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ORIGINAL ARTICLE

Caries Assessment by ORATEST in school going children: A cross sectional study

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ABSTRACT

Aim: To determine caries activity among school going children using an uncomplicated oral rinse test (Oratest)
Method: A Cross-sectional study was conducted in the Paediatrics Dentistry department of Bahria University Dental College Karachi, Pakistan from July 2019 to October 2019. Out of total 300 children visiting paediatrics dental clinic of private dental college, Karachi, Pakistan between July 2019-Oct 2019, 200 children were excluded who did not meet the inclusion criteria. Out of remaining 100 children, randomly selected 25 children were allocated to test group and separate 25 healthy children without caries were allocated to control group. On the basis of number of decayed teeth, the test group was divided into three subgroups: Group-I had 1-2 carious teeth, individuals with 3-5 carious lesions were included in Group-II, while 7-9 were included in Group-III. Microbial status was evaluated using Oratest. The time observed for the change colour represents the microbial activity, it was documented in planned proforma.
Results: A total of 50 children, 26 were female and 24 were male with a mean age of 6.74 ±2.20 yrs. were included. The result showed significant relationship between control and test group in term of mean time for Colour modification and number of carious lesion. The Oratest colour change time was higher in patients with less number of carious teeth, showing an inverse relationship between Oratest and presence of caries lesions. The result also showed a significant relationship between age and eruption status of molar with caries activity.
Conclusion: Caries activity can be assessed using Oratest as it is an uncomplicated, economical, chairside and time efficient test. It can be of immense service in aiding caries activity assessment in paediatric dental setups as it is gladly accepted by children. The Oratest can be used as a teaching tool to improve the oral health literacy of the children and their families, by viewing the activity of their bacteria.
Keywords: Caries detector, dental caries, microbial colonies, oratest

INTRODUCTION

The oral cavity is home to a host of commensal microbes, dis-balance of many of which causes diseases of the oral cavity particularly, caries and periodontal diseases which are of significant importance. Poverty and sub-standard health care systems in the developing countries have led to an increase in the incidence of dental caries[1]. In a large scale survey conducted by WHO, spanning the length and breadth of the communities of Pakistan, caries was established as a disease five times more prevalent than asthma and seven times more common than Hay fevers in the youth[2,3].

Dental caries is a disease of the dental hard tissues characterized by the dissolution of the mineralized content and destruction of the organic structure mediated by acid producing bacterial pathogens[4]. Factors associated with caries induction and progression include presence of bacterial biofilms, dietary habits of the patient, oral hygiene practices of the individual and salivary composition. Primarily organisms involved in caries include S. mutants, lactobacillus and Actinomyces[5]. Evaluation of the bacterial count of an individual can allow assessments of his risk of caries[6]. This in turn can potentially allow dentists to tip the scales in favour of caries prevention in those deemed as belonging to the vulnerable population. However, caries risk assessment of an individual by appraising bacterial load and other associated risk factors is an arduous undertaking[7].

Many of the techniques employed to assess caries activity depend on computing the total number of microbes. Such approaches involve tests that are lengthy, complex, requiring specialized equipment, laboratories and specially trained personnel, are financially taxing. And yet their results can be inconsistently accurate and sensitivity[8]. In 1989, Rosenberg *et al*[9] introduced Oratest, a cost effective, non-invasive and a less time consuming procedure to assess caries activity. In this test

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expectorated milk is used as a medium that aids to collect bacteria from oral cavity that changes color after oxygen depletion by aerobic micro-organisms generating anaerobic atmosphere. The methylene blue dye acts as oxidizing agent and is reduced to leukomethylene thereby producing the observed colour change. Several researches had used this procedure to assess level of microbial load for oral hygiene evaluation, Halitosis and gingivitis[1,10,11].

A research conducted in 2020 used oratest for caries risk assessment[12]. Ambati et al co-related oratest with caries activity and reported an inverse association between Oratest and DMFT score[13]. Kunte et al explored the relationship between Oratest with other caries activity test in children and found a positive result[14]. Multiple other studies done by Bhasin et al, Saxena et al., Sundaram and Gainneos et al[1,10,11,15] have also recommended the use of Oratest for chairside assessment of caries activity. None of the mentioned studies have evaluated the effect of various patient factors like age and presence or absence of first molar and there is still controversy regarding its specificity and no consensus has been obtained. Therefore, the current study was designed to appraise the effectiveness of simple chairside oral rinse test (Oratest) to assess caries activity among school going children and to identify various important patient factors affecting caries activity.

METHODOLOGY

A cross-sectional study was piloted at Paediatrics Dentistry department of Bahria University Dental College Karachi, Pakistan from July 2019 to October 2019 after taking ethical approval from the ethics committee of the college with ref no.04/2019. WHO sample size calculator was used to calculate sample size as it was used by Chandak et al[7] in their research. He reported in his study that mean time to observe change in color in the test group was 74±37 mins, using this value and with confidence level at 95% and absolute precision at 15%. The prerequisite sample size was

calculated to be 24 and with two groups i.e test and control, a total of 48 samples were required. We worked on a total sample of 50 i.e., 25 samples in each group.

Out of total 300 children visiting paediatrics dental clinic between July 2019-Oct 2019, 200 children were excluded who did not meet the inclusion criteria i.e., patient of both gender, age range between 4-12 with at least one carious tooth, systemically healthy, no history of antibiotic intake and mouth rinses within two months and consenting parents. Exclusion criteria included children who were lactose intolerant, uncooperative, had periodontal disease or teeth near exfoliation.

Out of remaining 100 children, 25 participants were randomly selected using computer generated number table method and were allocated to the test group and separate 25 healthy children free from intraoral diseases including gingivitis and caries were included in the Control group. Informed consent was procured from each individual parent before being incorporated in the research.

The test group was further divided on the basis of caries severity into three subgroups I (1-2 carious teeth), II (3-5 carious teeth) and III (7-9 carious teeth). The purpose of the divisions was to simplify sampling (Figure 1).

The status of caries was assessed visually using WHO criteria and coded as either sound or cavitated[16] by trained examiner who were blinded to the study objective and group allocation. According to this criteria, tooth was coded as cavitated only when there is pronounced cavitation with softened dentine floor, and rest were coded as sound based on stages of caries before development of visible cavitation.

Examiner calibration was performed by two session training including presentation and hands on training of the examiners included in the study under supervision of trained specialist. In each session examiner was asked to perform caries assessment based on WHO criteria and perform oratest on a random sample of five patients and record the time for color change. Intra-examiner reliability was performed to check the level of agreement among multiple repetitions of assessment performed by a single trained examiner.

Sterile beaker (glass) containing 10ml of cow milk (Nestle Nesvita, 3% fat, pH6.5) was given to the participants for rinsing. The expectorated milk was poured back in the beaker. Out of total 10ml, 3ml of the sample was collected using micro pippete into separate sterile test tube (Pyrex) containing 0.1% methylene blue dye (0.12ml). The test tube containing sample was then allowed to rest in the test tube stand and a calliberated examiner who was previously trained and not part of recruitment and sample collection process was asked to record the time for color change from white to blue depicting caries activity, using stop watch. The examiner then entered all the details in self-made proforma.

Statistical analysis: SPSS version 22 was used for data analysis. Frequency distribution was calculated for gender and eruption status of first molar. Means and SD were calculated for age, number of carious teeth and time for color change. One way ANOVA followed by post hoc Tukey test was performed for the evaluation of mean time for color change among the different sub groups. T-test was applied to determine the difference of mean time for color change between the test group and patient related variables. Pearson correlation test was performed to identify the strength of correlation between different patient variable (gender, age, molar eruption status) and number of carious teeth in test group. Intraexaminer reliability was checked using kappa (κ) statistic coefficient. The level of significance was kept at ≤ 0.05.

Pearson correlation test was performed to identify the strength of correlation between different patient variable (age, gender, molar eruption status) and number of carious teeth in test group. Intraexaminer reliability was checked using kappa (κ) statistic cofficient. The level of significance was kept at ≤ 0.05.

RESULTS

Out of total 50 children, 24 were male and 26 were female with a mean age of 6.74 ±2.20 yrs. The frequency distribution of patients in control and different test subgroups are given in Figure 2.

The time observed for color change ranges between 18-110mins. The present study reported a statistically significant difference between test and control in terms of mean time for color change i.e., 28.8±9.16 minutes in the Test Group and 91.96±14.01 minutes in the Control group (p-value of 0.000). There was also a statistically significant difference between test and control in terms of no of carious teeth (p-value = 0.00) (Table -1).

Table 1: Comparison between Test and Control group in terms of Patient characteristics and mean time for colour change (n=50)

Variables	Experimental Group		*p*-value
	Test Group	Control Group	
Mean time to change colour (minutes)	28.88 ± 9.16	91.96 ± 14.01	0.000
Male female	11(44%) 14 (56%)	13 (52%) 12 (48%)	0.77
Age (years)*	7.92 ± 1.99	5.56 ± 1.73	0.000
No of carious teeth*	4.28 ± 2.86	0.00 ± 0.00	0.00

**Independent sample T-test* $ Chi-Square test *P-value* ≤ 0.05

Table 2: Comparison of mean time for colour change depicting caries activity among subgroup I (1-2 carious lesions), II (3-5 carious lesions) and III (7-9 carious lesions).

Test Group n= 25	Mean ± SD	*p*-value	*Post-Hoc Tukey test *p-value ≤ 0.05*		
			Sub group-I VS Sub group-II	Sub group-I VS Sub group-III	Sub group-II VS Sub group-III
Sub group I (n=8)	37.50±6.21	0.000	0.38	0.18	0.00
Sub group II (n=10)	29.30±6.48				
Sub group III (n=7)	18.43±1.13				

*One way ANOVA **Post-hoc tukey test*

Table 3: Relationship between Patients related variables and mean time for colour change depicting caries activity in the test group

Test Group n=25	Mean time to change colour (minutes)	*p*-value ≤ 0.05
First Molar eruption Status		
Erupted (n= 19)	31.95 ± 8.35	0.00
Unerupted (n=6)	19.17 ± 1.83	
Gender		
Male(n= 11)	25.64 ± 8.835	0.12
Female(n= 14)	31.43 ± 8.89	
Age (years)		
< 6 Years(n= 6)	19.17 ± 1.83	0.001
>6 Years(n= 19)	31.95 ± 8.35	

**Independent sample T-test*

The test group was further into three subgroups (I =1-2 carious teeth, II =3-5 carious teeth and III =7-9 carious teeth) based on the severity of carious lesions. The present study reported a significant different among the test subgroups for mean time for color change (p-value = 0.000) (Table -2).

The present study reported higher Oratest time in female gender (31.43± 8.89 minutes) as compared to male gender (25.64± 8.835 minutes), but the results were not statistically significant (p-value 0.12). Caries activity was significantly associated with the age of the patient and eruption status of the first molar (p-value 0.00). (Table -3)

We also found a strong positive correlation between first molar eruption status and number of carious teeth (r= 0.65) and strong negative correlation between age, gender and number of carious teeth (r=-0.67 and r=-0.57 respectively). An inverse

relationship was also found between Oratest time and caries activity (r=0.86) (Table 4). The level of agreement between two sets of reading for ORATEST turned out to be strong (κ value=0.80).

Table 4: Correlation between patient variable and number of carious teeth in test group

Variable	Pearson correlation coefficient	*p*-value *p value* ≤ 0.01
Age (years) (n=25)	-0.67	0.000
Gender (n=25)	-0.57	0.002
First Molar eruption status (n=25)	0.65	0.00
Mean time for colour change (min)	-0.86	0.00

*Pearson correlation test

Figure 1: Patient recruitment process and distribution of groups

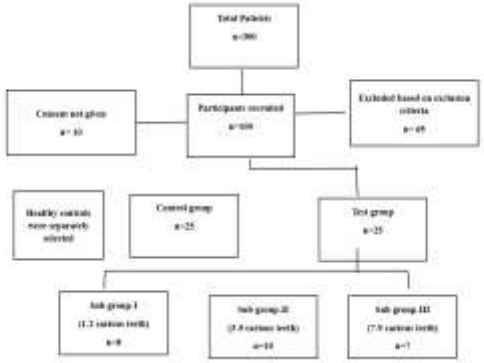
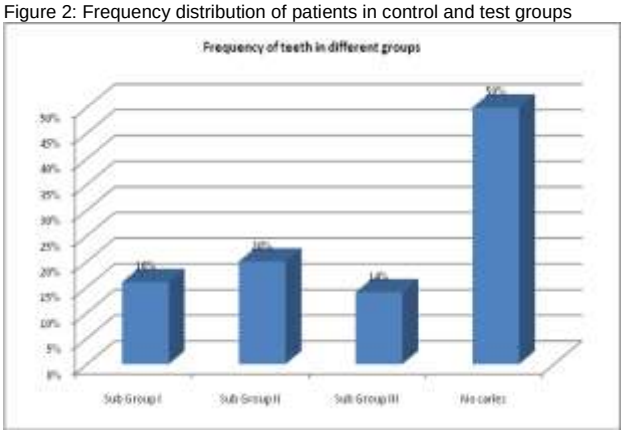


Figure 2: Frequency distribution of patients in control and test groups



DISCUSSION

Various methods of caries activity detection have been used to assess and motivate patients[17]. Such tests usually pertain to numerical quantification of the involved microorganism or in-depth analytical analysis of bacterial metabolism[18,19]. However, the exacting nature of such tests, stringent armamentarium demands and technique sensitivity make their clinical application arduous. Compared to all the other qualitative methods, Oratest stands a quick, uncomplicated, non–invasive procedure[10,20-22]. Therefore, the objective of the study was to assess the caries activity by using Oratest.

A higher Oratest time was recorded for females in our study, but the result was not statistically significant. Multiple other studies have also reported similar results[23-25]. However, higher Oratest time in males as compared to females was reported by Ambati *et al.*[13] but the results were not significant. This was likely caused by poor oral hygiene and greater number of carious teeth in females. The current study demonstrated a more rapid change in color in the test group as compared to the control group. This is due to significant difference in caries activity between the control and test group, with greater microbial load contributing to an earlier color change in the test group as compared to the control group. Similar results have also been concluded by various previous studies[1,9,23]. Statistically significant difference was observed between the carious teeth subgroups, with subgroup I showing the highest time taken for color change while subgroup III depicted the shortest time for color change. Sundaram *et al.*[10] and Patalay *et al.* also reported similar results in their studies[26]. Previously, the interdependence between Oratest time and caries activity has been appraised and the two variable have been found to be inversely correlated[13,15]. Oratest time and streptococcal count also depict anti correlation with each other, and this was also similarly mirrored in our study[22].

Hence it can be concluded that Oratest is a dependable and sound test and only produces a color change when the microorganism concentration is high. Moreover, rapidity of the color change is directly corelated with microbial concentration[28,29]. Current study also appraised the connection between age and number of carious lesions and established a strong anti-correlation i.e. caries activity was significantly less in the older population. This is in congruence with the research reported by Asma et al. and Qasim et al regarding age and caries cavity[24,25]

A study by Alves et al. reported that eruption stage was significantly associated with occlusal caries activity[30].The author also reported that partially erupted molar as compared to fully erupted were five times more likely to have active caries but only second molars were evaluated[30]. Our study also reported similar results and found a significant association between eruption status of first molar with caries activity.

Major failing of Oratest is that it lacks specificity with positive color change not limited to caries activity but also includes other scenarios of high bacterial load such as poor oral hygiene, gingivitis and periodontitis. Lastly it doesn't quantify microorganisms until the sample is cultured.

The strength of the study lies in the fact that Oratest is an uncomplicated and economical chair side test that indicates caries activity. Shortcomings include small sample size, uni-centric study, and qualitative method of assessment. It is recommended that studies conducted over a larger population with multi-center participation and comparison of Oratest with other caries evaluation methods and inclusion of factors like caries severity would improve insight into reliability of this test. Furthermore, recruitment of children with no caries or incipient lesions should also be carried out to analyze Oratest's ability to identify caries risk factors for caries.

CONCLUSION

Caries activity can be assessed using Oratest as it is an uncomplicated, economical, chairside and time efficient test. It can be of immense service in aiding caries activity assessment in paediatric dental setups as it is gladly accepted by children. The Oratest can be used as a teaching tool to improve the oral health literacy of the children and their families, by viewing the activity of their bacteria.

Ethics approval: Bahria University Dental College, Ethics Committee approved the ethical conduct of this study. (ERC 04/2019).

Conflict of interest: Nothing to declare

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