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Correlation of Salivary *Streptococcus Mutans'* Count between Mothers and Their Neonates within 48 Hours of Birth - An Ex-Vivo Study

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ABSTRACT

Context: Streptococcus Mutans are one of the causes for development of carious lesion. With the emergence of deciduous teeth, the number and species of the microflora in the oral ecosystem continues to grow and along with Streptococcus Mutans can cause early childhood caries.
Aims: To detect co-relation of Streptococcus Mutans' count between mother and their neonates.

Settings and Design:
Methods and Material:
Sample size - 60 healthy mothers and their 60 neonates born through vaginal-delivery
Group 1: 30 Pregnant women with DMFT score less than 5.
Group 2: 30 Pregnant women with DMFT score more than or equal to 5.
Salivary swab samples will be taken from mothers' oral cavity and from their neonates' oral cavity at the time of birth. Salivary swab samples of infants will also be collected after 48 hours of delivery. Samples will be stored in peptone water and will be grown on the Salivarius Mitis agar. Visible S. mutans colonies grown on these media will be counted using a bacterial colony counter.

Statistical analysis used: Mann Whitney U test

Results: Significant difference was observed in samples taken from neonates after 48 hours of both groups. Neonates of group 2 showed significantly higher SM count compared to neonates of group 1.
Conclusions: Vertical transmission of SM was observed from mothers to neonates. Nevertheless, environmental factors also seemed influential in colonisation of SM in infants' oral cavity.

Keywords: Streptococcus mutans, Vertical transmission, Salivary swab, Microbial count

INTRODUCTION

Oral cavity serves as gateway to the over-all health of an individual. It plays a vital role in essential functions such as speech, mastication, digestion and as space maintainer. For a pediatric dentist, a deep understanding of children's oral cavity is the basis for providing specialized oral health care to children and adolescents while assuring optimal results.[1]

The establishment of the newborn oral microbiome is an important aspect of early oral health, with microbial colonization beginning in utero and continuing postnatally.[2] *Streptococcus mutans* (*S. Mutans*) has emerged as a key microbe in the development of dental caries.[3] Infants

are generally considered to be free of microorganisms at the time of their birth, but during birth and shortly after birth, epithelial lining of the mouths of neonates are colonized by different microorganisms.[4] Early *S. mutans* colonization was associated with an increased risk of early childhood caries (ECC).[5] Vertical mother-to-child transmission of *S. mutans* during the perinatal period has been suggested as a significant mode of early acquisition.[6] Caufield *et al.* demonstrated that infant acquisition of *S. mutans* occurs during a discrete window of infectivity and highlighted the importance of understanding transmission dynamics during this critical time frame.[7]

While existing research provides valuable insights into mother-to-newborn transmission of *S. mutans*, the exact mechanisms and factors influencing this process during the first 48 hours after birth remain poorly understood. This ex-vivo study seeks to address this knowledge gap using controlled microbiological analyses of saliva samples collected from mothers and newborns during the first 48 hours after delivery.

MATERIALS & METHODS

It was an ex-vivo, microbial, comparative study. The study was conducted among 60 mothers and their 60 neonates born through vaginal-delivery who visited the Department of Obstetrics and Gynecology at the Sola Civil Hospital, Ahmedabad.

Inclusion Criteria:

- Healthy pregnant women consenting for the study.
- Neonates born through vaginal delivery.

Exclusion criteria:

- Neonates with premature birth or any physical disability.
- Mother and/or neonates having received any antibiotic therapy.
- Mothers having past medical history of systemic disease/diseases.
- Neonates born through cesarian section.

Materials: Swab sticks, Peptone water, Salivarius Mitis agar, Agar plates.

Study Design:

Based on the inclusion criteria, a total of 60 Pregnant women were selected for the study and were consenting to participate in the study. Participating women were requested to gargle with water before oral examination. DMFT (Decayed, Missing, Filled Teeth) index was used to determine the occurrence of coronal caries. All participants were divided into 2 groups according to their DMFT index score.

Group 1: Pregnant women with DMFT score >5 and their neonates

Group 2: Pregnant women with DMFT score </=5 and their neonates

Salivary samples were taken from mothers' oral cavity as well as from their neonates' oral cavity at the time of birth. Salivary samples of infants were also collected after 48 hours of delivery. Samples were stored in peptone water and were grown on the Salivarius Mitis agar. Visible S. mutans colonies grown on these media were counted using a bacterial colony counter. [Figure 1]

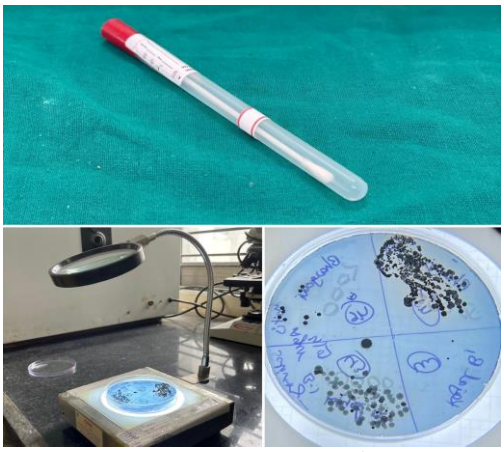


Figure 1: Materials used for the study

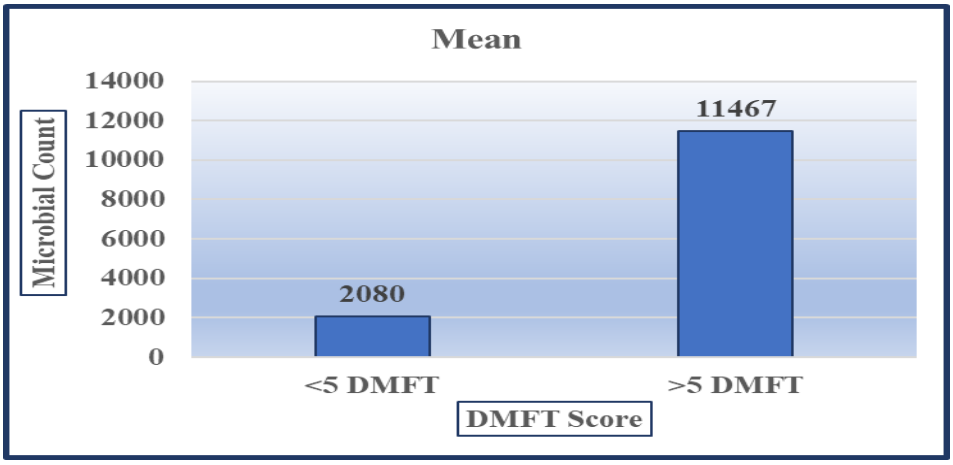
RESULT

Microbial count from the salivary swab samples of mothers were taken and were divided in 2 groups according to their respective DMFT score. Participants of group 2 consisted of samples having a

higher DMFT score than group 1. Mean S. Mutans count found in samples of group 2 was 11466.67±12544.36 and of group 1 was 2080±4035.57. Mann-Whitney U test was applied and a significant difference was found between both the groups as calculated *p* value was <0.01. [Table: 1, Graph: 1]

		N	MEAN±SD	MEDIAN (IQR)	RANGE (Min-Max)	Mann-Whitney U	P value
Microbial count in mothers	<5 DMFT	30	2080±4035.57	0(0,1000)	0 to 10000	186	**<0.001**
	>5 DMFT	30	11466.67±12544.36	10000(2000,20000)	0 to 50000		

Table 1: Microbial count in mothers

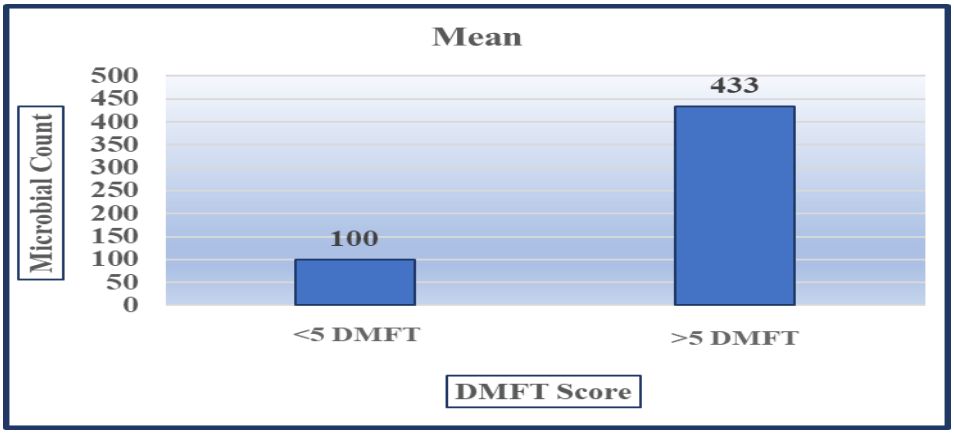


Graph 1: Microbial count in mothers

Salivary swab samples of 60 neonates born through vaginal delivery were taken at the time of birth. Neonates of both groups showed nearly sterile environment of oral cavity at the time of birth. A few samples in both groups showed presence of S. Mutans. Mean microbial count in infants of group 1 was 100±402.58 and of group 2 was 433.33±1304.72, but the difference between both results was not statistically significant as the *p* value was 0.363. [Table: 2, Graph: 2]

		N	MEAN±SD	MEDIAN (IQR)	RANGE (Min-Max)	Mann-Whitney U	P value
Microbial count at birth	<5 DMFT	30	100±402.58	0(0,0)	0 to 2000	418	0.363
	>5 DMFT	30	433.33±1304.72	0(0,0)	0 to 5000		

Table 2: Microbial count at birth



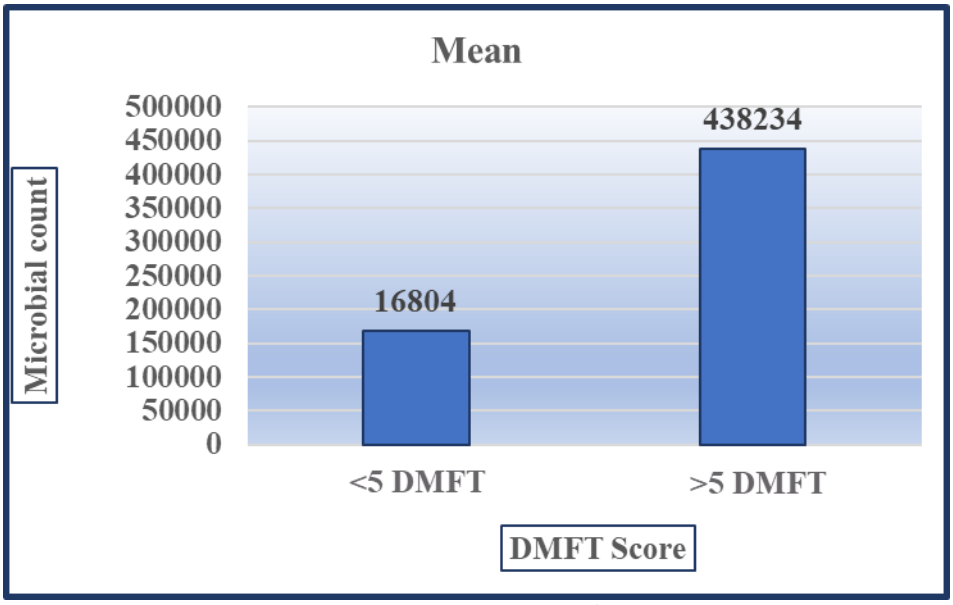
Graph 2: Microbial count at birth

Salivary swab samples of infants were taken 48 hours after birth and the grown colonies were counted. Samples of group 2 showed mean microbial count

438233.33±499662.69 against samples of group 1 with mean microbial count 168033.33±378162.66. The gained results were statistically significant as the *p* value is <0.01. [Table: 3, Graph: 3]

		N	MEAN±SD	MEDIAN (IQR)	RANGE (Min-Max)	Mann-Whitney U	P value
Change in microbial count after 48 hours	<5 DMFT	30	168033.33±378162.66	1000(0,5000)	0 to 1000000	146	**<0.001**
	>5 DMFT	30	438233.33±499662.69	15000(5000,1000000)	3000 to 1000000		

Table 3: Change in microbial count after 48 hours



Graph 3: Change in microbial count after 48 hours

DISCUSSION

Dental caries is widespread infectious and multiple factorial disease. These factors include presence cariogenic bacteria, fermentable sugars in the diet, tooth anatomy, host and time. Caries is considered to be a widespread disease affecting a wide range of people. Global prevalence of dental decay in primary dentition is seen to be 9% according to Frencken JE *et al.*[8] Beltrami characterized this pattern of early caries in young children in the 1930s as les dents noire de tout-petits or literally translated, "black teeth of the very young".[9] In 1962, Dr Elias Fass published the first comprehensive description of caries in infants, which he termed as nursing bottle mouth.[9] According to Davis (1998) Complex disease involving maxillary primary incisors within a month after eruption and spreading rapidly to other primary teeth is called childhood caries.[10] According to AAPD (2006) The disease of early childhood caries is the presence of 1 or more decayed (non-cavitated or cavitated lesions), missing (due to caries), or filled tooth surfaces in any primary tooth in a child 71 months of age or younger. In children younger than 3 years of age, any sign of smooth-surface caries is indicative of severe early childhood caries (S-ECC).[11] Overall prevalence of early childhood caries in India 49.6% according to Ganesh A *et al.*[12] Mutans Streptococci plays key role in pathogenesis of carious lesions in humans.

Caufield *et al.* (1993) suggested that the development of *S. Mutants*. The occurrence of streptococci is most likely in young children from 19 to 31 months of age during the "window infectiousness".[7] Infants acquire oral microflora from their surroundings, possibly from the first individuals they have direct contact.[13] Generally, the first those who interact with infants are mothers, nurses and often a hospital setting. Bacterial colonization

occurs within hours of birth.[13] Makhoul (2000) and Davey (1984) mentioned sophisticated technology using chromosomal DNA patterns or similar plasmids provided more convincing data to support the principle of verticality transmission.[14,15]

Present study aimed to find co-relation between of Salivary *Streptococcus Mutans'* count between mothers and their neonates within 48 hours of birth. In the present study mean DMFT of group 1 was 2.07 and of group 2 was 6.37.

Present study also assessed variables like mothers' contact with the baby, kissing by mothers and contact with any other relative than mother which was found to be 98%, 98% and 99% respectively. These gained results were in agreement with results gained in a study done be Rosenblatt R *et al*. where contact of mother with the baby was noted to be 96%, 86% of mothers kissed their babies and 96% of the babies were noted to have had contact with a relative other than the mother.[16] All the infants participating in the study were also breastfed in current study whereas, 73% of infants were breastfed in the study done by Rosenblatt R *et al*.[16] These results prompt that the neonates had a chance of getting infected through various other modules apart from vertical transmission.

According to a study done by Shah SS *et al* mean microbial count of mothers of group A(DMFT>5) was higher compared to that of group B(DMFT<1). This result was in accordance with the current study where mothers of group 2(DMFT>5) showed significantly higher microbial count compared to mothers of group 1(DMFT<5). [13] These results were statistically significant as the *p* value was <0.01.

As published by Shah SS *et al.* (2022) and Rosenblatt R *et al.* (2015), results showed *S. Mutans* count remained zero at the time of birth irrespective of microbial count of the mother.[13] These results were in accordance with current study as only 2 out of 60 samples showed presence of microorganism in a neonate's oral cavity at the time of birth.

According to the results gained by Shah SS *et al*. the mean streptococcus mutans count of neonates after 48 hours of birth was 156.81 and 50.10 in Group A and Group B respectively. These results were statistically significant.[13] The results gained in current study also showed higher number of microorganism count from samples of infants of group 2(438233) compared to group 1(168033). A positive correlation between mothers' and infants' bacterial colony counts can be appreciated.

Davey (1984) showed *S. Mutans* strains isolated from mothers and their children have a similar or equivalent bacteriocin profiles.[15] It also proves that maternal influence plays a major role when it comes to development of oral microflora in an infant after 48 hours of birth. Silk H *et al.* (2008) stated that the consumption of xylitol in mothers led to a reduction in the incidence of dental caries in newborns are otherwise expected to have a high risk of dental caries.[17] Prenatal dental care for expectant mothers during pregnancy can lead to a reduction in the incidence of childhood caries in their infants.

CONCLUSION

Crucial evidence of transmission of microorganism from mother to neonates in first few days of life has been found through various studies done in the past. Thus, these 48 hours can prove to be extremely important for any acquired oral bacterial infection. It is possible to track and modify the acquired microflora right from the start of human life, producing a new but less cariogenic oral flora. Promotion of better oral hygiene and early intervention in case of caries should be promoted in prenatal care. Use of xylitol/chlorhexidine mouthwash should also be promoted for expectant mothers.

Although a wide range of precautions and sterilization protocols are followed at hospitals during and after childbirth, there should be a development of stricter

protocols for visiting relatives in first 48 hours as well. Based on mothers' caries index and oral hygiene status, parents should be informed about risk of caries in their child. Development of dental home should be promoted for early intervention and prompt treatment in children.

If only one could find ways to stop this initial spread, incidence of caries can be limited in the future. Reinforcing value of oral hygiene of mothers in recent months of pregnancy and shortly after the birth of a child is crucial. Parents should also be instructed about breastfeeding, weaning, dietary restrictions and oral hygiene habits in early stages of infants' life to reduce the risk of caries.

Declaration by Authors

Ethical Approval: Approved

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