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To Validate Caries Risk Profiles Assessed with a Cariogram against Actual Caries Increment in 5 Year and 12 Year Old School Going Children

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ABSTRACT

Background: Dental caries is a bacterial driven, generally chronic, site- specific, multifactorial, dynamic disease process. The present study was conducted to validate caries risk profiles assessed with a Cariogram against actual caries increment in deciduous dentition in 5 year old school going children and in permanent dentition in 12 year old school going children and to findout main contributing individual risk factor, if any. **Methods**: A cariogram model was used to create caries risk profiles on 600 children aged 5 and 12 years ±6 months. They were divided into 2 groups. The group I and group II consisted of 300 and 300 children respectively. Reexamination was done after 1 year and caries increment was recorded. The caries risk profiles generated by the cariogram software were compared with caries increment. **Results**: The results showed that that dental caries, diet content, diet frequency, plaque index, S. Mutans, fluoride, salivary flow rate and buffer capacity are significantly associated with actual chance to avoid caries. Initial dental caries is strongest predictor for future dental caries amongst all of them in both the groups. The mean caries increment in one year in 5 year old children is higher than in 12 year old children. **Conclusion**: Mean caries increment was higher in children who are at high risk according to cariogram and low in children who are at low risk according to cariogram. The risk of developing new carious lesions consistently reduced from high risk category to low risk category reflecting the ability of Cariogram in accurately estimating future caries. Thus, Cariogram can be an effective tool for motivating the patient and also serve as a support for clinical decision making.

Keywords: Caries, cariogram, plaque index.

INTRODUCTION

Dental caries is defined as the localized destruction of susceptible hard tissues by acidic by-products from bacterial fermentation of dietary carbohydrate.[1] In India prevalence of dental caries in 12 year old children in 2009 was found to be 85% while in America in 2010 it was 18.8%.[2] Dental caries is a disease of the mineralized tissues of the teeth with a multi-factorial etiology related to the interactions over time between tooth substance and certain micro-organisms and dietary carbohydrates producing plaque acids.[3] Among the numerous factors affecting dental caries, the important ones are Streptococcus mutans, Lactobacillis counts, saliva flow rate, buffering capacity and past caries experience. It is also modified by factors like type of diet taken, oral hygiene practices, use of fluoride and other preventive measures and dental visits which are dependent on socioeconomic status.[4] To assess the susceptibility of caries, Professor D. Bratthall developed the concept and the formula for the Cariogram. The "Cariogram" is an interactive PC program for caries risk evaluation. It is a graphical picture illustrating in an interactive way the individual's/ patient's risk for developing new caries in the future, simultaneously expressing to what extent different etiological factors of caries affect the caries risk for that particular patient. However, the Cariogram does not specify a particular number of cavities that will or will not occur in the future.[5] Hence, the present study was conducted to validate caries risk profiles assessed with a Cariogram against actual caries increment in deciduous dentition in 5 year old school going children and in permanent dentition in 12 year old school going children and to findout main contributing individual risk factor, if any.

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MATERIALS AND METHODS

The present study was conducted in the schools of a known region. The Ethical clearance and necessary permissions were obtained from

concerned authorities prior to the start of the study. A total of 600 children aged 5 years±6months (deciduous dentition) and 12 years ±6 months (permanent dentition) were randomly selected at government primary and middle schools. The children were divided in to 2 groups: Group-I. Deciduous dentition (n=300) Group-II. Permanent dentition (n=300). Children studying in schools located at known region, children permanent residents of that area, 5 years ±6 month's old children with fully erupted deciduous dentition and 12 year ±6 month's old children with fully erupted permanent dentition were included in the study. Children on regular use of chlorhexidine gluconate etc., over the last 3 months or antibiotics for the last 1 month and those having mixed dentition were excluded from the study. A brief history of each child including name, age, sex, and father's name was recorded. Caries risk profiles were assessed by Cariogram by putting the parameters in PC software in weighed scores using following criteria :related general disease, diet content, diet frequency, fluoride exposure, caries scores at baseline, plaque scores, S. mutans—estimation of levels of S. mutans in saliva, salivary secretion rate, and salivary buffer capacity. An optional factor for scoring, i.e., clinical judgment, is also available which gives an opportunity for the examiner to express his/her clinical feelings, if it differs from the program in-built estimation. By default, its value is set to "1." A set of questions were asked from the patient or patient's parents/attendants regarding medical history, method of cleaning of teeth, and brushing frequency. Also, history of use of fluorides including the topical fluoride application and toothpaste used was noted and used for scoring. A 24-hour diet recall was done for all the 600 children selected for the study for both the groups. The diet recall was taken by personal interview of the child/ parents by the investigator following the recollection of intake of anything eaten or drunk in the last 24 hours in a backwardly preceding fashion. After the interview, caries prevalence, decayed, missing, and filled teeth (DMFT) index, and decayed, missing, and filled surfaces (DMFS) index were recorded using the World Health Organization (WHO) standard criteria for oral health surveys. Oral hygiene was estimated by employing plaque index. Paraffin-stimulated whole saliva was collected from all the children to measure the (1) saliva secretion rate (expressed as mL/min), (2) buffering capacity of saliva, and (3) Lactobacillus and S. mutans counts. For S. mutans, mitis salivarius-bacitracin agar(HI MEDIA, code 259) was used and for Lactobacillus, de Man, Rogosa and Sharpe agar (TM MEDIA, code M641) was used. These risk factors for dental caries were evaluated using cariogram for both the age groups at baseline. All the children were cariographed to know their caries risk profile i.e., high-risk group, medium-risk group, and low-risk group, which was further kept for record and analysis. At baseline, no intervention or preventive interception was done intentionally. However, children were free to get any knowledge or treatment on their own. After a period of 1 year, only 600 children were available, who were considered for statistical analysis. All the children were reexamined by the same examiner in order to avoid interexaminer variation and the caries status was recorded using DMFT/dmft by WHO criteria. The difference between the caries status at baseline and after one year was assessed and statistical analysis was done. The results obtained after 1 year were compared with predicted results of cariogram to check the validity of cariogram. The nine factors of the cariogram were compared with actual chance to avoid caries by linear regression analysis. Mean and standard deviation of dental caries increment were calculated after 1-year follow-up according to age and caries risk profile of the cariogram.

RESULTS

Table 1: Linear regression analysis of predictor variables in relation to estimation of the 'Actual chance to avoid new cavities' among 5 years old children

Predictor variables	Standardized Coefficients	P value
	Beta	
(Constant)		.000
dental caries	-.322	.000
diet content	-.274	.000
diet frequency	-.223	.000
plaque index	-.098	.000
S.mutans	-.273	.000
Fluoride	-.322	.000
SalivaryFlowrate	-.110	.000
buffer capacity	-.104	.000

Table 2: Linear regression analysis of predictor variables in relation to estimation ofthe 'Actual chance to avoid new cavities' among 12 years old children.

Predictor variables	Standardized Coefficients	P value
	Beta	
(Constant)		.000
Dental caries	-.433	.000
diet content	-.244	.000
diet frequency	-.175	.000
plaque index	-.102	.000
S. mutans	-.240	.000
Fluoride	-.315	.000
SalivaryFlowrate	-.090	.000
Buffer capacity	-.105	.000
medical history	.009	.651

In the present study all children were cariographed and their caries risk profile at baseline was recorded. Then, the nine factors of the cariogram were compared with actual chance to avoid caries by linear regression analysis. Finally, Mean &

Standard deviation of dental caries increment was calculated after 1 year follow up according to age and caries risk profile of Cariogram.

The above [Table 1] shows that dental caries, diet content, diet frequency, plaque index, S. Mutans, fluoride, salivary flow rate and buffer capacity are significantly associated with actual chance to avoid caries. Initial dental caries is most significantly associated with actual chance to avoid caries in comparison to other factors and hence strongest predictor for future dental caries amongst all of them.

The above [Table 2] shows that dental caries, diet content, diet frequency, plaque index, S. Mutans, fluoride, salivary flow rate and buffer capacity are significantly associated with actual chance to avoid caries. According to the above table, medical history/related disease is statistically not significantly associated with actual chance to avoid caries. This could be due to the fact that there was just one student with positive medical history. Initial dental caries is most significantly associated with actual chance to avoid caries in comparison to other factors and hence strongest predictor for future dental caries amongst all of them.

Table 3: Mean & Standard deviation of dental caries increment after 1 year follow up according to age and caries risk profile of Cariogram.

Age Group	Group		N	Mean	Std. Deviation
5	Low	New caries	140	0.12	0.342
	Medium	New caries	96	0.48	0.660
	High	New caries	66	0.97	0.804
12	Low	New caries	125	0.10	0.342
	Medium	New caries	102	0.37	0.642
	High	New caries	73	0.7	0.810

The [Table 3] shows that mean caries increment in 1 year in 5 year old children in low, medium and high risk patients is 0.12, 0.48 and 0.97 respectively. Mean caries increment in 12 year old children in low, medium and high risk patients is 0.10, 0.37 and 0.7 respectively. Mean caries increment in one year in 5 year old children is higher than in 12 year old children.

DISCUSSION

Generally speaking,' risk' is the probability that some harmful event will occur. Risk is often fined as the probability of an 'unwanted' event occurring within a specified period of time.[5] Caries risk is the probability of individual developing carious lesion, reaching a given stage of the disease in progression during a specified period of time, conditional that the exposure status for risk factorise mains stable during the period in question. Thus, Caries risk relates to the likelihood of a person developing caries lesions or not.[5]

In the present study all children were cariographed and their caries risk profile at baseline was recorded. Then, the nine factors of the cariogram were compared with actual chance to avoid caries by linear regression analysis. Linear regression analysis shows that dental caries, diet content, diet frequency, plaque index, S. Mutans, fluoride, salivary flow rate and buffer capacity are significantly associated with actual chance to avoid caries. Initial dental caries is most significantly associated with actual chance to avoid caries in comparison to other factors and hence strongest predictor for future dental caries amongst all of them in both the groups. The mean caries increment in 1 year in 5 year old children in low, medium and high risk patients is 0.12, 0.48 and 0.97 respectively. Mean caries increment in 12 year old children in low, medium and high risk patients is 0.10, 0.37 and 0.7 respectively. Mean caries increment in one year in 5 year old children is higher than in 12 year old children.

Imfeld T (1993),[6] Midda M et al (1994),[7] reported that diet is a major factor influencing dental caries and its role in the caries process is primarily local rather than systemic.

A highly significant correlation was found between diet frequency and actual chance to avoid caries by Celik EU et el (2012),[8] Hebbel M et al (2012).[4]

In our study highly significant positive correlation was found between fluoride programme and actual chance to avoid caries which is in accordance with the studies done by Hebbal M et al (2012) and Peker I et al (2012).[4,9]

Initial dental caries came out to be the strongest predictor of dental caries in future which is in accordance with the study undertook by Seppa L et al in 1988,[10] in which he showed that caries prevalence in primary teeth can correctly predict future caries in permanent teeth. Celik et al (2012)8 also concluded the same.

Sheiham A (1997),[11] in the epidemiological studies showed a positive correlation between past caries experience and future caries development.

Morinushi T et al (1995),[12] demonstrated that poor oral hygiene is directly associated with plaque score and contributes to the high prevalence of dental caries.

High count of Streptococcus Mutans is detected in the mouth of individuals with high activity of caries.[4]

Kuriakose S et al (2014),[13] Animireddy D et al (2014),[14] concluded that statistically significant relation was found between salivary flow rate and actual chance to avoid caries.

A highly significant relation was found between salivary buffer capacity and actual chance to avoid caries in the studies done by Kuriakose S et al (2014),[13] and Animireddy D et al (2014).[14]

CONCLUSION

Mean caries increment was higher in children who are at high risk according to cariogram and low in children who are at low risk according to cariogram. The risk of developing new carious lesions consistently reduced from high risk category to low risk category reflecting the ability of Cariogram in accurately estimating future caries. Hence a Cariogram can be said to be a useful tool for caries prediction. Thus, Cariogram can be an effective tool for motivating the patient and also serve as a support for clinical decision making, when selecting preventive strategies for the patient.

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