventive Dentistry (AAPD). On behalf of the IJOH Editorial Team, I would like to extend my gratitude to all authors and editors, who contributes to the continued success of the journal.

The 11th International conference of Asian Academy of Preventive Dentistry was successfully held in Beijing, China from September 17 to 19, 2014. It is a special meeting for AAPD with the theme of “Promoting Oral Health with Systemic Health”, a message to emphasize the importance of oral health to the wellbeing of mankind. A total of 332 delegates from 11 countries attended this AAPD meeting, with 30 oral presentations and more than 100 poster presentation demonstrating the recent advances in oral health research. It was a successful conference with many enlightening new knowledge in the field of oral health. My great appreciation also went to our fellow country members of AAPD and the local organizer, especially those from the Department of Preventive Dentistry, Peking University School of Stomatology, without your enthusiastic participation and strong support, it was impossible to have a successful AAFP conference which brought us together.

In this issue, we have seven original articles on different aspects, from health policy analysis to clinical research relevant to oral health. As the Editor-in-Chief of IJOH, I am glad to present to you this issue and feel confident the continued success of IJOH, a journal representing the AAPD and an avenue to link us together to share the learnings and our vision to promote oral health for all.

Sincerely

Professor XU Tao
Immediate Past President of AAPD
MESSAGE of the first PRESIDENT of AAPD

Congratulations commencing the 11th AAPD’14 in Beijing China

First of all, I would like to thank all Executive Committee Members who belong to today's 11th AAPD'14.

In order to keep an agreement that the authorized limit of rights of Executive Committee Members enter upon the year of the expiration of a term, that is when the number of Executive Committee Members exceed 20 or after the laps of 20 years in office as an Executive Committee Member. So, I will retire from Executive Committee Member at the end of this 11th AAPD’14.

Now, in order to send you the spirit of the first meeting of AAPD’94, 1994, 20 years ago, I would like to make a little speach interspersed with the documents of AAPD’94 as follow.

It is a nice situation that oral health has been understood widely as an essential step to the quality of life. As you may know, the year 1994 had been decided by the WHO as the Year of Oral Health with the theme "Oral Health for a Healthy Life". Fortunately, in this memorable year 1994, the first meeting of the Asian Academy of Preventive Dentistry was launched, in Fukuoka Japan.

The Academy, AAPD was born in concurrence with the 3rd World Congress of Preventive Dentistry in Fukuoka, JAPAN in 1991. The Academy has been commencing to establish a strong network through the countries and regions in Asia since the first pre-meeting of AAPD in 1991.

"Oral Health in Asia" has been proposed by AAPD for this Academy as the most important health subject of the day in Asia. As you may have noticed, WHO proposed the year as "The Year of Oral Health". Fortunately, in the memorable year of 1994, twenty years ago, AAPD94 was launched in Fukuoka JAPAN.

The program of the meeting of AAPD’94 was as follows.

Professor Kim Jhoong-bai, Seoul National University in Korea, Professor Shen Yanmin, Zhongshan Medical College in China and Professor Philip Sutcliffe, University of Edinburgh in U.K. have been chosen as the special lecturers in the meeting. Furthermore, fourteen persons from thirteen Asian countries attended this Academy as guest lecturers. That is, Bangladesh, Cambodia, China, Hong Kong, India, Indonesia, Japan, Korea, Philippines, Singapore, Sri Lanka, Taiwan, Thailand and U.K. et al..

At the time, we have to make a lot of effort to understand and cooperate with each other through activation of our spirit for the people's health welfare in all Asian countries and regions.

In conformity with this important view point, we would like to contribute toward the health of all Asian countries and regions by developing an ideal in the WHO's health promotion. In other words, in order to bring closer an Ideal to Reality, we have to make a further effort to bring the Renaissance for health to all Asian people.

Thank you, thank you very much for your kind cooperation.

Yoko Kawaguchi
DDS, PhD, Professor,
Department of Oral Health Promotion, Tokyo Medical and Dental University
The Prevention and Control of Noncommunicable Disease: work progress in China

Jian Liu, Xunnan Liu, Tao Xu, Shuguo Zheng

Department of Preventive Dentistry, Peking University school of Stomatology

Abstract: Four types of chronic diseases including cardiovascular diseases, cancer, chronic respiratory diseases and diabetes make the largest contribution to morbidity and mortality. The top layer designs of the Macro Strategy in Prevention and Control of Noncommunicable Disease in China are government dominating, departments cooperation, society supporting and population participation. Based on the above principles, chronic disease prevention strategies and projects have been started by the government. From 2011, based on the platform of "Chinese Healthy Lifestyle" and "National Prevention and Control of Noncommunicable Disease Demonstration District", 14 provinces participated the "Better Oral Health Happier Family" project. The technical procedures have been improved through controlling of the controllable risk factors and developing surveillance. The national mortality surveillance points as representative of provinces increases to 605 points, which integrated the existing mortality registration system and the national disease surveillance system. Out of 605 surveillance points, 302 have been selected for chronic disease and nutrition surveillance. Since 2013, 60 surveillance points has been selected for oral diseases surveillance. It's expected that oral disease surveillance would be routinely included in the 3-year nutrition and chronic disease surveillance. The innovative management model has been explored from both national level and local level. The experiences of prevention and control of chronic diseases in China are summarized. Innovative policies: seizing the opportunities of medical reform, breakthrough of health insurance. Innovative management: integrating resources, purchasing health services.

Key Words: chronic diseases, prevention, policies, disease surveillance

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The 66th World Health Assembly which was held in May 2013 reiterated the importance of preventing noncommunicable disease for human health. Four types of chronic diseases including cardiovascular diseases, cancer, chronic respiratory diseases and diabetes make the largest contribution to morbidity and mortality. According to the World Health Organization, in 2008, an estimated 36 million of the 57 million global deaths were due to
non-communicable diseases, including about 9 million deaths before the age of 60, and that nearly 80 percent of those deaths occurred in developing countries. The World Health Assembly endorsed the WHO Global Action Plan for the Prevention and Control of NCDs, which will contribute to progress on 9 global NCD targets to be attained in 2025, including a 25% relative reduction in premature mortality from NCDs by 2025. WHO’s global monitoring framework on NCDs will start tracking implementation of the Global Action Plan through monitoring and reporting on the attainment of the 9 global targets for NCDs. Therefore, Heads of State and Government committed themselves in the UN Political Declaration on NCDs to establish and strengthen, by 2013, multisectoral national policies and plans for the prevention and control of NCDs, and consider the development of national targets and indicators based on national situations.

The main objectives of the Global Action Plan For The Prevention And Control Of Noncommunicable Diseases (2013-2020) ¹ include:

Objective 1. Raise the priority accorded to the prevention and control of noncommunicable diseases in the global, regional and national development agendas and in internationally-agreed development goals through strengthened international cooperation and advocacy.

Objective 2. To strengthen national capacity, leadership, governance, multisectoral action and partnerships to accelerate country response for the prevention and control of noncommunicable diseases.

Objective 3. To reduce modifiable risk factors for noncommunicable diseases and underlying social determinants through creation of health-promoting environments.

Objective 4. To strengthen and reorient health systems to address the prevention and control of noncommunicable diseases and the underlying social determinants through people-centred primary health care and universal health coverage.

Objective 5. To promote and support national capacity for high quality research and development for the prevention and control of noncommunicable diseases.

Objective 6. To monitor the trends and determinants of noncommunicable diseases and evaluate progress in their prevention and control.

Base on the above goals, the top layer designs of the Macro Strategy in Prevention and Control of Noncommunicable Disease in China is becoming clear. A "Healthy China 2020" ² strategic plan was issued in 2012 China Health Forum. 2012 China Health Forum issued a "healthy China 2020" strategic plan. According to the severity of the harm; prevalence of the impact; effective intervention methods, fairness and foresight principle, the strategy plan selected three prior fields for major population, main diseases and controllable health risk factors. Furthermore, it developed 21 action plans for the 3 prior fields respectively to attain the goals of medical services, which is an important task for the coming future. The goals is to control the risk factors, to prevent, reverse and reduce the prevalence and the impacts of chronic diseases as well as to reduce the health harm. The Strategic objectives are: to effectively prevent the controllable risk factors by 2020; to halted and reverse the prevalence of chronic diseases, to accelerate the conversion of clinical medical model, to highlight the prevention and control of the chronic disease as well as the
whole life course management, and to reduce the mortality of chronic diseases. Specific indicators include the prevention and control on hypertension, stroke, coronary heart disease, malignant tumor, diabetes and injuries poisoning. The common risks of these diseases, e.g. smoking, polluted environment, unreasonable nutrition, lack of exercise, obesity, mental factors, etc. can be prevented.

The policy of the prevention and control strategy focus on the government dominating, departments cooperation, society supporting and population participation. The highlighted community-based prevention procedures which involve in the whole society and improve the individual prevention skills mainly focus on rural and poverty population. Nevertheless, the strategy of noncommunicable disease control changed from profession behaviours to government behaviours, from treatment oriented to prevention oriented, from major hospitals to community medical institutions, from urban limited to urban and rural area, from the health sectors to the whole society, from professional action to the whole population.

The China Prevention and Control of Chronic Diseases Work Program (2012-2015) which was issued by 15 Ministries and Commissions was the first health program considered chronic disease worldwide. The essential principals of the program includes adhering to prevention procedures, integrating prevention and treatment, dividing individual responsibility, grading administration and emphasizing community-based work. The objectives of the China Prevention and Control of Chronic Diseases Work Program (2012-2015) are: 40% of the hypertension patients receive standardized management; 40% of the diabetes patients receive standardized management; blood pressure control rate of the managed population reach 60%, blood glucose control rate of the managed population reach 60%, 30% of the regions with high cancer incidence start early-stage diagnosis and treatment for main cancer; no less than 20% of eligible children receive pit and fissure sealant; the caries incidence among 12 year old children less than 25%; the mortality surveillance of total population covers 90% of the counties (cities, districts) in China; the surveillance of chronic diseases and risk factors covers 50% of the counties (cities, districts) in China; the surveillance of nutrition conditions covers 15% of the counties (cities, districts) in China.

Recently the Chinese government is formulating a long-term plan about the prevention and control of chronic diseases (2015-2025), including oral health content. The main points of the plan are as follow: constructing the legal system for the prevention and control of chronic disease; emphasizing the multi-sectoral participation in prevention and control of chronic disease; building up teams in prevention and control of chronic disease; innovating working machanism; developing health related industries; accelerating the construction and application of information.

The chronic diseases surveillance has been developed in China. The national mortality surveillance points as representative of provinces increases to 605 points, which integrated the existing mortality registration system and the national disease surveillance system. The integration surveillance of nutrition and chronic disease has been carry out every 3 years since 2014. Considering the local situation and the working continuity, the surveillance scope has been made based on the 605 mortality surveillance points. Out of 605 surveillance points, 302 has been selected for chronic disease and nutrition surveillance, 100
for cardio-cerebrovascular disorders surveillance, 150 for maternal and infant nutrition surveillance, 125 for chronic obstructive pulmonary disease surveillance. Since 2013, 60 surveillance points have been selected for oral diseases surveillance. It's expected that oral disease surveillance would be routinely included in the 3-year nutrition and chronic disease surveillance. Nevertheless, The Fourth National Oral Health Epidemiological Survey in China will be launched this year.

The "Chinese Healthy Lifestyle" program aims to promote oral health knowledge and behavior. By the end of 2014, 2401 (77.2%) of the counties (districts) started the "Chinese Healthy Lifestyle" program. From 2011, based on the platform of "Chinese Healthy Lifestyle" and "National Prevention and Control of Noncommunicable Disease Demonstration District", 14 provinces participated the "Better Oral Health Happier Family" project. The overall objectives of the project is based on community and household, to promote oral health knowledge, to advocate healthy lifestyle, to create community supported environment, and to control the common risk factors of oral and chronic diseases, improve self-care ability of oral health.

The local governments explored and built up different chronic diseases prevention systems with local characteristics. Shanghai established trinity management mode for prevention and control of chronic diseases. The Center for Disease Prevention and Control (CDC) as the subject of policy and quality control responsible for formulating plans and strategies; professional guidance and training; quality control, supervision, examination and evaluation; carrying out scientific researches with the data and information, providing evidence for the government in investing public health funds. General hospitals and specialist hospitals as the subject of providing treatment possess two-way referral function, responsible for technical training and guidance, the diagnosis and treatment of chronic disease and its complications, carrying out scientific researches with the data and information. Community health center as the management subject responsible for the management of chronic patients through the whole process, quality control and evaluation, obtaining and providing basic data and information to carry out research projects at community level.

Hebei province established Regional Health Union. The disease prevention and control departments provide health management services to group people, e.g. occupational population, primary and middle school children, directed and supervised the health management primary health organizations, manage and analyze the data and information. Comprehensive medical institutions carry out the health management for pre-, in-, and after-hospital, so that the major disease can be diagnosed and treated in early stage. Through signing up contract with community residents, the primary health care institutions provide community-based health management service, which using Wechat- a cellphone application to intervene and manage hypertension, hyperglycemia, hyperlipidemia, obesity and other special risk factors.

The experiences of prevention and control of chronic diseases in China are summarized. Innovative policies: seizing the opportunities of medical reform, breakthrough of health insurance. Innovative management: integrating resources, purchasing health services.

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Original Article

Caries Preventive Effect of Glass Ionomer Sealant in Primary Molars

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Abstract

Background: Placement of glass ionomer (GI) sealant in preschool children could provide added benefits of promoting remineralization and resisting demineralization. Aims: To evaluate the retention and caries preventive effect of GI sealant over primary molars with no or enamel occlusal caries. Designs: Seventy-four children participated in a randomized, split-mouth, trial for GI and resin sealant. Caries transition (caries progression or regression) was evaluated in teeth with partial retention and complete loss using ICDAS II criteria. Chi-square and Fisher's exact test were used to analyze the data. Results: After 12 months, 256 teeth were evaluated. In the GI Group, complete retention, partial retention and complete loss were 24.2%, 47.7% and 28.1%, respectively. In the Resin Group, complete retention, partial retention and complete loss were 61.7%, 32.8% and 5.5%, respectively. The retention significantly differed between materials (p <0.05). The caries preventive effect of GI and resin sealant were 95.3% and 97.7%, respectively. No studied tooth in both groups progressed to dentin. The ratio of caries regression in the GI Group was 2.6 times compared with that in the Resin Group at 12 months. Conclusion: Sealing primary molars with GI and resin sealant could effectively prevent dental caries and promote caries regression.

Keywords: Glass Ionomer Sealant, Caries Prevention

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Introduction

Dental caries is a significant health problem in young populations. The report of Thailand Dental Health Survey in 2012 revealed that prevalence of caries accounted for about 52% and 79% among 3- and 5-year-old children, respectively. Among young children, one of the reasons for untreated dental caries believed by both dentists and parents is child cooperation. Unfortunately, deferring treatment has several deteriorative effects such as pain, discomfort and oral problems that may affect general health. Progressive dental caries makes overall treatment more complex and costly.

Currently, the concept of minimal invasive dental treatment and incipient lesion remineralization has been increasingly accepted. This approach consists of the alteration of the oral environment and the use of remineralizing agents that promote remineralization. Management of caries in children should be achieved as soon as possible together with establishing good rapport with children. Thus, nonaggressive and painless caries management must be encouraged.
Much evidence shows that sealant is an effective method in caries prevention and caries control. Sealant materials widely used include resin sealant and glass ionomer (GI) cement. Fontana et al. reported that resin sealant retention rate after 1 year was 89% over occlusal caries score 0-4, using ICDAS criteria, in permanent teeth and that no teeth scored ≥5 after 1 year. With an excellent retentive property, resin sealant acts as a physical barrier against bacteria and carbohydrates. The caries preventive effect of resin sealant exists as long as the sealant remains intact. On the contrary, using GI, a fluoride-releasing material, as a sealant provides added benefits of promoting remineralization and resisting demineralization even when the sealants have been disappeared. Liu BY et al. reported that even though the retention rate (complete and partial retention) of GI sealant was significantly lower than resin sealant (50% VS 73%), the effectiveness in preventing fissure caries did not differ after 2 years.

Fuji VII was claimed as an ideal GI sealant material with high fluoride releasing capacity. The newly-formed Fuji VII capsule, proposes the distinctive property of easy manipulation. Although it is self-cured, the setting time of the pink-colored sealant can be commanded by light energy, which can additionally reduce the moisture critical time. This may be substantially helpful for young children who are difficult to obtain the strict isolation critical for resin sealant placement. Many studies had been reported that Fuji VII could reduce the possibility of caries progression. Nonetheless, little information of sealing this material in primary teeth is known. A study of Fuji VII was conducted in sound primary teeth. The results showed no difference in the complete and partial retention of resin sealant and Fuji VII after 1 year, but a significant higher retention of resin sealant was observed compared with Fuji VII at 2-year follow-up. However, caries occurrence was not investigated at the end of that study.

Due to the effect of fluoride influencing remineralization and the easily manipulated Fuji VII capsule-type, evaluating the clinical efficacy of these materials may prove advantageous for preventing occlusal caries among preschool children. They normally receive topical fluoride application as a preventive measure, which may not be sufficient for pits and fissures caries. It would be beneficial to integrate this treatment with the routinely provided public health package. The ultimate goal is to prevent and arrest the progression of caries and thus reduce the need for restoration. The aims of the study were to evaluate the retention of GI and resin sealant and compare the caries preventive effect between the two sealant materials in primary molars at 6- and 12-month follow-ups.

**Methods**

The study was a randomized, split-mouth, clinical trial of two sealant interventions (GI and resin sealant) placed over either sound or enamel caries of primary molars. The research protocol was approved by the Committee on Human Rights Related to Human Experimentation, Mahidol University, Thailand. The study was carried out at two kindergartens in Nakorn Pathom Province about 40 km from Bangkok. One hundred and thirty six children, aged 3-5 years, were invited to the study. The screening examination, using ICDAS II, was carried out at kindergarten schools. The inclusion criteria was deep pits and fissures or enamel caries (score 0-3) on the occlusal surface of first or second primary molars. Teeth were excluded if they were carious involving dentin (score 4-6) or sealed/filled on
either the occlusal or proximal surface. Results of the oral examination and questionnaire for oral health care were sent to their parents.

A sample size was estimated under the assumption that type I error (alpha) was 0.01 and type II error (beta) was 0.05. Calculation was based on the complete loss of the sealants (Concise =26%, Fuji VII= 50%)\(^8\). The calculated sample size was 105 plus 26 (25%). Therefore, the sample size totaled 131 teeth. Seventy four children, having 272 primary molars met the criteria, were included. Sealant was supplied at kindergarten schools using a mobile dental unit with operating light source and mobile high-powered dental suction. Sealant procedure was performed by one operator throughout the study to overcome the effect of operator variability. Appropriate patient management was introduced during sealant procedure. The operator was a student training in a Master's of Science Program in Pediatric Dentistry and the dental assistant was well-trained.

**Allocation**

Teeth applied with GI and resin sealant were randomly allocated as GI and Resin Groups. Each participant belonged to both groups. The teeth were allocated by simple randomization. With replacement, the balls representing patterns 1, 2, 3 and 4 were randomly drawn. The factors considered in each pattern were the tooth side (left and right) and the types of sealant. Consequently, the patterns 1, 2, 3 and 4 were left/GI, left/resin, right/GI, and right/resin. When the participant had more than one pair of studied teeth, each pair of teeth was allocated using the same allocation method.

Visual examination and a blunt probe were used to detect and diagnose dental caries. External stain, discoloration of surrounding area of pits and fissures and cavitated carious lesion were distinguished carefully. For sealant procedure, the equipment used in this study, i.e., dental unit, light curing unit, suction, triple syringe and operating light were strictly checked on the basis of their instructions. Mouth gags were used in all children to facilitate opening their mouth and prevent saliva contamination.

All teeth were cleaned with pumice before sealant procedures. Cotton rolls were used to ensure moisture control. In the GI Group, cavity conditioner (GC Co., Japan) was applied for 10 seconds followed by rinsing and drying. Fuji VII capsule (Fuji VII, GC Co., Japan), pink shade, was mixed by mixing machine and placed on occlusal surfaces using an applicator. After applying sealant with a dycal carrier, excess materials were removed with a carving instrument and light cured for 20 seconds. The sealant was covered with petroleum jelly. In the Resin Group (Concise, 3M, ESPE, USA), an acid was applied on occlusal surfaces and then rinsed and dried. A thin film of resin sealant was placed with a dycal carrier and light cured for 20 second. To gain the compliance of participants, no more than four teeth were sealed in each 2 hour-session.

Baseline caries was scored by the operator before sealant procedures. Evaluation of caries status and sealant retention was performed by another dentist who did not place the sealant at 6- and 12-month follow-ups. Sealant retention was evaluated using Simonsen's criteria\(^4\). Sealant retention and caries preventive effect were evaluated.

Calibration of intra and inter-examiner reliability was performed and calculated. In calibration of caries evaluation, the operator and evaluator
examined 60 molars representing various stages of dental caries. After 3 hours, these teeth were re-examined under the same condition. In calibration of retention evaluation, the evaluator examined 31 resin-sealed molars. After 3 hours, these teeth were re-examined under the same condition.

Caries transition
Caries transition was considered by the change of caries score at the date of analysis compared with baseline. It was categorized as 'no change' of caries status when caries score equaled baseline, 'caries progression' when caries score was higher than baseline and 'caries regression' when caries score was lower than baseline. Thus, caries preventive effect was the summation of 'no change' and 'caries regression'.

In the complete retention group, caries score at 6- and 12-month follow-ups were considered unchange. In teeth with partial retention and complete loss, caries status was examined at the occlusal surface where sealant was lost (re-exposed surface) and was evaluated as no change of caries status, caries progression, and caries regression.

Chi-square test was used to compare retention between the two materials. Fisher's exact test was used to compare caries transition in re-exposed surfaces between the two materials at the 95% level of confidence (p=0.05).

Results
In calibrating caries evaluation, inter- and intra-examiner reliability tested by Cohen's kappa statistics were 0.86. In calibrating sealant retention, the intra-examiner reliability tested by Cohen's kappa statistics was 0.9.

Seventy four children (39 boys and 35 girls), ages ranging from 3 years 4 months to 4 years 8 months (mean=4 years 6 months), participated in the study. The average dmft was 2.6. According to questionnaires, most participants had sugar-containing snacks between meals twice daily. Seventy percent of children brushed their teeth by themselves. Fluoride varnish was provided once a year as a routine preventive measure. Participants were classified as high caries risk category.

Two hundred and seventy two molars were sealed either with GI or resin sealant (maxillary first molar = 68, mandibular first molar = 64, maxillary second molar = 66 and mandibular second molar = 74). Four children (12 teeth) had moved to other schools at 6-month follow-up, so a total of 130 teeth in each group were analyzed. At 12 months, another two children (4 teeth) were lost for the same reason. Therefore, the number of teeth analyzed in each group totaled 128 (Figure 1).

At baseline, dental caries found in the GI and Resin Groups were categorized as score 0, 1, 2 or 3. The caries distribution of teeth with score 0, 1, 2 or 3 in the GI Group was 91, 25, 16 and 4, respectively, while the caries distribution in the Resin Group was 88, 26, 19 and 3 respectively. The caries distribution did not differ between groups (p>0.05).
Sealant retention is shown in Table 1. Highly significant differences in retention were found between both materials (p < 0.05) at 6 and 12 months. The resin sealant performed better in terms of retention.

At 6- and 12-month follow-ups, re-exposed pits and fissures with partial retention or complete loss of sealant were evaluated for caries transition. Seventy one and 97 teeth were examined in the GI Group while 37 and 50 teeth were examined in the Resin Group at 6 and 12 months.

At 6 months, the percentage of caries preventive effect of the GI Group observed after partial and complete loss was 93% (summation of 74.7 and 18.3%) while the percentage of caries preventive effect of the Resin Group was 81.1% (summation of 70.3% and 10.8%). At 12 months,
Table 3 Percentage of Caries Prevention of all studied teeth with complete retention and teeth with re-exposed surfaces (partial retention and complete loss) of GI and Resin Groups at 6- and 12-month follow-ups

<table>
<thead>
<tr>
<th>Follow-up (month)</th>
<th>GI Group</th>
<th></th>
<th>Resin Group</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete retention</td>
<td>Re-exposed teeth</td>
<td>Caries Prevention</td>
<td>Complete retention</td>
<td>Re-exposed teeth</td>
</tr>
<tr>
<td>No Change</td>
<td>Caries Regression</td>
<td></td>
<td>No Change</td>
<td>Caries Regression</td>
</tr>
<tr>
<td>6 (n=130)</td>
<td>59(45.4%)</td>
<td>53/71</td>
<td>13/71</td>
<td>125(96.2%)</td>
</tr>
<tr>
<td>12 (n=128)</td>
<td>31(24.2%)</td>
<td>81/97</td>
<td>10/97</td>
<td>122(95.3%)</td>
</tr>
</tbody>
</table>

Caries Prevention= Teeth with complete retention + re-exposed teeth with no change of caries status and caries regression

the percentage of caries preventive effect of the GI Group was 93.8% (summation of 83.5% and 10.3%) while the percentage of caries preventive effect of the Resin Group was 92% (summation of 88% and 4%) (Table 2). No lesion developed to dentin (score 4) at 6- and 12 month follow-ups. Although a higher percentage of caries regression and lower percentage of caries progression was found in the GI Group compared with the Resin Group, no difference was observed in rate of caries progression and caries regression of re-exposed surfaces between the two groups (p > 0.05).

When comparing the proportion of caries regression in re-exposed surfaces, it was interesting to find that the ratio of caries regression of teeth with partial retention or complete loss in the GI Group was 1.7 and 2.6 and times compared to that of the Resin Group at 6 and 12 months, respectively.

The caries transition was considered in all categories of retention (including teeth with complete retention) at 6 and 12 months (Table 3). The percentages of caries preventive effect of the GI sealant group was 96.2% and 95.3%, respectively, while the percentage of caries preventive effect of the resin sealant group was 94.6% and 97.7%, respectively, at 6 and 12 months. No difference was found in the caries preventive effect of pit and fissure sealants between the two materials at 6 and 12 months (p > 0.05) (Table 3).

Discussion

This study was a split-mouth design where both modalities of treatment were compared in the same oral environment. The possible confounding factors affected both treatments equivocally. Pre-operative radiographs were not taken because radiographs should not be obtained for the sole purpose of placing sealants. The pink colored- Fuji VII was able to command the setting time that was beneficial in reducing the moisture critical time. In evaluating at 6- and 12-month follow-ups, the evaluator did not know the previous caries status of teeth examined.

A conditioner was used to remove the smear layer and impurities from the tooth surface to enhance the bonding of the material and reduce the surface tension of the tooth surface facilitating the penetration of the material in the fissures. After conditioning, the tooth was rinsed with water or blotted with moistened cotton pallet. When contamination occurred, the surface was not
re-conditioned, contrasting to resin sealant where re-etching, re-rinsing and drying were required.

The difference of complete and partial retention between the resin and GI sealant groups in primary teeth was significant after 1 year (resin sealant = 94.5%, GI sealant = 71.9%). This was not in accordance with the study of Ganesh et al. The result of their study showed no difference between the two retention materials at 12 months while a significant difference was presented at 24 months. In that study, the retention (complete and partial) of resin sealant (conside) was 74% while the retention of GI sealant (Fuji VII) was 60%. The retention (complete and partial) of resin sealant in our study was higher than that study, which may have resulted from a highly significant difference of the two materials. For permanent teeth, complete and partial retention of Fuji VII varied from 72%-80% and 70%-89% after 1 and 2 years, respectively.

The success of sealant placement was evaluated not only by sealant retention but by preventing and regressing dental caries. From this study, both resin sealant and GI sealant applied to the occlusal surface with sound or enamel caries could effectively prevent dental caries, which was in accordance to previous studies. Liu BY et al. compared the preventive performance of ART sealant and fluoride-releasing resin sealant in sound or incipient caries fissure caries in permanent molars over 24 months. They reported that even though the sealant retention (full and partial) rate of resin sealant (73%) was significantly higher than ART sealant (50%), the molar survival (no development of dentine caries) rates in the ART sealant (93%) and resin sealant (96%) groups did not significantly differ.

In our study, although no significant difference in caries transition was found in the partial retention and complete loss groups, the rate of caries progression in the GI Group was lower than that in the Resin Group. In addition, the rate of caries remission in the GI Group was higher than in the Resin Group. This may have accounted for the capability of glass ionomer to release and recharge fluoride. Glass ionomer-based sealants (Fuji VII and Fuji II LC) were shown to have significantly higher initial fluoride release as well as higher fluoride recharge capacity than other resin sealants (Fissurit F, Ionosit, Aelite Flo). Fluoride can be dispersed in the adjacent tissue and the surrounding fluid. It was demonstrated that GI cement (Fuji IX) had a lower mineral loss at the sealant margin than resin sealant (Concise, FluroShield, and Helioseal Clear Chroma) and that GI cement (Fuji IX) showed the highest fluoride release on the 7th and 14th days of evaluation.

This trial was conducted in field operation using a mobile dental unit and high power suction. The sealant operation carefully followed the instructions especially the moisture control technique. Nevertheless, in some conditions, standard equipment and facilities may not be available. Hence, it would be beneficial to further study using GI sealant in nonideal circumstances and in a longer follow-up. It was concluded that resin sealant performed significantly better in the view of retention after 12 months in primary teeth. However, the caries prevention effect of both GI and resin sealant did not differ. Using GI sealant to prevent occlusal caries may be an alternative management in young children because the GI procedure is less sensitive compared with resin sealant. GI sealant is more likely to promote caries remission due to its fluoride releasing and recharging property. Moreover, among young children with initial occlusal caries together with deep dentinal carious teeth, Fuji VII may be considered a good choice of material because it can be used as interim restoration for controlling caries and as sealant. Using the same material for
controlling and preventing caries in one individual child is convenient and also yields the maximum cost-effectiveness.

References

17. Bayrak S, Tunc ES, Aksoy A, Ertas E, Guvenc D, Ozer S. Fluoride release and recharge from different materials used as


Original Article

A clinical study on the candy with IgY influence to the oral micro-organism and periodontal tissue

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Abstract

Objective: In order to estimate the influence of the candy with IgY to periodontal tissue and the decreasing effect of the oral micro-organism. Method: 65 volunteers age 20S. to 60S. were collected and divided with 2 groups as experimental and control, to supply the candy with IgY for 3 tablets every day for 4 weeks through sucking it for 3 minutes with the saliva for experimental group, otherwise the placebo for control group. PHP(Plaque index as PHP), PMA(Papillary, Marginal, Attached Gingival index), GCF (Gingival Crevicular Fluid), malodor gas (B&B Checker) were checked and compared the data with the control group. Results: There was no different on PHP between the experimental group and control, otherwise less level on PMA and GCF or volatile sulfur compound gas were revealed in experimental group than in control (p<0.05). Porphyromonas gingivalis was less level in experimental group than in control checked by real time PCR (P<0.05). Conclusion: It was recommended to use of the candy with IgY, to subside the early stage of the gingivitis.

Key words: Immunoglobulin Y (IgY), Periodontal disease, gingivitis, Plaque index, oral micro-organism. Real time PCR


Introduction

It has been well known that periodontal disease is a chronic and accumulative disease which cannot be reversible if it has processed or advanced. 1) It can be occurred from the dental plaque as we know as dental bio-film which can accumulated tooth surface, especially at the proximal area and excretion of various toxin to irritate gingiva with inflammation. 2) In general, the early stage of gingivitis can be prevented or treated with reversible recovered, otherwise in irreversible in case of the state as advanced periodontitis and the origin has been introduced by oral micro-film which can produce the toxin from the oral micro-organism by itself and mechanical irritation to the gum tissue after changing it to dental calculus as crystallization in later. 3) Anyway, dental plaque with periodontal disease related oral micro-organism such as Gram negative anaerobic bacteria and the end products can be the origin of the periodontal disease and the effective prevention method can be introduced to eliminate or diminish for the oral micro-organism through the mechanical or chemical method. 4) 5)

Egg yolk immunoglobulin as IgY has been gained from the egg for anti-body 6) and the anti-body can be concentrated at the egg yolk 7). It can be gained from the egg yolk after injection the antigen into the maternal hen and be used for several ways for periodontal disease treatment.
So, the aims of this study would be an evaluation in clinical for the Immunoglobulin Y (IgY) to decrease the dental plaque or to weaken the oral micro-organism especially for Porphromonas gingivalis and influence to gum tissue, by use of candy style including IgY, intake every day.

**Method**

**Subjects**

65 adult volunteers were collected after the signature for the agreement of the clinical experiment, as 33 for experimental group and 32 for the control, who were aged from 20 to 65 with mild or moderate leveled periodontal disease state, without the cervical caries or filling material with more than 20 of natural teeth and have performed tooth-brushing for 3 times in a day. It was eliminated the volunteers with such symptoms as emergency state, prescription for the antibiotics medicine or taking other medicine, body weight loss person, systemic diseases person, allergy response for the egg, pregnant or lactation woman. 70 volunteers were participated at start point but 65 remained for 4 weeks experiment period, to be subjects for analysis in this clinical study.

### Table 1 Ingredients and the composition of the materials

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Evidence for use</th>
<th>Experimental group</th>
<th>Control group (Placebo)</th>
<th>App.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egg Yolk (IgY) contained powder</td>
<td>Food Material</td>
<td>1.389</td>
<td>16.668</td>
<td>-</td>
</tr>
<tr>
<td>MaltoDextrin</td>
<td>Food Material</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>D-Sorbitol</td>
<td>Additional F.</td>
<td>92.761</td>
<td>1,113.132</td>
<td>92.761</td>
</tr>
<tr>
<td>Sucralose</td>
<td>Additional F.</td>
<td>0.100</td>
<td>1.200</td>
<td>0.100</td>
</tr>
<tr>
<td>Flavor (Blue grape)</td>
<td>Additional F.</td>
<td>2.500</td>
<td>30.000</td>
<td>2.500</td>
</tr>
<tr>
<td>Flavor (Menthol)</td>
<td>Additional F.</td>
<td>0.250</td>
<td>3.000</td>
<td>0.250</td>
</tr>
<tr>
<td>Citric acid (Dehydro)</td>
<td>Additional F.</td>
<td>2.000</td>
<td>24.000</td>
<td>2.000</td>
</tr>
<tr>
<td>Stearin acid Magnesium</td>
<td>Additional F.</td>
<td>1.000</td>
<td>12.000</td>
<td>1.000</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100.000</td>
<td>1,200.000</td>
<td>100.000</td>
</tr>
</tbody>
</table>

**Materials**

Two types of candies were prepared with the same shape of white tablet as the experimental candy which was include IgY and the control type of the candy without IgY. The weight of each candy was 1.2g and 100 tablets for each subject were prepared in consideration with some enough amounts for experiment as 3 tablets consumption daily for 4 weeks. All candies would be stored in the room temperature as 20 to 25 C. The composition of the experimental candy and the control were as shown in Table 1. Malto-dextrin which was no acting ingredient was added in the control candy to compensate the weight instead of IgY in the experimental group.

**Method**

IRB was achieved from the Scientific committee in the university as number as DJK2014-090004-001. The volunteers for clinical experiment were
collected among the dental patients who visited one of dental hospital during the period from September to November in 2014, through the advertising for collecting and selecting the volunteers by verbal advertisement.  

2 groups as the experimental and the control group were divided with the double blinded test method and share the candy with the same shape and color but different component as Ig Y contained in the experimental candy. Let all volunteer intake 3 candies every day after 1 or 2 hours later of every meal. Oral examination was performed before experiment, 2 weeks later and 4 weeks later, with such standardizations of periodontal index related items as Patient Hygiene Performance index (PHP), Papillary Marginal, and Attached gingival index (PMA), Gingival Crevicular Fluid (GCF), Oral Malodor check by use of B&B checker(mBA-21, Plustech, Korea), and oral-micro-organisms test by use of real time PCR method. The standardization and the procedure of each method would be as followings.

1) Patient Hygiene Performance index (PHP)

Simplified PHP index was checked for dental plaque deposition with sharing the labial or buccal surface with 5 portions as incisal, cervical, mesial, distal and central area, indicated the plaque through enlightening the fluorescence light on the tooth surface. Every 1 point was added when the plaque deposit at one portion, and calculate the average for tooth surface as 5 points for full score.

2) Papillary, Marginal and Attached gingival index (PMA)

This index was checked for the inflammatory changes at the frontal teeth area. If the inflammation sign was detected at the Papillary, Marginal and Attached gingiva, between each tooth, at the frontal teeth side gingiva, both in upper and lower, give 1 point at every inflammatory site on the labial side. Maximum 30 points would be gained for each subject.

3) Gingival Crevicular Fluid (GCF)

The relative amounts of the fluid in the gingival sulcus was measured by use of the absorption paper, by inserting it into the gingival sulcus for 10 seconds at the gingival sulcus on the labial portion of Central Incisor and measure the wet length with scale and recorded it with mm unit.

4) Oral malodor check with B&B checker

Relative amounts of Volatile Sulfur Compound was measured by use of B&B checker, after 3 minutes mouth closing and inserting the paper tip of the mouth piece into the mouth and breathing for 15 seconds, and then, the relative amounts of Volatile Sulfur Compound was measured automatically as relative unit as BBV level.

5) Real time PCR (Polymerase Chain Reaction)

Specific oral micro-organism was measured after gargling 20 seconds and spilt it out in the plastic pack with the saliva, to send it to the real time PCR institute as Cyto- Gene Test LTD (CytoGen Co. NO.221). The kinds and the amounts of oral micro-organisms were checked by PCR method.

6) Statistical analysis

SPSS version 21.0 was used by use of two sample t-test to compare with the results for the experimental group and the control. Repeated measured ANOVA test was used for the test results between
before, 2 weeks later and 4 weeks later.

Results

PHP was no different between the experimental group and the control both in 2 weeks and 4 weeks.

GCF was decreased in 4 weeks later and significantly different from the control group. (P<0.05)

Oral malodor checked by B&B Checker was decreased 4 weeks later and it was significantly different from the control group. (P<0.05)

Pophyromonas gingivalis, Tannarella forsythia and Treponema denticola were decreased at 4 weeks later and significantly different from the control group. (P<0.05)

Table 2. PHP changes according to the periods of IgY candy uses.

<table>
<thead>
<tr>
<th>Period</th>
<th>Control group (n=32)</th>
<th>Experimental group (n=32)</th>
<th>p-value**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base</td>
<td>7.41±3.77</td>
<td>5.91±3.91</td>
<td>0.121</td>
</tr>
<tr>
<td>2weeks</td>
<td>3.75±3.72</td>
<td>3.58±3.16</td>
<td>0.839</td>
</tr>
<tr>
<td>4weeks</td>
<td>3.59±2.72</td>
<td>3.24±2.61</td>
<td>0.597</td>
</tr>
<tr>
<td>P value ***</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td></td>
</tr>
</tbody>
</table>

* : p-value by 2 sample t-test (between control group and experimental group)
*** : p-value by repeated measured ANOVA test

Table 3. GCF changes according to the period of IgY candy uses.

<table>
<thead>
<tr>
<th>Period</th>
<th>Control group (n=32)</th>
<th>Experimental group (n=32)</th>
<th>p-value**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base</td>
<td>3.09±1.42</td>
<td>3.21±1.56</td>
<td>0.750</td>
</tr>
<tr>
<td>4 weeks</td>
<td>2.55±2.21</td>
<td>1.45±0.83</td>
<td>0.012</td>
</tr>
<tr>
<td>P value ***</td>
<td>0.115</td>
<td>&lt;0.001</td>
<td></td>
</tr>
</tbody>
</table>

* : p-value by 2 sample t-test (between control group and experimental group)
** : p-value by paired t-test

Table 4. PMA changes according to the period of IgY candy uses.

<table>
<thead>
<tr>
<th>Period</th>
<th>Control group (n=32)</th>
<th>Experimental group (n=32)</th>
<th>p-value**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base</td>
<td>6.38±4.52</td>
<td>5.09±3.37</td>
<td>0.198</td>
</tr>
<tr>
<td>2weeks</td>
<td>5.50±3.94</td>
<td>4.00±3.17</td>
<td>0.096</td>
</tr>
<tr>
<td>4weeks</td>
<td>4.38±4.09</td>
<td>1.85±1.97</td>
<td>0.003</td>
</tr>
<tr>
<td>P value ***</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td></td>
</tr>
</tbody>
</table>

* : p-value by 2 sample t-test (between control group and experimental group)
*** : p-value by repeated measured ANOVA test

Table 5. B.B Checker changes according to the period of IgY candy uses.

<table>
<thead>
<tr>
<th>Period</th>
<th>Control group (n=32)</th>
<th>Experimental group (n=32)</th>
<th>p-value**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean ± SD</td>
<td>Mean ± SD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Base</td>
<td>32.1±24.2</td>
<td>36.7±18.1</td>
<td>0.382</td>
</tr>
<tr>
<td>4 weeks</td>
<td>42.0±27.9</td>
<td>26.0±14.8</td>
<td>0.006</td>
</tr>
<tr>
<td>P value ***</td>
<td>0.105</td>
<td>0.001</td>
<td></td>
</tr>
</tbody>
</table>

* : p-value by 2 sample t-test (between control group and experimental group)
** : p-value by paired t-test

PMA was decreased both in 2 weeks and 4 weeks later and significantly different from the control group. (P<0.05)

Discussion

Periodontal disease is known as caused by local factor, occurred from dental plaque which has been called as oral micro-film and lots of Gram negative anaerobic bacteria such as Fusobacterium nucleat in the plaque can produce or excretion of toxin to irritating to gingival tissue. 10) This oral micro-organism can adhere at the epithelial tissue and take a role of the bridge as an intermediate between the early coated plaque micro-organism and such post coated plaque micro-organisms as Pophyromonas gingivalis, Tannarella forsythia, and Treponema denticola .11). Pophyromonas gingivalis is one of the post coated plaque micro-organisms and the main causative oral micro-organism through excretion of the enzyme
for hydrolysis of the protein and exotoxin to make collagen degeneration for inflammatory response. 12) Bio-film can combine with Calcium and Phosphate ion to make a calculus and it can cause a gingival pocket by depositing and accumulating between the tooth surface and gingival tissue so we call as gingival pocket. 13) Moreover, oral micro-organism in the biofilm can excretion of Lipopolysaccharide (LPS) to increase the activity of Neutrophils and Macrophages and to stimulate the inflammatory Cytokine production with such substances as IL-1, TNF-α or prostaglandin e2. 14) Cytokine can stimulate the osteoclast activity to make a destruction of alveolar bone. So it should be eliminated the biofilm on the tooth surface as possible as one can in order to prevent the gingivitis or periodontal disease effectively.

<table>
<thead>
<tr>
<th>Bacteria</th>
<th>Control group(32)</th>
<th>p-value**</th>
<th>Experimental group(33)</th>
<th>p-value**</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Base</td>
<td>4 weeks</td>
<td>Mean ± SD</td>
<td>4 weeks</td>
</tr>
<tr>
<td>PG</td>
<td>1.14±2.24</td>
<td>0.76±2.05</td>
<td>0.118</td>
<td>0.56±1.54</td>
</tr>
<tr>
<td>p-value*</td>
<td>Base</td>
<td>0.228</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TF</td>
<td>1.42±2.17</td>
<td>0.74±1.77</td>
<td>0.072</td>
<td>1.56±2.25</td>
</tr>
<tr>
<td>p-value*</td>
<td>Base</td>
<td>0.662</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TD</td>
<td>2.14±2.67</td>
<td>2.14±2.67</td>
<td>0.013</td>
<td>1.99±2.54</td>
</tr>
<tr>
<td>p-value*</td>
<td>Base</td>
<td>0.827</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>8.91±0.48</td>
<td>8.56±0.46</td>
<td>0.001</td>
<td>8.83±0.35</td>
</tr>
<tr>
<td>p-value*</td>
<td>Base</td>
<td>0.428</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*: p-value by 2 sample t-test (between control group and experimental group)
**: p-value by pair t-test
PG; Pophyromonas gingivalis    TF; Tannrellia forsythia    TD; Treponema denticola

Susumu 15) has reported that it revealed the diminishment of the coaggregation activity of P. gingivalis and S. gordonii by treating with 2.5ug of gingipains specific IgY in vitro test, compared with the control group. Rahman 16) has experimented with 5 dogs to supply with 70mg/kg of Pophyromonas gingivalis specific IgY into the doggy food and gained the result as significantly decrease of Bleeding on Probing (BOP) on 4 weeks and 8 weeks later. And he has reported that periodontal pocket depth was diminished on 4 weeks later, by supplying 20% of IgY GP ointment into the periodontal pocket with 200mg/every time for 4 times in a day and also BOP was proved significantly compared to before level. Yokoyama 17) has reported that Bleeding on Probing (BOP) and the amounts of Pophyromonas. gingivalis were remarkably decreased in 4 weeks later compared with the control, with applying Pophyromonas. gingivalis gingipains specific IgY contained ointment with 30 to 60 mg of 20% IgY, topical application at the gingival pocket at the contralateral anterior single rooted teeth for 5 adult subjects in clinical study and checked such items as the amounts of Pophyromonas. gingivalis, gingival pocket depth and BOP.

From the results above, it can be considered that the use of the response for antigen antibody reaction from IgY into the egg yolk might be effective to protect the biofilm production with specific response within a short time. 18)

From the experiment, Patient Hygiene Performance index (PHP) was not remarkably decreased and no different between the experiment

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and the control and it was considered that IgY could not contributed to decrease the plaque formation or deposition, otherwise it revealed decreased PHP index according to the time passing both in experimental and the control group, because of more salivation on candy sucking to cleansing effect for dental plaque both in experimental and the control group. 19) Gingival Crevicular Fluid was decreased for time passing for 4 weeks later and more decreased in experimental group than in control, and it was considered that IgY contained candy was some effective to decrease and to subside the gingival inflammation, but it left more detailed experiment in the future because variable in gingival pocket fluid in individual difference might be existence and influence with an bias era.

PMA index was shown as the inflammation existence at the papillary gingiva, marginal gingiva and attached gingiva and it revealed remarkable decrease in 2 weeks later and 4 weeks later, in experimental group, because it could be relatively simple and easy to control the gingivitis at anterior potion than in posterior and easy to configure out the inflammation scale as from 0 point to 30 points for PMA index and express as remarkable difference in case of different score between in experiment and the control.

Comprehensive oral malodor as volatile sulfur compound was decreased from on 4 weeks later in experimental group compared with the control and it was estimated that IgY had an effect for decreasing oral malodor gradually. 18)

Porphyromonas gingivalis was decreased after intake IgY contained candy for 8 weeks probed by Real Time PCR method analysis 19) and it was estimated that the gingivitis, periodontitis and oral malodor could be decreased because of diminish of Porphyromonas gingivalis as main causative oral micro-organism for periodontal disease, through the effect for IgY. Treponema denticola which was known as an oral micro-organism to cause the oral disease through the production of inhibitory materials for photolytic enzyme was decreased both in experimental and the control group. 20), 21) It was considered that the increase of salivary flow when sucking on the candy both in experimental and the control group could activate the plaque control ability by time passing, and decrease for total bacterial load. 20) Tannerella forsythia which showed in irreversible periodontal disease as one of the main causative oral micro-organisms, revealed no different between in experimental and the control group in 4 weeks use of IgY, otherwise it could be effective for more use of it and it was recommended to use it more than 4 weeks period, in order to expect for contribution of the prevention of periodontal disease. 22)

From the results above, IgY contained chewing candy would be effective to control the periodontal disease through the control of dental bio-film and recommended to use for the gingival health. 23)

**Conclusion**

The authors has performed the clinical experiment to prove the effect of IgY contained candy for subside gingival inflammation and decrease the dental plaque deposit 65 volunteers adults were participated divided with 2 groups as experimental and the control, and double blind test was performed for all subjects for 2 weeks and 4 weeks. PHP, PMA, GCF oral malodor and Real Time PCR were examined and done to compare with two groups. The obtained results were as followings.

1. PHP was no different between experimental and the control group at 4 weeks and 8 weeks later (p>0.05)
2. GCF, PMA, GCF and Oral malodor were decreased in experimental group compared with the control (p<0.05) in 2 or 4 weeks later.

3 Porphyromonas gingivalis, Tannerella forsythia, Treponema denticola were decreased in numbers by use of IgY contained candy and influenced to diminish the gingival inflammation.

4. It was recommended to use of the candy with IgY, to subside the early stage of the gingivitis

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18. Tamura K, Minami K, Inaba D. The Influence


Original Article

Knowledge, attitude and perception on smoking cessation among undergraduate dental students.

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Abstract

Objectives: To determine the knowledge, attitude and perception in smoking cessation among future dentists from University of Malaya and to identify the effectiveness of smoking cessation teaching in the current syllabus. Materials and Method: This is a cross-sectional study involving 234 future dentists in University of Malaya, selected by simple random sampling technique. Self-administered questionnaires were distributed, completed and returned to researcher. Results: Findings showed more than fifty percent of the students scored excellent in their knowledge and attitudes. Majority had the right perceptions on smoking cessation and this finding was consistent with other research done. Although majority of these future dentists had good knowledge, attitude and perception in smoking cessation, only a few of them were actually involved in conducting smoking cessation practical sessions. The main barrier cited was lack of practical skills. Conclusion: Future dentists were aware and informed on smoking cessation techniques however, their practical involvement was limited. Therefore, the dental curriculum could be improved by emphasizing the practical aspects of training in lieu with the theoretical aspects.

Key words: Dentists, Smoking Cessation, Training, Curriculum, Perception

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Introduction

The Oxford Dictionary (2010) defines smoking as the action or habit of inhaling and exhaling the smoke of tobacco or a drug. Global consumption of cigarettes has risen steadily since manufactured cigarettes were introduced at the beginning of the 20th century. While consumption is leveling off and even decreasing in some countries, worldwide more people are smoking, and smokers are smoking more cigarettes.
(Mackay & Eriksen, 2002). The number of smokers will increase mainly due to expansion of the world’s population (Mackay & Eriksen, 2002). By 2030, there will be at least another 2 billion people in the world who may be smoking (WHO, 2010). Even if prevalence rates fall, the absolute number of smokers will increase, the expected continuing decrease in male smoking prevalence will be offset by the increase in female smoking rates, especially in developing countries (Mackay & Eriksen, 2002).

In 2015, 43% of Malaysian males and 1.4% of female were estimated to smoke cigarette (The Sun Daily, 2016). Smoking accounts for one in five deaths in Malaysia (Ministry of Health Malaysia, 2002). It is the most important modifiable cause of premature death, responsible annually for an estimated 120,000 years of potential life lost (Ministry of Health Malaysia, 2002). About 20,000 Malaysians die each year as a result of smoking (Ministry of Health Malaysia, 2002). Since early studies in the 1950s and 1960s, a large body of epidemiological evidence has accumulated evidences regarding the health effects of smoking (Office of the Surgeon General, 1964, 1967, 1968, 1969). The Surgeon General report on “The Health Consequence of Smoking – 50 Years of Progress” concluded that smoking can cause cancer, respiratory disease, cardiovascular disease, reproductive disease, dental disease, inflammatory bowel disease, diabetes and autoimmune disease (U.S. Department of Health and Human Services, 2014). Previous studies including cohort and case-control studies as well as other data sources reported consistent, convincing evidence associating the use of tobacco with a variety of serious pulmonary, cardiovascular, and neoplastic diseases (Ministry of Health Malaysia, 2003).

One initiative to address this is through tobacco control, including both prevention and cessation of smoking. Both initiatives are recommended in the Framework Convention for Tobacco Control (FCTC) of which Malaysia has ratified a decade ago. In 2015, this commitment has been strengthened by providing a roadmap towards a smoke-free nation by 2045 with the introduction of the National Strategic Plan which complements the National Oral Health Plan 2010 – 2020 document initiated in 2010 (Ministry of Health Malaysia, 2011).

According to Warnakulasuriya (2002), smoking cessation advice provided by dentists has been shown to be effective. In Malaysia, a study on dentists and smoking cessation found that they were equally motivated to provide cessation service and their knowledge, attitudes and perception improved with training (Abdul Kadir et al., 2013).

Since 2009 tobacco control including smoking cessation has been included in the curriculum of major dental institutions in Malaysia. In 2015, the Malaysian Dental Dean Council has made it mandatory for all dental students to fulfill minimum competency requirement in smoking cessation practice before their graduation (Amer Siddiq et al., 2014). This is to support the inclusion of Smoking Cessation among the Key Performance Index for dentists in the latest National Oral Health Plan 2011-2020 of the Ministry of Health (Ministry of Health
Malaysia, 2011).

Given the above scenario, this study aims to determine the knowledge, attitude and perception on smoking cessation among undergraduates in Faculty of Dentistry from University of Malaya.

**Methods**

**Data collection**

This is a cross sectional study using a self-administered questionnaire. The questionnaire was self-constructed based on established questionnaires including the Global Health Professional Students Survey (GHPSS) 2008. The questionnaire contains three questions on demographic which were age, gender and year in school and 50 questions regarding knowledge, perception and attitudes on smoking cessation. A pilot study was conducted among 50 medical students prior to commencement of this study.

Participants were recruited from the Faculty of Dentistry in University of Malaya. All students from year one to five were included. All students were given the questionnaires together with the consent letter and instructions to answer. A total of 234 questionnaires were completed and returned. Anonymity and confidentiality were assured and this study was approved by the Medical Ethics Committee University Malaya Medical Center (MEC Ref. No: 956.44).

**Data analysis**

Data were entered and analyzed using Statistical Package for Social Sciences (SPSS) version 20 software package (SPSS Inc., Chicago, IL). Exploration of the data was performed prior to analysis to determine missing values and the distribution (normality) of the variables. Both descriptive and inferential statistics were applied wherever appropriate. Descriptive statistics were used to describe patients’ demographic information, knowledge, attitudes and tobacco use behaviors. Knowledge on tobacco use was evaluated using total score for each participant, with one point for each correct answer and zero points for each wrong answer. Frequency, cross tabulation among variables and chi-square test were done as part of the analysis.

**Results**

*Socio demographic*

The students studied were between 19 to 24 years old with a mean age of 21.0 years. Majority of the respondents were female (n=189; 80.8%); and slightly less than a quarter, 19.2% (n=45) were males. Third year students made up the highest group participating in the study (n=71; 30.3%)

*Level of knowledge on smoking cessation*

Table 1 shows the proportions of the respondents who answered each item of tobacco use knowledge correctly. Nearly all of the respondents were able to recognize the dose-response relationship between smoking and related diseases. About 85.0% of the respondents knew that smokers were less likely to live as long as non-smokers and that chronic bronchitis among smokers were caused by irritation of the lungs and bronchial tubes.
Table 1: Items measuring knowledge on tobacco use among dental students (N=234).

<table>
<thead>
<tr>
<th>Knowledge item</th>
<th>N (% correct responses)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking has the greatest effect on the vascular system</td>
<td>203 (86.8)</td>
</tr>
<tr>
<td>A smoker's heart works harder because carbon monoxide makes blood carry less oxygen</td>
<td>223 (95.3)</td>
</tr>
<tr>
<td>Nicotine, an ingredient in cigarette smoke is both stimulating and depressing to the nervous system</td>
<td>209 (89.3)</td>
</tr>
<tr>
<td>Cigarette smokers get tired easily because their lungs cannot exchange well</td>
<td>220 (94.0)</td>
</tr>
<tr>
<td>Cigarette smokers are not likely to live as long as non-smokers</td>
<td>199 (85.0)</td>
</tr>
<tr>
<td>The smoker's cough, a type of chronic bronchitis is caused by irritation of the lungs and bronchial tubes and due to the chemical in the cigarette</td>
<td>228 (97.4)</td>
</tr>
<tr>
<td>The dangers with cigarette smoking increase with dose (number of cigarette smoked, number of years a person smoked and amount of smoke inhaled)</td>
<td>226 (96.6)</td>
</tr>
</tbody>
</table>

The seven questions on knowledge were then arbitrarily split into three levels of knowledge namely; excellent (score of 6-7), good (score 5-6) and satisfactory (score of 3 or less). Higher scores mean better knowledge (Table 2). Findings showed overall, 86.7% of dental students have excellent knowledge in tobacco effects and control, the highest group being Year Three students (97.2%). This is probably because they have just started clinical work and therefore were more meticulous in making sure they have the correct messages when they start giving oral health education advice on tobacco.

Figure 1: Breakdown of questions assessing perception of smoking cessation

<table>
<thead>
<tr>
<th>Perception on smoking cessation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Majority of students, regardless of their course year, agreed that people can get addicted and harmed by nicotine. An equally high proportion perceived that those who smoke regardless whether on weekends or a few days or every day in a week are at risk of harming themselves (76.8 - 97.8%) (Figure 1).</td>
</tr>
</tbody>
</table>

Attitudes towards smoking cessation

Attitude towards smoking cessation was analyzed based on eleven questions. The total score ranged from 0 to 11. An arbitrary cut-off point was agreed upon which excellent was 8-11 points, good attitude was 5-7 points and satisfactory attitude was those who scored 4 points and below. The result showed all students in the clinical years (from third to fifth year) had excellent attitudes towards smoking cessation practice (95.7%).
Nevertheless, there were a few satisfactory attitudes observed among pre-clinical students too (Table 3).

Table 2: Distribution of Knowledge level across all learning years (N=234)

<table>
<thead>
<tr>
<th>Course year in school</th>
<th>Knowledge Level, N(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Excellent (Score 6-7)</td>
</tr>
<tr>
<td>1st year, n(%)</td>
<td>37(90.2)</td>
</tr>
<tr>
<td>2nd year, n(%)</td>
<td>42(75.0)</td>
</tr>
<tr>
<td>3rd year, n(%)</td>
<td>69(97.2)</td>
</tr>
<tr>
<td>4th year, n(%)</td>
<td>38(86.4)</td>
</tr>
<tr>
<td>5th year, n(%)</td>
<td>19(86.4)</td>
</tr>
<tr>
<td>Total, n (%)</td>
<td>205(87.6)</td>
</tr>
</tbody>
</table>

Table 3: Attitudes towards smoking cessation among undergraduate dental students.

<table>
<thead>
<tr>
<th>Course year in school</th>
<th>Attitudes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Excellent</td>
</tr>
<tr>
<td>1st year, n (%)</td>
<td>38(92.7)</td>
</tr>
<tr>
<td>2nd year, n (%)</td>
<td>49(87.5)</td>
</tr>
<tr>
<td>3rd year, n (%)</td>
<td>71(100.0)</td>
</tr>
<tr>
<td>4th year, n (%)</td>
<td>44(100.0)</td>
</tr>
<tr>
<td>5th year, n (%)</td>
<td>22(100.0)</td>
</tr>
<tr>
<td>Total, n (%)</td>
<td>224(95.7)</td>
</tr>
</tbody>
</table>

Discussion

Knowledge

It is encouraging to note that majority of the students, regardless of the course year in school, had an excellent understanding on the effects of tobacco use. Our finding was consistent with similar studies conducted among students in higher education (Nabie et al., 2000; Ma et al., 2003). As smoking cessation has already been included in the dental curriculum for almost a decade, our finding reflected well that the objectives of our course had been met. It also indicated that these future dentists will fit well into the requirement of the Ministry of Health’s Tobacco Control and Cessation program. If performed well they too will complement in the efforts to reduce the smoking prevalence in Malaysian population.

Attitudes

Education level was also associated with the attitude scores, which was consistent with previous studies (Nabie et al., 2000; Ma et al., 2003). Those with higher level of knowledge on smoking hazard showed more positive attitude (higher scores). It is also noted that entry requirement into dentistry is stringent in Malaysia as set by the Ministry of Higher Education and the Malaysian Dental Council. Therefore, only the top 20% of the cohort will qualify for the program. In addition, the student intake per year is relatively small, i.e. between 50 – 80 students a year. This is due to the intensity of the dental education program. What makes it more relevant is that dental students begin their patients’ examination and diagnosis as well as clinical treatment during third year and continue to do so up to graduation to meet the clinical competency requirement in smoking cessation or therapy. This requires them to be well prepared with not only knowledge on the harm of tobacco use but also there is a need to accompany knowledge with positive attitudes to fulfill the task.

Perception

Our findings from the present study added to
the literature on the risk perception among young adults, aged 19-24 years. It is encouraging to note that regardless whether they are pre-clinical or clinical students, all of them strongly believed that smoking can cause or at risk of body harm to health. The small observation among pre-clinical students on the definition of serious smoking (on weekends or occasional) is probably due to the fact that they have not undertaken to receive the full smoking module; because in general, this module started only in their first clinical year (i.e. third year). Arnett (2000) reported that 60% of young people and 48% of adults thought they could safely smoke for a few years and then quit. In trying to explain these results, Slovic (2001) suggested that young people should appreciate the concept that every cigarette smoke is doing body harm. Wrong perception towards something will lead us to the wrong way. The strong belief that patient can be addicted to nicotine as shown by the students is also important as it will motivate them further to conduct smoking cessation program.

Risk perceptions may be influenced by beliefs about what constitutes a pattern of regular smoking. Among young adults it is especially common to observe infrequent bouts of smoking as someone begins to acquire a regular smoking pattern. Findings from the present study can be used to help educators and learners in health sciences see the importance to not only have strong commitment in educating their patients about quitting to smoke or not to smoke at all, but to also tailor their communications about smoking to correct common misperceptions. A basic tenet of communication theory is that messages will be more effective if they are made personally relevant to target audiences (Hill, Chapman & Donovan, 1998). The traditional approach of educating smokers about the long term health consequences of smoking may reinforce the perception that smoking is a risk that is not especially relevant to young adult population because the risks are seen as being far in the future. Anti-tobacco messages need to communicate more effectively the concept that each cigarette smoked is doing them damage.

Conclusion
In general, this study highlighted the potential role of dentists to contribute effectively to smoking cessation conduct. It is therefore important to include this in the undergraduate education curriculum. Findings from this study showed that by including the smoking module in the dental curriculum since almost decade ago, dental students are much prepared with knowledge, have positive perceptions towards tobacco harm and, positive attitudes and are better prepared to conduct smoking cessation program.

Acknowledgements
The authors would like to thank the Faculty of Dentistry especially the dental students for participating in this study. Appreciation is also extended to the Medical Ethics Committee UMMC and all relevant agencies who have contributed directly or indirectly to this study. This study is supported by the GC004-15HTM and GC004A-15HTM grant.

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Original Article

Self-reported evaluation of the patients on the psychosocial effects of fluorosis

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Abstract

Objective: The purpose of this study was to investigate the psychosocial effects of fluorosis on the patients in the fluorosis epidemic area. Methods: In the rural fluorosis epidemic areas in Hebei province of China, 416 inhabitants were selected to be examined using Dean’s Index (DI). Surface Index of Fluorosis (TSIF) was used in 178 filtered patients who were also involved in a psychosocial questionnaire investigation. Demographic information and six five-point subscales about “Attitude to Teeth”, “Index of Well-Being”, “Index of General Affect”, “Interaction Anxiously Scale” (IAS), “Self-Esteem Scale” (SES) and “Impact on Behavior” were included in the questionnaire. SPSS12.0 software was used to analyze the data. Result: Fluorosis prevalence in the fluorosis epidemic areas of Hebei province was 71.2%, with 1.77 of Community Fluorosis Index. Prevalence of fluorosis according to DI was lower than the results of TSIF. Difference of fluorosis prevalence calculating by DI and TSIF was evident in 35-44 years old group, and the proportion of “questionable” in 35-44 age group was the highest, which was 40.3%. With the increase of DI score, the average value of subscale “Attitude to Teeth” (2.58-3.51) and “Index of Well-Being” (2.35-2.90) were arising. Significant difference of the evaluation on “Attitude to Teeth” could only be found between the “mild group” (DI=1/2) and the “severe group” (DI=3/4), also between the “control group” (DI=0/0.5) and the “severe group”. As for the evaluation scores on “Index of Well-Being”, there was significantly different between the “control group” and the “severe group”. According to the results of multivariate linear stepwise regression analysis, the independent variable entered the regression model was mainly the DI score, while the evaluation of other subscales were not significantly associated with the independent variables in this analysis. Conclusion: The “questionable” fluorosis would make the prevalence results of DI was lower than that of TSIF. The self-reported psychosocial effects of fluorosis was mainly appeared in “Attitude to Teeth” and “Index of Well-Being”, and the evaluation was mainly correlated to the DI score.

Key Words: Fluorosis, Social psychology, Self-reported

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Introduction

From 1980s, health model had been transferred from the “Simple Physical Model” to the “Physical-Psychological-Social Model”, so the diseases should be analyzed from these three aspects, and the psychosocial factors should also be taken into account firstly when considering the etiology, diagnosis, therapy and prevention of diseases[1].

Most studies about dental fluorosis focused on the epidemiology surveys[2] and the evaluation of the indices of fluorosis[3]. The risk factors of fluorosis[4] had also been well documented, especially about the relationship between the prevalence of fluorosis and water fluoridation or the fluoride concentration in drinking water[5]. A few studies had referred to the effects of oral diseases on patients[6] and some concerned about the satisfaction of the appearance of teeth with fluorosis[7]. But there were no systemic studies about the psychosocial effects of fluorosis. It is necessary to evaluate the effects of fluorosis on the patients from the aspect of psychology.

As we all know, fluoride had been well proved to be useful to prevent dental caries in 20th century[8][9], but overdose of fluoride for long period time during the formation of enamel would cause fluorosis, which could affect the appearance of teeth. The esthetic problem of fluorosis had been discussed in a few literatures[10-12]. Then we concerned about what difference of the psychosocial effects could be found among different degrees of fluorosis? Which degree of fluorosis could cause psychosocial effects and would appear in what aspects of psychosocial status? What correlated factors would be associated with the self-evaluation of the patients with fluorosis? This pilot study would discuss the above questions, which would also be useful for the fluoride using to prevent dental caries in future in China.

Methods

1. Study subjects
Qinghe County and Nangong County (water fluoride concentration: 3.7-4.0ppm) were selected randomly among the fluorosis epidemic areas (water fluoride concentration ≥1.5ppm ) in Hebei province. Adults (35-44 years old) were sampled in the villages, while the 12-year-old group and 15-year-old group were recruited in schools. All subjects were all born and living in the county, and hadn’t been continuously outside for more than 3 months since born to 6 years old. They were also absence of fixed orthodontic appliances and absence of non-fluoride-related opacities of teeth. At length, 416 inhabitants were involved, including 12, 15 and 35-44 years old groups which were 149, 131 and 136, respectively.

Total 178 patients with different degrees of fluorosis were filtered from all the above subjects. The filter criteria included no missing teeth, no decayed teeth, neither of the evident malocclusion. Among the filtered samples, there were 61(34.3%) 12-year-old students, 55(30.9%) 15-year-old students and 62(34.8%) 35-44 years old respectively. The average age was 38.7 years old.

2. Clinical examination
Dean’s Index (DI) was firstly developed by
Dean in 1934[13] and was modified in 1942. Two severest teeth with fluorosis were selected, and the score of the second severest teeth was recorded as the score of the subject. The fluorosis of 416 inhabitants was recorded by DI, and the 178 filtered samples were re-examined using Tooth Surface Index of Fluorosis (TSIF). TSIF was established by Horowitz from the National Institute of Dental Research in 1984[14], which included eight levels (0-7) and excluded the level of “questionable”. A separate score was given to each facial and lingual surface of the anterior teeth, and for the posterior teeth, the scores were recorded by the buccal, occlusal and lingual surfaces.

Two examiners (s/c) were trained by an experienced epidemiologist (w) before the investigation. The theoretical training was performed firstly, and the weighted Kappa coefficients were 0.89(w/s:DI), 0.86(w/c:DI), 0.96(w/s:TSIF), 0.89(w/c:TSIF) according to the maxillary right central incisors of the 20 fluorosis photos, and the prevalence of agreement were 84.21%, 84.21%, 94.73% and 84.21% respectively with the strength of agreement was “very good”. Then the clinical training was carried out, and 15 patients were examined by the reference examiner and the two examiners. Examiner of DI (c) was entirely accordance with the standard examiner and the Kappa coefficient was “1”, while the weighted Kappa coefficients of the examiner of TSIF (s) compared with the reference examiner were 0.81 when calculated the scores of the labial surface of anterior teeth. The prevalence of agreement was 91.67% and the strength of agreement was “very good”.

3. Evaluation of psychosocial status

Literature review and a series of pretests were performed before the study. The self-reported psychosocial questionnaire involved demographic data and six subscales, “Attitude to Teeth”, “Index of Well-Being”, “Index of General Affect”, “Interaction Anxiousness Scale” (IAS), “Self-Esteem Scale” (SES), “Impact on Behavior”[15], which included 12, 8, 4, 15, 10 and 9 items in the subscales respectively. All the psychosocial items were five-point questions, that is level “1” to level “5” represented five levels from “very good ” to “very bad” (positive questions) or from “very bad” to “very good” (negative questions).

The validity of psychosocial questionnaire was evaluated by the “internal consistency reliability” using Cronbach’s $\alpha$ Coefficient. The larger Cronbach’s $\alpha$ Coefficient means more validity of the questionnaire[16]. Except for the 0.57 Cronbach’s $\alpha$ Coefficient of the subscale of “Self-Esteem Scale”, the Coefficients of other subscales ranged from 0.65 to 0.84, which indicated that the validity of the psychosocial questionnaire used in this study was acceptable.

4. Statistical analysis

SPSS12.0 software was adopted to analyze the data.

Basic descriptive statistics such as the prevalence and proportion of fluorosis and the Community Fluorosis Index (CFI) was calculated first. Before the questionnaires data analyzed, the evaluation scores of the negative questions were unified according to the positive questions. Therefore, we got the
uniform evaluation scores, ranging from 1 to 5, in which higher scores represented severer psychosocial effect of fluorosis.

Difference of the evaluation scores among different severity of fluorosis were analyzed using “One-Way ANOVA”. Subjects were divided into “control group”(DI=0/0.5), “moderate group”(DI=1/2) and “severe group”(DI=3/4) according to DI scores for further analysis. “Independent-Samples t Test” was used to compare evaluation scores between the three groups on the six subscales.

Multivariate linear stepwise regression analysis was performed to determine the correlated factors of the evaluation of the patients with fluorosis, with enter level was 0.05 and removal level was 0.10, in which the evaluation scores on the six subscales were regarded as “dependent variables”, and the “independent variables” included DI score and the demographic data of the evaluators, including age, gender, educational level, occupation and the marriage status.

Results

1. Epidemiological data of fluorosis

Fluorosis prevalence in fluorosis epidemic areas of Xingtai City in Hebei province was 71.2% (DI≥1, n=416), and the prevalence of the three age groups were 94.6%, 87.0% and 66.2%. Significant difference existed among three age groups (Chi-square test, P <0.001). On account of TSIF scores recorded for each teeth surface, three methods were suggested to compute the prevalence of fluorosis[14]. The subject with one of the following criteria was computed as a fluorosis case: 1)The maximum TSIF score of the labial surfaces of the maxillary anterior teeth was one or above; 2)The maximum TSIF score of the labial surfaces of the anterior teeth was one or above; 3)The maximum TSIF score of all the surfaces of a subject was one or above.

The results of the prevalence computed according to TSIF scores were all higher than those of DI scores, especially in the 35-44 years old group, in which the difference of the two indices was almost 40% (figure 1). The percentage of the fluorosis patients according to DI scores in the three age groups were showed in the figure 2, from which one could found that the percentage of the “questionable” level was higher in the middle-age group than in the other two age groups.

![Figure 1. Comparison of fluorosis prevalence by Dl/TSIF](image)

a : the maximum TSIF score of the labial surfaces of the maxillary anterior teeth≥1;  
b : the maximum TSIF score of the labial surfaces of the anterior teeth≥1;  
c : the maximum TSIF score of all the surfaces of a subject≥1

According to the DI scores, CFI could be calculated as follow[17]: (0.5×number of “questionable” + 1×number of “very mild”+ 2×number of “mild”+ 3×number of “moderate”+ 4×number of “severe”)/ number of all the subjects. The CFI scores and the
The public health significance of the three age groups were listed in Table 1. CFI in fluorosis epidemic areas of Xingtai City in Hebei province was 1.77, indicating the degree of fluorosis prevalence in the community was moderate.

2. Evaluation of the psychosocial status of the patients with fluorosis

The average evaluation scores and Standard Deviations of six subscales for various degrees of fluorosis had been calculated (Table 2). With the increase of DI score, the average value of subscale “Attitude to Teeth” rose, ranging from 2.58 to 3.51, and the value of “Index of Well-Being” was also increasing, ranging from 2.35 to 2.90. The results of analysis of variance showed that statistical differences of subscale average values only existed in “Attitude to Teeth” \((P<0.001)\) and “Index of Well-Being” \((P=0.030)\), and no significant difference could be found among different degree of fluorosis in other subscales.

Three groups of different degrees of fluorosis were reassigned according to DI scores for further analysis. The results of "Independent-Samples T Test" showed that the evaluation on “Attitude to Teeth” was significantly different between the “mild group” \((DI=1/2)\) and the “severe group” \((DI=3/4)\) \((T=4.55, P=0.000)\), and between the “control

---

**Table 1** Community Fluorosis Index (CFI) in Xingtai City of Hebei province

<table>
<thead>
<tr>
<th>Age groups</th>
<th>CFI</th>
<th>Public health significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>35-44 years old</td>
<td>0.59</td>
<td>Borderline</td>
</tr>
<tr>
<td>15-year-old</td>
<td>2.22</td>
<td>Marked</td>
</tr>
<tr>
<td>12-year-old</td>
<td>2.46</td>
<td>Marked</td>
</tr>
<tr>
<td>Total</td>
<td>1.77</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

**Table 2** Evaluation scores on six subscales of patients with fluorosis

<table>
<thead>
<tr>
<th>DI</th>
<th>Attitude to Teeth</th>
<th>Index of Well-Being</th>
<th>Index of General Affect</th>
<th>Interaction Anxious Scale</th>
<th>Self-Esteem Scale</th>
<th>Impact on Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>S.D.</td>
<td>Mean</td>
<td>S.D.</td>
<td>Mean</td>
<td>S.D.</td>
</tr>
<tr>
<td>0</td>
<td>2.58</td>
<td>0.94</td>
<td>2.39</td>
<td>0.52</td>
<td>2.33</td>
<td>1.00</td>
</tr>
<tr>
<td>0.5</td>
<td>2.78</td>
<td>0.63</td>
<td>2.35</td>
<td>0.70</td>
<td>2.28</td>
<td>0.63</td>
</tr>
<tr>
<td>1</td>
<td>2.88</td>
<td>0.49</td>
<td>2.58</td>
<td>0.62</td>
<td>2.29</td>
<td>0.68</td>
</tr>
<tr>
<td>2</td>
<td>2.84</td>
<td>0.55</td>
<td>2.52</td>
<td>0.60</td>
<td>2.32</td>
<td>0.79</td>
</tr>
<tr>
<td>4</td>
<td>3.23</td>
<td>0.49</td>
<td>2.70</td>
<td>0.53</td>
<td>2.28</td>
<td>0.89</td>
</tr>
<tr>
<td>5</td>
<td>3.51</td>
<td>0.51</td>
<td>2.90</td>
<td>0.67</td>
<td>2.53</td>
<td>0.74</td>
</tr>
<tr>
<td>Total</td>
<td>2.95</td>
<td>0.62</td>
<td>2.55</td>
<td>0.62</td>
<td>1.17</td>
<td>0.38</td>
</tr>
</tbody>
</table>

---

**Table 3** Comparison of the evaluation on “Index of Well-Being” between groups

<table>
<thead>
<tr>
<th></th>
<th>Mean(S.D.)</th>
<th>Mild (DI=1,2)</th>
<th>Severe (DI=3,4)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Difference of value</td>
<td>P</td>
<td>Difference of value</td>
<td>P</td>
</tr>
<tr>
<td>Control (DI=0/0.5)</td>
<td>2.36(0.65)</td>
<td>0.19</td>
<td>0.100</td>
<td>0.38</td>
</tr>
<tr>
<td>Mild (DI=1,2)</td>
<td>2.55(0.61)</td>
<td>---</td>
<td>---</td>
<td>0.19</td>
</tr>
<tr>
<td>Severe (DI=3,4)</td>
<td>2.74(0.56)</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
</tbody>
</table>

\(^{a}\) no significance difference between "Control group" and "Mild group" \((P>0.05)\)

\(^{b}\) significant difference between "Control group" and "severe group" \((P<0.001)\)

\(^{c}\) no significance difference between "Mild group" and "Severe group" \((P>0.05)\)
Table 4 Results of multivariate linear stepwise regression analysis of the evaluation of the patients with fluorosis

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>Independent variables entered the regression model</th>
<th>Adjusted $R^2$</th>
<th>Partial coefficient $\beta$</th>
<th>$T$ value</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attitude of Teeth</td>
<td>DI scores</td>
<td>.12</td>
<td>.51</td>
<td>5.77</td>
<td>0.000</td>
</tr>
<tr>
<td>Teeth</td>
<td>Age</td>
<td>.16</td>
<td>.26</td>
<td>2.93</td>
<td>0.004</td>
</tr>
<tr>
<td>Index of Well-Being</td>
<td>DI scores</td>
<td>.04</td>
<td>.22</td>
<td>2.96</td>
<td>0.000</td>
</tr>
</tbody>
</table>

group” (DI=0/0.5) and the “severe group” ($T=-4.51, P=0.000$), while the difference between the “control group” and the “mild group” had no statistical significance. As for the evaluation scores on “Index of Well-Being”, significant difference could only be found between the “control group” and the “severe group” ($T=-3.18, P=0.002$) (table 3). While no statistical significance was existed between the three groups when analyze the evaluation scores on the other subscales.

3. Correlated factors of the evaluation of the patients with fluorosis

The results of the multivariate linear stepwise regression analysis (table 4) indicated that only the evaluation scores on “Attitude to Teeth” and “Index of Well-Being” could establish the regression models, and the independent variable entered the regression model was mainly the DI score, which meant that degree of fluorosis was significantly associated with the evaluation scores, while the evaluation of other subscales were not significantly associated with the independent variables involved in this analysis.

The multivariate linear stepwise regression model of the evaluation on “Attitude of Teeth” was as follows: $Y_1=2.19+0.27X1(DI)+0.01X2(age)$, which had been proved to have statistical significance ($F=16.94, P<0.001$). And the model of the evaluation on “Index of Well-Being” was $Y_2=2.35+0.12X1(DI$ 记分), which also had been validated ($F=8.76, P=0.004$).

Discussion

In the present survey, the prevalence of fluorosis recorded as DI was lower than the results by TSIF, especially in the 35-44 years old group, with the difference was almost 40%. Dean’s Index has been used in many epidemiological surveys for half a century since it was developed, which was also the recommended index for survey of fluorosis by the World Health Organization[18]. But Dean suggested that “one person, one disease”, and DI score was based on a person or a community, not on a tooth or a tooth surface[14][17]. Kingman pointed out that prevalence for the TSIF at surface level could be defined by requiring that TSIF $\geq 1$, but DI required fluorosis to be present on at least two teeth if the case could be regard as a patient[19]. In the adult group of this study, the severest teeth were almost consistent with the second severest teeth, while the proportion
of “questionable” in the 35-44 years old group was the highest (40.3%). The difference of the prevalence between the two indices was attributed to the imprecise diagnosis of the level “questionable” (DI=0.5), which could be diagnosed as fluorosis in the criteria of TSIF (TSIF=1) or TFI (TFI=1)[20]. Some other literatures had also reported that the diagnosis of “questionable" could affect the result of fluorosis prevalence[21].

Persons with attractive appearance are always assumed to possess more socially desirable personalities, and are happier and more successful than other who are less attractive[22]. Oral cavity is an important area for the appearance of a person[4][22], so the dental diseases could not only affect the physical health of patients, but also influence the psychological health, which could impact their day-to-day living or life quality in turn[6]. The results of this study showed that the psychosocial effects of fluorosis in the rural epidemic areas were mainly appeared in the aspects of “Attitude to Teeth” and “Index of Well-Being”. A study of Tanzania also concluded that dental fluorosis impacted negatively on the functional, social and psychological well-being of the secondary school children who were 12-20 years old[23]. Mwaniki in Kenya reported that 60%-84% of mothers with children aged 3-6 years old regarded fluorosis could affect the individual’s personality and had observed affected people cover their mouths with the hand when laughing, and dental fluorosis was viewed as an embarrassing condition by 77.5%[24].

There were no significant difference among the self-reported evaluation scores with different degree of fluorosis in the aspects of the other subscales, i.e. “Index of General Affect”, “Interaction Anxiousness Scale” (IAS), “Self-Esteem Scale” (SES) and “Impact on Behavior”. Because all the subjects were the inhabitants of the epidemic fluorosis areas, and many of the surrounding people of the subjects were also the patients with fluorosis, so the psychosocial status of these aspects was not so obvious. The psychosocial status could also be affected by the economic and cultural environment. The subjects in this study were almost peasants coming from rural areas, and may not care about these aspects of psychosocial status. Further studies in more areas were needed to be carried out to evaluate the influence of fluorosis on the psychosocial status of patients.

With the increase of DI score, the average value of subscale “Attitude to Teeth” and “Index of Well-Being” was raising, which implied that the influence of fluorosis was more apparent in the severer patients. Many studies had also come to the conclusion[4][10]. Alkhathib reported that the proportion of respondents who were dissatisfied with their own tooth color ascended with the increasing severity of discoloration[11]. The study of Riordan also showed that fluorosis with TFI≥2 could easily noticed, and the observers would felt that the appearance would increase the embarrassment of children as the TF score rising[10].

The evaluation of “Attitude to Teeth” was significantly different between the “mild group” (DI=1/2) and the “severe group” (DI=3/4), and between the “control group” (DI=0/0.5) and the “severe group”, and the difference of
scores on “Index of Well-Being” was significant between the “control group” and the “severe group”, while the difference between the “control group” and the “mild group” had no statistical significance. Woodward also found that the parents of the children with TSIF ≥ 2 was half as likely to be satisfied with the appearance of the children’s teeth than the parents of the children with no or mild fluorosis[7]. So some investigators pointed out the psychosocial effects of fluorosis were mainly appeared in the moderate and severe fluorosis, not in the patients with mild fluorosis[4][12][25], and this study also had a similar result.

The evaluation scores on “Attitude of Teeth” and “Index of Well-Being” were significant associated with the DI score, while the demographic data of evaluators didn’t enter the regression models. But a previous self-evaluated study presented that the gender, age, income and smoking of evaluators had statistically significant effects on the prevalence of perceived discoloration[11]. The possible reason maybe the demographic data of the subjects in this study were similar, and the difference could not be found. The further study was suggested in the field of the surrounding people of the patients with the fluorosis and the public, so that we could explore the psychosocial effects of the esthetic problem of fluorosis from variable aspects.

The first conclusion could be drawn that the most probably reason for the results of DI was lower than that of TSIF was that a person with “questionable” fluorosis wouldn’t be calculated as a fluorosis patient. The second conclusion was the self-reported psychosocial status of the patients with fluorosis in epidemic areas was mainly appeared in the aspects of “Attitude to Teeth” and “Index of Well-Being”, especially in the severe group, and the evaluation was mainly correlated to the DI score.

Reference:

7. Woodward GL, Main PA, Leake JL. Clinical determinants of a parent's satisfaction with the appearance of a child's teeth. Community Dent Oral Epidemiol
1996;24:416-418.
Origial Article

Orthodontic treatment needs of 14-year-old Yemeni adolescents

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Abstract
Objectives: To assess orthodontic treatment needs of 14-year-old Yemeni adolescents using the Index of Orthodontic Treatment Need (IOTN). Methods: This is a cross-sectional study involving a sample of 2400 adolescents from Yemen urban and rural government secondary schools, selected by multi-stage stratified random sampling technique, located in nine governorates representing five geographical zones of Yemen. Assessment of treatment was measured by the Dental Health Component (DHC) and Aesthetic Component (AC) of the IOTN. Clinical examination was carried under natural lighting using both disposable mouth mirrors and DHC rulers. The Aesthetic Component (AC) to assess aesthetic need was subjected to both study subjects (ACS) and examiner (ACE). Results: Findings showed 44.3% of the sample needed some form of orthodontic treatment (IOTN grades 3, 4 and 5). Of this, a quarter (26.8%) 'definitely' needed treatment. Assessment of orthodontic treatment needs using AC showed the examiner perceived at least 28.9% of the adolescents needed orthodontic treatment (18.8% 'borderline' and 10.1% 'definite' need). On the contrary, the subjects themselves perceived a lower proportion (13.4%). Clinically assessed normative 'definite' and 'borderline' need for orthodontic treatment was 3.5 times more than the subject's self-perceived need. Conclusion: Although the need for orthodontic treatment was identified, the public health implications of treatment provision need to be discussed and weighed against a backdrop of other more pressing needs for basic oral care by the providers of oral health care.

Key Words: Malocclusion, Treatment need, Yemeni adolescents


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Introduction

Health is a basic human right, within which oral health is a significant component. Planning for provision of orthodontic treatment within a public health system requires information on the malocclusion and orthodontic treatment needs of the population (Alhaija et al., 2004). There are a number of indices for the measurements of malocclusion and orthodontic treatment need (Thilander et al., 2001). In essence, the primary purpose of an orthodontic index is to identify individuals who would benefit from orthodontic treatment and should be given treatment priority. It is also useful to determine appropriate manpower needed to provide treatment (Foster and Menezes, 1976). This is especially true for the provision of orthodontic treatment in the public sector.

The Index of Orthodontic Treatment Need (IOTN) developed by Brook and Shaw (1989)
had two parts: The Dental Health Component (DHC) and the Aesthetic Component (AC). The former assessed the malocclusion and normative needs while the latter evaluated perceived need for treatment by the subjects. The IOTN has gained international acceptance in the last decade as it was found to be valid, reliable and easy to use (Beglin et al., 2001; Ovsenik and Primožič, 2007). Thus IOTN had been used by many investigators in different ethnic groups and populations.

Yemen is a developing country in the southwest corner of the Arabian Peninsula. Although dental services are reasonably accessible to its population, the current orthodontist to population ratio in the country is 1: 788,866 (Annual Statistical Health Report 2008). As there has been no study on the extent of orthodontic 'problems', this study was conducted to elicit relevant information in a selected adolescent population. At the time the data was collected, the relevant health agencies were interested in developing a baseline data bank for all types of appropriate oral diseases in the country to enable the government to improve oral services in the country.

Methods

Survey Organization and Sampling
A multi-stage stratified sampling technique involving adolescents in nine of the 20 governorates from five diverse geographical zones in Yemen as described in an earlier publication by AbdulKadir, R and Rasheed, A. (2010) was used. A random sample of 2,400 14-year-old Yemeni adolescents, equally distributed by gender, geographical zones and locations (urban and rural) were identified and included in the study (Figure 1). Ethical approval was obtained from the Medical Research Ethics Committee, University of Malaya (DF CD0701/0006(P)). Permission to conduct the study in the school setting was obtained from the Yemeni Ministry of Education as well as Head of Education in each governorate. In addition, individual consent was also obtained. All subjects were Yemeni in origin, without any history of orthodontic treatment.

Calibration.
Laboratory calibration was carried out two weeks prior to clinical calibration exercise. The examiner (RAS) and the gold standard (NZ) practise the various measurements of occlusal traits and treatment need on study models based on the FDI/WHO method and IOTN at University Malaya. Discussions were held to resolve any uncertainties or confusions.

Inter-examiner clinical calibration against a gold standard was done on 30 secondary school children aged 14-year-old in Malaysia. Cohen's Kappa values for the Dental Health Component and Aesthetic Component were 0.693 and 0.755, respectively. Intra-examiner calibration by the field examiner (RAS) was carried out by re-examination of the same subjects with a time lapse of one week apart. Findings of Kappa values for the Dental Health Component and Aesthetic Component were 0.780 and 0.857, respectively. The interpretation of the scores was in accordance with the guidelines of Kappa statistic (Landis and Koch, 1977) as follows:

- 0.81 or more - Very good agreement.
- 0.61 to 0.80 - Substantial agreement.
- 0.41 to 0.60 - Moderate agreement.
- 0.21 – 0.40 - Fair agreement.
- 0.20 or less - Slight to Poor agreement.
As an added precaution, a pilot study was carried out in Sanaa*, Yemen on 60 students from two schools by RAS and observed by RAK over a week period prior to actual data collection. The objectives of this exercise were among others; to identify any logistical problems in a local set up and familiarise the examiners with the school system and environment of Yemen. Kappa values were calculated and found to be 0.726 and 0.878 for DHC and AC measurements, respectively.

Data collection
Clinical examination using disposable mouth mirrors and DHC rulers was carried out under natural lighting. Student was seated on a portable chair in an upright position. DHC was recorded by direct examination of the subjects. Infection control procedures were strictly adhered to as much as possible. Only disposable dental mirrors and DHC rulers were used to measure the DHC component. Rubber gloves were used once and changed for every subject. Various occlusal traits were classified into five grades according to severity of malocclusion as well as the need for orthodontic treatment. Grades 1 and 2 represented ‘no need’ for treatment, grade 3 for ‘borderline need’ for treatment and grades 4 and 5 represented those in ‘definite need’ of orthodontic treatment.

AC measurement used a scale based on ten colour photographs showing different levels of dental attractiveness; grade 1 represents the most attractive while grade 10 the least attractive dentition. In accordance with the study by Richmond and co-workers (1995), grades 1-4 represented ‘no need’ for treatment, grades 5-7 ‘borderline need’ for treatment and grades 8-10 ‘definite need’ for orthodontic treatment. Aesthetic Component of IOTN was evaluated by examiner and subject. Duplicate examination was carried out on 10% of the children examined at each site to monitor examiner’s consistency.

The actual data collection was carried out by one examiner (RAS) and took four months to complete. He was assisted by a local dentist who volunteered as a recorder and one driver, both also assist in the preparation of the instruments and control the flow of the subjects to be examined and the random selection of subjects for duplicate examination.

Results

Dental Health Component (DHC) Measurement
Findings of DHC showed that 26.8% of the study population had ‘definite’ (Grades 4, 5) need for treatment, 17.5% were in ‘borderline’ need (Grade 3) category and 55.7% had a ‘slight or no’ need orthodontic treatment (Grades 1, 2) (Table 1). When analysed by geographical zone, more students from the north (mountains) and east (desert) zones were in definite need for treatment 31.5% and 30.6%, respectively (Table 2). Students from the west coastal island zone (19.4%) needed the least. The differences were found to be highly significant at p=0.000. A similar distribution pattern was observed in the other categories.

<table>
<thead>
<tr>
<th>DHC grades</th>
<th>Sample affected (%)</th>
<th>Treatment needs categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 5</td>
<td>282 (11.8)</td>
<td>Definite need treatment</td>
</tr>
<tr>
<td>Grade 4</td>
<td>360 (15.0)</td>
<td>Borderline need treatment</td>
</tr>
<tr>
<td>Grade 3</td>
<td>420 (17.5)</td>
<td></td>
</tr>
<tr>
<td>Grade 2</td>
<td>574 (23.9)</td>
<td>No need treatment</td>
</tr>
<tr>
<td>Grade 1</td>
<td>764 (31.8)</td>
<td></td>
</tr>
</tbody>
</table>

Analysis by urban-rural location and gender were as reported in Table 3. There was not such difference in “definite” treatment needs between urban-rural adolescents (27.6% vs 25.9%; p=0.356) or for ‘borderline’ need (16.3% vs 18.8%; p=0.107). While there is no difference for ‘definite’ treatment between males and females (28.3% vs 26.2%; p = 0519), however the difference is statistically significant between males and females for “borderline” need (p=0.004) and, no treatment needed (p=0.005).
**Aesthetic Component (AC) Measurement**

Analysis of the AC measurement showed the examiner perceived only slightly over a quarter (28.9%) of the students examined needed orthodontic treatment need (10.1% definite and 18.8% borderline). Majority (71.1%) was perceived by the examiner as not needing treatment. A similar pattern of perceived needs for treatment by the students were observed (Table 4). The quantum was however much lower (13.4% combined).

<table>
<thead>
<tr>
<th>Table 2: Distribution of normative orthodontic treatment need by zones</th>
<th>P-value&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment needs categories</td>
<td>DHC grades</td>
</tr>
<tr>
<td></td>
<td>North (n= 480)</td>
</tr>
<tr>
<td>Definite need</td>
<td>grade 5</td>
</tr>
<tr>
<td></td>
<td>grade 4</td>
</tr>
<tr>
<td>Borderline need</td>
<td>grade 3</td>
</tr>
<tr>
<td></td>
<td>No need</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 3: Distribution of normative orthodontic treatment need by location (urban &amp; rural) and gender</th>
<th>P-value&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment needs categories</td>
<td>DHC grades</td>
</tr>
<tr>
<td></td>
<td>Urban (n= 1200)</td>
</tr>
<tr>
<td>Definite need</td>
<td>grade 5</td>
</tr>
<tr>
<td></td>
<td>grade 4</td>
</tr>
<tr>
<td>Borderline need</td>
<td>grade 3</td>
</tr>
<tr>
<td></td>
<td>No need</td>
</tr>
<tr>
<td></td>
<td>grade 1</td>
</tr>
</tbody>
</table>

| Table 4: Distributions of treatment need categories between examiner and subject |  |
|---|---|---|
| Treatment needs categories | AC grades | Examiners assessments | Total (N= 2400) | Subjects assessments | Total (N= 2400) |
|  |  | n | % | n | % | n | % |  |
| Definite need | grade 10 | 22 | 0.9 | 244 | 10.1 | 21 | 0.9 | 113 | 4.7 |
|  | grade 9 | 46 | 1.9 | 37 | 1.5 | 55 | 2.3 |  |
|  | grade 8 | 176 | 7.3 | 47 | 2.0 | 127 | 5.3 |  |
| Borderline need | grade 7 | 98 | 4.1 | 33 | 1.4 | 207 | 8.7 |  |
|  | grade 6 | 210 | 8.8 | 47 | 2.0 |  |
|  | grade 5 | 142 | 5.9 | 127 | 5.3 |  |
| No need | grade 4 | 299 | 12.5 | 247 | 10.3 |  |
|  | grade 3 | 366 | 15.2 | 484 | 20.1 |  |
|  | grade 2 | 470 | 19.6 | 580 | 24.2 |  |
|  | grade 1 | 571 | 23.8 | 769 | 32.0 | 2080 | 86.6 |  |

45
Table 5: Relationship of normative treatment and subjects’ perceived needs

<table>
<thead>
<tr>
<th>Treatment needs categories</th>
<th>Normative treatment need (DHC)</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No need (%)</td>
<td>Borderline Need (%)</td>
</tr>
<tr>
<td></td>
<td>grade 1</td>
<td>grade 2</td>
</tr>
<tr>
<td>No need</td>
<td>15.8</td>
<td>8.9</td>
</tr>
<tr>
<td></td>
<td>8.6</td>
<td>6.5</td>
</tr>
<tr>
<td></td>
<td>5.2</td>
<td>4.4</td>
</tr>
<tr>
<td></td>
<td>1.8</td>
<td>2.3</td>
</tr>
<tr>
<td>subtotal</td>
<td>53.5</td>
<td>14.8</td>
</tr>
<tr>
<td>Borderline need</td>
<td>0.3</td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td>0.4</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td>0.1</td>
<td>0.2</td>
</tr>
<tr>
<td>subtotal</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Definite need</td>
<td>0.1</td>
<td>0.3</td>
</tr>
<tr>
<td></td>
<td>0</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>subtotal</td>
<td>0.2</td>
<td>0.7</td>
</tr>
<tr>
<td>Total</td>
<td>31.8</td>
<td>23.9</td>
</tr>
</tbody>
</table>

Normative Need Assessment (DHC) versus Subject perceived needs (AC)
Cross-tabulation between the normative orthodontic treatment need (measured by DHC) and student’s perceived need (AC measurement) for treatment is as shown in Table 5. Analysis showed slightly more than half (53.5%) were in agreement (“true” cases) of not needing any orthodontic treatment by the examiner and subjects. However, ‘true’ cases of ‘definite’ orthodontic treatment need was observed in only 3.8% of the sample affected although 18.3% were assessed objectively by the examiner as needing ‘definite’ treatment need. A weak but significant correlation however was found in the treatment needs categories assessed by examiner and subjects’ perception ($r = 0.326, p = 0.000$).

Discussion
Yemen has only 25 orthodontists to serve its 23 million populations and to date there is no information on the actual need for orthodontic treatment. Such information is important and relevance for future planning of dental services as well as for manpower required for orthodontic services. In this study, the IOTN was used to allow comparison to be made with similar studies globally. In addition, the Index had been established as reliable and had been used in the Middle East (Hassan, 2006; Ama et al., 2014; Abu-Fanas et al., 2015). Approximately a quarter (26.8%) of 14-year-old adolescents were found needing ‘definite’ orthodontic treatment on the basis of DHC measurement. The need for orthodontic treatment is comparable with several studies reported by Hamdan (2001) for Jordanian children, Tausche and co-workers (2004) for German children and Perillo and co-workers (2010) for Italian subjects which had results of 27.5%, 26.2% and 27.3%, respectively.

Findings from this study also showed slightly lower rates than that reported by Bernabé and Flores-Mir (2006) in 18-year-old Peruvian university students (29.9%) and several British studies by Brooke and Shaw (1989) (32.7%), Holmes (1992) (32%) and Burden (1995) (36%). Our findings were also higher than some other Caucasian studies (Souames et al., 2006; Manzanera et al., 2009; Danaei and Salehi, 2010) who observed a 21%, 17.1% and 12% ‘definite’ treatment need for French, Spanish
and Iranian children, respectively. Apart from ethnic and environmental differences, the smaller sample size of these studies might be reasons for the observed differences between their findings and the present study.

‘Definite’ need for treatment as assessed by the examiner using the AC measurement was found in a tenth (10.1%) of the adolescents. The finding concurs with Burden and Holmes (1994) who assessed 955 first-year secondary children in Sheffield, England and reported an 8.5% need treatment. In a similar study, Mandall et al. (2000) assessed 14-15-year-olds Manchester schoolchildren and observed a 9% ‘definite’ need for treatment. The finding of this study is also comparable to another study by Dias and Gleiser (2010) who found 11% of their Brazilian schoolchildren needed treatment to improve their aesthetics. When cross-tabulating between normative (DHC) assessment and that of subjects’ perceived assessment (AC), it is interesting to note that only 3.8% were “true” cases of those definitely needing treatment. Yet 18.3% diagnosed as definitely needing treatment were assessed normatively. This finding appear to suggest that subjects were either not aware they needed treatment or did not think they have a problem with aesthetics.

Given the scenario of the country, findings from this study hoped to generate a better understanding of the orthodontic problems in Yemen. As Yemen moves into the modern era in the future, provision of orthodontic treatment may become important particularly among its more educated, urban population. The question remains however who should provide the treatment or whether preventive measures to educate the population using the oral health promotion approach should instead be the priority “care”.

Conclusion

Findings from this first orthodontic epidemiological study on a national scale in Yemen can assist in preparing the grounds and encouraging those decision makers concerned with achieving better health care for the population to debate and discuss further to improve decision making regarding future delivery of dental services for orthodontic care in the country.

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