Profile of Dental Caries in Teenagers in Mumbai City Visiting Nair Hospital Dental College

Abstract

Background: Witnessing the alarming rise and pattern of distribution of dental caries worldwide, the need of the hour is to take initiative in preventing the spread further. Aim: This survey was conducted to determine the occurrence of dental caries and its associated risk factors in teenagers of Mumbai city who visited Nair Hospital Dental College. Materials and Methods: The objective of the study was to analyze the current dietary habits, oral hygiene status, and the number of sugar exposures in teenagers by a questionnaire followed by clinical examination which was carried out using International Caries Detection and Assessment System (ICDAS) II to detect the profile of dental caries. Statistical Analysis: The data obtained from the questionnaire and examination were analyzed using Chi-square test. Results: The survey showed that, out of the 300 teenagers examined, 67% visited the dentist only when they were symptomatic. Around 60% consumed sweets 2–3 times/day. A major percentage, 89%, consumed sweets irrespective of meal time and 52% consumed aerated drinks often. Only 16% used appropriate brushing techniques and 93% were not aware if their toothpaste was fluoridated. ICDAS II revealed that a total number of teeth requiring preventive treatment ranged from 8.3% to 14% and total number of teeth requiring definitive treatment ranged from 36% to 48%. It was found that tooth most commonly treated was 36 followed by tooth number 46 showing that the incidence of caries is higher in lower arch. Conclusion: Most of the teenagers had a high rate of sweet consumption in between meals and poor knowledge of brushing techniques, fluoridated toothpaste, interdental aids, and mouthrinses. ICDAS showed a high incidence of caries in teenagers, especially in the lower arch. ICDAS II showed good accuracy in differentiating between noncavitated and cavitated lesions which helps to provide an accurate treatment plan for teenagers so that it prevents the progression of the lesion.

Keywords: Dental caries, diet, International Caries Detection and Assessment System, survey

Introduction

Dental caries is defined as a multifactorial, transmissible, infectious oral disease caused primarily by the complex interaction of cariogenic oral flora (biofilm) with fermentable dietary carbohydrates on the tooth surface over time.[1]

A new pattern of caries is occurring worldwide, where the prevalence of dental caries is declining in developed countries, and is increasing in less developed countries, which is taking epidemic proportion in countries with emerging economies. This is referred to as polarization of caries.[1]

The decline in caries prevalence in developed countries may be associated with improved awareness regarding the oral hygiene practices, better approach to sugar consumption, and several preventive programs being conducted.[2] The rise in dental caries in developing countries is believed to be due to lower incomes besides social and cultural norms which often do not allow ready acceptance to new oral care methods and hygiene procedures.[2]

Risk factors affecting dental caries are highlighted by few studies; Ismail et al. found that different individual, social, and community risk indicators were associated with noncavitated versus cavitated tooth surfaces.[3] Harris et al. concluded that prevalence and incidence of dental caries in a population is influenced by a number of risk factors such as age, sex, ethnic group, dietary patterns, and oral hygiene habits.[4] As per Keys concept, 1960, factors affecting dental caries include host (teeth, saliva, etc.), microflora, and substrate (diet). In addition, a new dimension in the form of time is also included as per Newburn concept, 1982.[5]
Relation between diet and dental caries cannot be explained without mention about the three landmark studies. First, Hopewood house study by Sullivan and Harris, 1961, concluded that the average dimethyl fumarate rate in Hopewood house was 0.90–6.0, whereas for others, it was to 13.9. It was also proved that when Hopewood house children left the home and consumed a more traditional diet, their caries rate increased dramatically. Second, In the Turku sugar study 1975, sucrose in the diet was almost totally replaced by fructose and xylitol. After 2 years, there was an 85% reduction in caries in the xylitol group; with fructose, the caries was reduced by 32%. Third, study by Rugg-Gunn et al. which concluded that the weight of sugar intake appeared to be more strongly correlated with caries than frequency of intake; concentration of sugars in foods was positively related, and sugars in snacks were more strongly related to caries than dietary sugars.

It was realized that there were many inconsistencies among the research criteria for measuring caries. World Health Organization (WHO) criteria did not differentiate between the noncavitated and cavitated lesions, so treatment could not be done at early stage. The International Caries Detection and Assessment System (ICDAS) was developed in 2002 by an international group of researchers (cardiologists and epidemiologists) based on a systematic review of clinical caries detection systems to provide clinicians, epidemiologists, and researchers with an evidence-based system for caries detection. ICDAS I was modified into ICDAS II at a workshop in Baltimore, USA in 2005. The ICDAS can serve as a basis and benchmark for clinical and epidemiological research.

The aim of this study was to determine the profile of dental caries in teenagers in Mumbai city visiting Nair Hospital Dental College, with the objective to study the occurrence of dental caries and the associated risk factors in these teenagers using ICDAS. This study was conducted to determine the knowledge, awareness, and attitude of the teenagers toward diet and oral hygiene practices as well as to determine the correlation of diet and oral hygiene on the prevalence of dental caries as it requires continuous understanding and investigation. The parameters checked were the current dietary habits, oral hygiene status, and the number of sugar exposures in teenagers and whether there exists a correlation of the above factors with the occurrence of caries.

Materials and Methods

The study design used for the study was randomized sampling technique. A total number of 300 teenagers (13–19 years of age) who visited Nair Hospital Dental College were examined in the current survey. A written informed consent and a written assent form were obtained from all the participants. All the permanent teeth were examined. They were selected using cluster sampling method.

Teens with systemic conditions and teenagers who were physically or mentally challenged were excluded from the study. Before the examination of dental caries, a questionnaire was filled by the subjects to gather information about the personal data along with their oral hygiene and dietary habits. Oral prophylaxis was also carried out before examination. A questionnaire was prepared keeping in mind objectives of the study, i.e. analysis of the current dietary habits, oral hygiene status, and the number of sugar exposures in teenagers and correlation of the above factors with the occurrence of caries. The questionnaire was answered by a total of 300 participants.

Examination and assessment were done using ICDAS II, after completion of the questionnaire and oral prophylaxis. ICDAS II system has coding for caries as well as restoration. A simple noninvasive intraoral examination was carried out using mouth mirror and CPITN Probe.

The data obtained from the questionnaire and examination were analyzed using Chi-square test.

Results

The survey showed that, out of the 300 teenagers which comprised of 42% males and 58% females, most of the teenagers visit dentist only when symptomatic which can be attributed to lack of awareness. Their dietary habits reveal frequent consumption of meals with high rate of sweet consumption in between meals. Teenagers in the survey lack knowledge about brushing techniques, do not use mouthwash or any interdental aids, and do not rinse frequently. The result of the questionnaire is exhibited in Figures 1-4, respectively, in the form of pie graphs 1–10.

Incipient occlusal caries has been proved difficult to detect because of widespread use of fluorides and its superficial remineralization potential, which allows the development of dentinal caries under a macroscopically intact surface. ICDAS II differentiates between noncavitated and cavitated lesions and helps to diagnose incipient occlusal caries with high sensitivity and specificity which facilitates the appropriate treatment and prevents further spread of caries. The result of examination conducted using ICDAS II is exhibited in the Figures 3 and 4, respectively, in the form of bar graphs. Figures 3 and 4 demonstrate the caries code and restoration codes, respectively, in all the four molars by four separate bar graphs.

As per Figure 5, a total number of teenagers examined in this survey, who obtained ICDAS II, [Table 1] (1–6) which will need preventive treatment are as follows: 16 is 13.6%, 26 is 14%, 36 is 10%, and 46 is 8.3%. The cases requiring preventive treatment are incipient, noncavitated carious lesions which can be only diagnosed by ICDAS II. Teenagers who obtained ICDAS II caries code: 3–6 which will need definitive treatment are as follows: 16 is 36.6%, 26 is 39.7%, 36 is 44.3%, and
is 48.1%. This shows a high incidence of caries in the lower arch. This could be related to unrestricted dietary habits practiced by the teenagers as reported by them in questionnaire.

As per Figure 6 [Table 1] restoration codes revealed that there were 64%–78% of teenagers who did not receive any preventive treatment in the form of sealants which again could be correlated to lack of awareness among the teenagers. There was a total of 30.4% of the teeth restored with temporary restoration, which indicated treatment being initiated but had not been followed up with the appointments probably since they were not symptomatic. It was found that tooth most commonly treated was 36 followed by 46 showing that the incidence of caries is more in lower arch.

**Discussion**

There is convincing evidence, collectively from human intervention studies, epidemiological studies, animal
studies, and experimental studies, for an association between the amount and frequency of free sugars intake and dental caries.\(^1\)

The food our ancestors ingested was in its largely natural state, i.e., neither refined nor deprived of any of its valuable components. These people did not use toothbrushes, floss, and naturally no toothpaste or fluoridated water. With/without all this, studies have shown them to have a healthy dentition. Conversely, when the primitive diet is being abandoned in favor of ones including sugar, white flour, and canned foodstuffs, both tooth decay and various health issues start appearing rapidly. The more often consumption of caries promoting foods and the longer the foods are in your mouth, the more potential damage can occur to your teeth.

With an increase in celebrity-studded advertisements and social media, there is expectation of an increase in the awareness of teenagers toward diet and oral hygiene practices. With this aim in mind, this study was conducted...
to evaluate the oral hygiene status, dietary habits, and profile of dental caries of the teenagers in Mumbai city visiting Nair Hospital Dental College.

According to the results of the survey as shown in Figures 1 and 2, 93% teenagers had visited a dentist previously. About 67% of them visited the dentist when they were symptomatic and only 23% had visited dentist for routine checkup. About 89% of the population had noticed some kinds of decay or discoloration and 80% of population gave a history of food lodgment. About 76% consumed 3–5 meals/day and 73% consumed food frequently after every 3–4 h. Around 60% consumed sweets 2–3 times/day. Only 11% consumed sweets at meal times, 43% consumed sweets anytime, and 46% consumed sweets in between meals or after meals. About 52% consumed aerated drinks often and 41% consumed aerated drinks sometimes.

As per result of this study, there is a high percentage of teenagers consuming aerated drinks and sweets/chocolates regularly in between meals. With the development of the I.T industry, the number of people consuming sugar-filled sodas, sweetened fruit drinks, and snacks that contain little, if any, nutritional value is skyrocketing among the general
Table 1: International Caries Detection and Assessment System II (ICDAS II)

| Scores | Severity of caries                                      |
|--------|--------------------------------------------------------|
| 0      | Sound tooth                                            |
| 1      | First visual change in enamel                          |
| 2      | Distinct visual change in enamel                       |
| 3      | Localized enamel breakdown                             |
| 4      | Underlying dark shadow from dentin                     |
| 5      | Distinct cavity with visible dentin                    |
| 6      | Extensive distinct cavity with visible dentin          |
| 97     | Tooth missing because of caries (tooth surfaces will be coded 97) |
| 96     | Tooth surface cannot be examined: surface excluded     |

Restoration codes  Restoration

| 0      | Not restored or sealed                                 |
| 1      | Sealant (partial)                                      |
| 2      | Sealant (full)                                         |
| 3      | Tooth-colored restoration                              |
| 4      | Amalgam restoration                                    |
| 5      | Stainless steel crown                                  |
| 6      | Porcelain or gold or PFM crown or veneer or inlay or onlay, etc., |
| 7      | Lost or broken restoration                             |
| 8      | Temporary restoration                                  |

PFM: Porcelain fused to metal

population. Irregular meal times and increased consumption of refined foods and aerated drinks have led to an increase in the rate of dental caries, especially among children and teens. This correlates with the findings of ICDAS II coding system which showed increase rate of dental caries among teenagers in this study.

A total of 93% percentages of teenagers were consuming aerated drinks. It can be attributed to the advanced media which acts as a double-edged sword. The increasing number of advertisements regarding aerated drinks and chocolates allures the teenagers. The high socioeconomic status as well as peer pressure has led to their increased consumption.

According to the results of the survey as shown in Figures 1-4, despite the fact that 93% of the teenagers who had visited dentist previously, only 65% of them brushed their teeth only once and only 16% used appropriate brushing techniques when questioned about their brushing habits. About 90% of teenagers did not use any mouthwash. About 32% of teenagers were too busy to spend even 2 min on brushing. About 98% of teenagers were not aware of the use of any gel for massaging the gums after brushing to keep them healthy. This could be due to lack of awareness as teenagers visited dentist only when symptomatic or the teenagers were not too cooperative and motivated enough to follow the instructions given by the dentist.

Most astonishing result was obtained when teenagers were questioned about knowledge about fluoride in their toothpaste as only 7% of the teenagers knew that their toothpaste was fluoridated. This shows the lack of awareness among the teenagers despite the numerous advertisements regarding the same on the social media.

More is the retention of sticky food in the mouth and the duration for which the foodstuffs’ stay in mouth higher is the incidence of carious lesions affecting the tooth. Only 34% of the teenagers rinsed their mouth after every meal. This correlates with the findings of ICDAS II coding system [Table 1] which showed increased rate of dental caries among teenagers in this study.

Dental caries has been traditionally described as a multifactorial disease that involves interaction of host factors (tooth surface, saliva, and acquired pellicle), diet, dental plaque, and time. Most important in the understanding of caries process is that dental caries does not occur in the absence of either dental plaque or dietary fermentable carbohydrate, and thus dental caries must be considered a dietobacterial disease. A modern concept of caries also includes the importance of social, behavioral, and psychological factors as well as biologic factors.[12]

Caries diagnosis is considered as a three-step procedure, which begins with the identification of the lesion (caries detection), followed by the assessment of the lesion severity and assessment of the lesion activity.[13]

According to (WHO 1997), caries detection surveys have been performed at cavitation level because examiners frequently cannot reliably detect noncavitated lesions. However, the inclusion of noncavitated lesion is necessary since these can be arrested through preventive management, lowering the costs of restorative treatment.[14,15] In addition, introducing a criterion which includes noncavitated caries has the purpose of improving the sensitivity of caries epidemiology and clinical trials, especially in populations with low prevalence of dental caries, in which caries lesions present a low progression rate and are found mostly in initial stages.[15]

ICDAS, based on visual inspection, was developed for use in clinical research, clinical practice, and for epidemiological purposes (Pitts, 2004). The system is intended to be feasible for use in epidemiological surveys and to detect cavitated and noncavitated stage lesions with acceptable reliability. (Pitts 2004; Ismail et al. 2007) ICDAS II differentiates between cavitated and noncavitated lesions.[11]

Chester’s et al., 2002, stated that most children classified as caries free according to the WHO criteria had noncavitated caries lesion. In this cohort study, the use of ICDAS system, which allowed the evaluation of both noncavitated and cavitated carious lesions, might have detected associations more sensitively or decreasing a shorter follow-up period. This could also decrease the duration of clinical trials.[16]

According to Diniz et al., the advantage of ICDAS-II is
its ability to detect the first changes in the dental surfaces because of caries development. Another advantage is the possibility of recording detailed characteristics of the teeth and monitor the changes in their surfaces.\cite{13} Braga et al., 2008, stated that ICDAS II is feasible in epidemiological surveys in preschool children. With Score 3 as the cutoff, this system provides data comparable with WHO criteria.\cite{16}

The ICDAS is a clinical scoring system for use in dental education, clinical practice, research, and epidemiology. It is designed to lead to better quality information and to inform decisions about appropriate diagnosis, prognosis, and clinical management of both the individual and public health levels.

ICDAS II can be used to detect depth and severity of the lesion and measuring different degrees of severity of the carious lesion. ICDAS demonstrated a significant and close relationship between its scores and histologic depth of the lesion. Histological classification system is based on the classification given by Ekstrand et al., 1997.\cite{9,13} It was concluded that it is possible to predict coronal lesion depth correctly. It is possible to assess the activity of primary coronal caries lesions accurately using the combined knowledge obtained from visual appearance, location of the lesion, and tactile sensation during probing.\cite{13} This system has a moderate-to-good sensitivity (0.63–0.82) and specificity (0.63–0.94) for occlusal surfaces.\cite{13} Advantage of ICDAS II is its ability to detect the first changes at dental surfaces because of caries development.\cite{9}

Active lesions always require management which can be either nonoperative/preventive or operative. The appropriate treatment for active lesions should be related to the depth and severity of the lesions assessed using ICDAS II. The active lesions with score 1 and 2 (superficial lesions) require nonoperative/preventive treatment, while active lesions with detection scores 3-6 (profound lesions) require operative treatment.\cite{13}

The WHO criteria proves insufficient on their own to identify the preventive and/or therapeutic treatment needs for the examined molars and it did not differentiate between the cavitated and noncavitated lesions. ICDAS II has good reproducibility and accuracy for the detection of occlusal caries lesions at different stages of the diseases. ICDAS allows a standardization of data collection and would also enable better comparability among studies.\cite{9,13}

After the questionnaire, an examination was conducted which was assessed using ICDAS II. All the permanent teeth were examined, it was found that tooth most commonly affected by caries as well as most commonly restored tooth is permanent first molar.

The first molar is first permanent tooth to erupt in oral cavity. The high proportion of noncavitated caries lesions in permanent molars can be attributed to the posteruptive onset of caries process within up to 6 years after tooth eruption.\cite{17}

Occlusal surfaces are most caries affected sites in children and adolescents.\cite{9} Pits and fissures are present in occlusal surface of the first molar have a complex invaginated anatomy and hence are highly susceptible to caries. They pose a difficulty in plaque removal and make caries detection even more difficult.\cite{18}

According to the results shown in Figures 3 and 4, ICDAS II conducted in our study showed that females have much more carious teeth. It was found that a total number of teeth in this survey which required preventive treatment ranged from 8.3% to 14% which could not be identified by other means. It was found that a total number of teeth requiring definitive treatment ranged from 36% for maxillary and 48% for mandibular teeth. It was found that there was a high incidence of dental caries in the lower arch as compared to the upper arch.

ICDAS II revealed that there were 64%–78% of teenagers who did not receive any preventive treatment in the form of sealants which again could be correlated to lack of awareness among the teenagers. There was a total of 30.4% of the teeth restored with temporary restoration which as reported by the teenagers were either undergoing treatment or could not follow-up with the appointments as they were not symptomatic. It was found that tooth most commonly treated was 36 followed by 46 showing that incidence of caries is more in lower arch.

Since the first permanent mandibular molar erupts at about 6 years of age, children and their parents are ignorant about it and consider it as primary tooth and hence it’s most neglected. Parents are unaware of the eruption of permanent teeth and do not treat it seriously. Very few schools give training and education of oral health. Hence, the teenagers do not treat their oral health seriously, leading to high incidence of dental caries.

There is a need to increase awareness among the teenagers regarding the oral health care practices so as reduce the incidence of caries. The health-care professionals need to educate and motivate the patients to follow the appropriate oral hygiene practices. The patients need to be instructed to regulate their dietary habits to reduce the incidence of caries.

**Conclusion**

Concluding this survey, we have come across many interesting findings among teenagers which include increased consumption of aerated drinks and refined carbohydrate, increase in the number of sugar exposures in between meals, inadequate knowledge about the different brushing techniques, toothpaste used, and other oral hygiene practices, improper timing of eating among the teens, and inadequate rinsing after meals. All these factors lead to retention of food and increased incidence of dental caries.
ICDAS is a very effective tool, helped to diagnose the incipient, noncavitated as well cavitated carious lesions which would determine the appropriate treatment plan for the patient which would be cost-effective to both the patient as well as clinician. It also helped the teenagers to understand the importance of oral hygiene and dietary practices in relation to their oral health.

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Conflicts of interest
There are no conflicts of interest.

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