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Original Article

Association between maternal — child levels of salivary *Mutans Streptococci* and early childhood caries

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ABSTRACT

Background: To find out if there is an association between levels of salivary *Mutans Streptococci* (MS) of mothers and salivary MS and Caries experience of their Children.

Materials and Methods: A cross sectional study was designed among 180 mother-child pair attending Vanivilasa Children Hospital, Bangalore, India. Caries was diagnosed using WHO criteria. Ninety children with Early Childhood Caries (ECC) with their mothers were included in case group and 90 caries free children with their mothers were included in the control group. Whole non-stimulated saliva was collected from mothers and children and cultured for MS. Colonies were counted and compared. Data was analyzed using SPSS version 10. Chi-square test and *t*-test were used to find differences between groups. *P* value of <0.05 was considered as significant.

Results: Among 180 children, 80 of them had a high MS count. Among them, 60 (75%) had ECC and only 20 (25%) were caries free. This difference was significant with $P < 0.001$. Among 180 mothers, 100 had a high MS count. Among them, 60 (60%) belonged to case group and 40 (40%) to the control group ($P = 0.003$). Forty nine of the Children in case group with a high count also had mothers with high count as against only 14 in the control group ($P < 0.001$).

Conclusion: Present study showed a strong association between maternal and child salivary MS levels indicating that mother's MS count could be an important risk indicator for ECC development.

Key Words: Children, early childhood caries, maternal, *Mutans Streptococci*

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INTRODUCTION

Early childhood caries (ECC), is an infectious disease affecting primary dentition, believed to be mainly caused by *Mutans Streptococci* (MS).[1-3] Studies have shown that initially these *Streptococci* are acquired by the children through their mothers around 2 years of age, which is the window of infectivity.[4] A quantitative correlation thus exists between levels of MS in mothers and their children. While this correlation could be partly because of common genetic or environmental factors, some studies have reported that a child's degree of colonization or disease may be dictated by mother's level of MS at the time of transmission.[5,6]

This suggests that by identifying mothers to be with high MS levels and intervening to optimize the mother's oral health so as to reduce MS while the mother is still pregnant, it may be possible to reduce the incidence of caries in children.[7] Hence, this study was undertaken to investigate if there was an association between mothers' and their children's MS levels, which in turn would have influenced the development of ECC.

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MATERIALS AND METHODS

A cross sectional analytical study was conducted among 180 mother-child pair attending Vani vilasa Children's Hospital Bangalore, India. It is one of the four biggest government hospitals in Bangalore and serves people from low socio economic status.

180, 3-5 year old children visiting the hospital with their mothers for the purpose of vaccination selected randomly were included for the study. The study was approved by the Institutional Ethical Committee.

Mothers were informed about the study and informed consent was taken from mothers. Children and mothers suffering from either chronic systemic diseases, or who had undergone chemotherapy, under long term oral medication or who had taken a recent dose of antibiotics were not included.

Children were examined on an ordinary chair using mouth mirror and Community Periodontal Index probe under natural light. Caries was diagnosed using WHO criteria. National Institute of Dental and Craniofacial Research's (NIDCR) definition was used for ECC diagnosis, which was based on the presence of one or more primary teeth affected.[8] The examiner was trained for caries identification on dental patients who were not part of study for 2 weeks. Intra examiner reproducibility was calculated using Cohen-Kappa scores and recorded as 0.89.

Ninety children who had at least one frank carious lesion were diagnosed as having ECC and included in case group along with their mothers. Ninety caries free counterparts selected from the same hospital were included in the control group along with their mothers.

Bacterial sample collection

Whole non-stimulated saliva was obtained from all mothers and children. Subjects were refrained from swallowing for a minute and made to passively drool saliva in disposable sterile plastic containers. 1 ml of this saliva was transferred to a graduated tube containing 1 ml of autoclaved, diluted Ringer's lactate with the help of disposable syringes. This was transferred to the lab on ice and processed within ½ h.

Sample processing

Salivary samples were vortex mixed for 30s. A 100 fold dilution of saliva was prepared using Phosphate buffered saline. 0.1 ml of this was plated on Mitis Salivarius-Bacitracin agar (Hi-media, Mumbai) with 15% sucrose and 0.2 units/ml of Bacitracin prepared according to Gold *et al*.[9] Plates were incubated at 37°C in a 5% CO_2 atmosphere for 48 h and colony forming units were counted. The colonies were identified by their characteristic morphology. Gram staining, mannitol and sorbitol fermentation tests were done for confirmation. A colony count of >100 was considered as high.

Statistical analysis

Data was analyzed using SPSS version10. Chi-square test or fisher exact test were used to analyze categorical data. Independent *t*-test was used to find the differences in the mean number of colonies between groups. $P < 0.05$ was considered as statistically significant.

RESULTS

Regarding salivary MS colony count in children, among the total of 180 children, 80 (44.4%) of them had a high MS count and 100 (55.6%) had a low MS count. Of the 80 children with high count, 60 belonged to case group as against only 20 children who belonged to control group. This difference was statistically significant with $P < 0.001$ [Table 1].

Regarding salivary MS count in mothers, among the total of 180 mothers, 100 had a high MS count, whereas 80 of them had a low MS count. Of the 100 mothers with high count, 60 belonged to case group and 40 belonged to control group. This difference was also significant with $P = 0.003$ [Table 2].

In the case group, out of 60 (66.7%) children who had a high colony count, 49 of them had mothers with a high colony count. In the control group out of 20 children with a high colony count, 14 of them had mothers with a high colony count. This was statistically significant with $P < 0.001$ [Table 3].

Independent *t*-test showed a significant difference in the mean number of colonies among both mothers and children in the case and control groups. Both mothers and children in the case group had a higher number of colonies as compared to mothers and children in the control group Table 4.

DISCUSSION

ECC is a significant socio-behavioral, dental problem in many developing countries including India, especially concentrated in deprived families.[10-12]

Table 1: Distribution of children according to the salivary MS count

MS count	Case (%)	Control (%)	Total (%)	*P* valve
Low	30 (33.3)	70 (77.8)	100 (55.6)	<0.001
High	60 (66.7)	20 (22.2)	80 (44.4)	
Total	90 (100)	90 (100)	180 (100)	

MS: *Mutans Streptococci*

Table 2: Distribution of mothers according to the salivary MS count

MS count	Case (%)	Control (%)	Total (%)	*P* value
Low	30 (33.3)	50 (55.6)	80 (44.4)	0.003
High	60 (66.7)	40 (44.4)	100 (55.6)	
Total	90 (100)	90 (100)	180 (100)	

MS: *Mutans Streptococci*

Table 3: Distribution of mothers based on MS counts of their children

Groups	MS count of children	MS count of mothers		Total (%)
		Low (%)	High (%)	
Case	Low	19 (63.3)	11 (18.3)	30 (33.3)
	High	11 (36.7)	49 (81.7)	60 (66.7)
Total		30 (100)	60 (100)	90 (100)
Control	Low	44 (88)	26 (65)	70 (77.8)
	High	6 (12)	14 (35)	20 (22.2)
Total		50 (100)	40 (100)	90 (100)

MS: *Mutans Streptococci*

Table 4: Mean number of colonies among children and mothers in the case and control groups

Subjects	Case group	Control group	*P* value
Mothers	136.4±86.7	108.2±90.9	0.05
Children	125.8±68.3	58.0±55.1	0.000

Vanivilasa Hospital was selected as it is one of the biggest government hospitals in Bangalore which provides services to people from low socio economic status. Hence children and mothers did not show much variation in education, oral hygiene practices, frequency of dental visits etc.

Prevalence of ECC world wide is highly variable owing to the differences in case definition and diagnostic criteria. In the present study, NIDCR definition[8] was used for ECC diagnosis and only frank cavitations were considered as caries, in order to keep the diagnosis non-ambiguous as examination was carried out on an ordinary chair with limited light and instruments.

In the present study, 3-5 year old children were selected so that they would have a full complement of deciduous teeth. Whole non-stimulated saliva was collected as collecting stimulated saliva was difficult from 3-year-old children by making them chew on the paraffin wax.

In the present study, MS was detected in salivary samples of almost all mothers and children except for one. However, there has been a variation in detection levels in different studies owing to differences in type of salivary sample collected, microbiological methods used and also variation in colonization time and pattern.[6,13]

In the present study, 44.4% of the children had a high MS count compared to 55.6% who had a low colony count. In the case group, 66.7% had a high count as compared to only 22.2% in the control group. This could be attributed to the high caries experience of children in case group. Many previous cross sectional and longitudinal studies have shown significant relationship between MS levels and caries.

In a study by Aaltonen and Tenovuo, children with caries experience ($df > 1$) had significantly more MS in their salivary samples than without caries.[14] In a follow up study by Mattos-Graner *et al*. on Brazilian children, results showed that heavily infected children had a higher risk for caries development.[15] A study by Thibodeau and O'Sullivan showed a positive association between salivary levels of MS and caries pattern.[16]

In the present study, there was a significant difference between MS count in the case and control groups. In case group, 66.7% of mothers had a high MS count as compared to only 44.4% in the control group. In a study by Smith *et al*., 69% of the mothers in the test group were positive for MS while only 16% of the control mothers were positive.[17] This difference could have been due to the individual caries experience, frequency of sugar consumption and other factors among mothers which have not been included in the present study.

Many studies have reported that maternal factors like education, high MS levels, poor oral hygiene, high caries experience etc.,could be an important risk indicators for caries in their children. Mothers with high Decayed Missing Filled Surfaces scores and high *mutans* levels may affect a child's early infection with *mutans*, resulting in ECC.[6-18] In the present study, when the MS count in children was associated with the MS count in their mothers, a significant difference was found in the case and control groups. Among

children in case group, 49 of them who had a high MS count also had mothers with a high MS count, as compared to only 14 in the control group. Also, the mean number of colonies was significantly higher in case than in the control group.

In a study conducted by Thorild *et al*., in which 52% children who had mothers with high *mutans* count, also exhibited colonization with the bacteria.[5] A study by Li *et al*. suggested that mother's level of MS in saliva may be related to the acquisition of MS in their children.[19] Also, Kohler *et al*. study has shown that children of mothers having high levels of MS are more likely to exhibit levels of MS corresponding to their mothers' levels.[20] This implies that mother's MS level is a risk indicator for high levels of MS in their children and subsequent development of ECC.

The results of the study could be used to promote good oral hygiene practices among mothers to reduce their salivary MS count which in turn could reduce MS load in saliva of their children and there by chances of development of ECC.

However, limitations of the present study are that, many other factors like diet, oral hygiene practices, feeding habits, use of fluorides, plaque scores etc., which have significant influence on the MS count were not considered in the present study. Also, the caries and MS level is not constant in a child's mouth, but changes as the child grows and exposed to different factors. Hence a longitudinal study would be better to test the effect of mother's *mutans* on their children's *mutans* level and in turn the development of ECC.

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