Evaluation Of Oral Health Status, Salivary Characteristics And Dental Caries Experience In Down's Syndrome Children

Ashish Raurale, Mopagar Viddyasagar*, Swapnil Dahapute, Saurabh Joshi, Chandrashekhar Badakar, Kataria Mitesh, Vivek Purohit

* Professor, Department Of Pediatric & Preventive Dentistry, Rural Dental College, Pravara Institute Of Medical Sciences, Loni – 413736, Maharashtra

Abstracts: **Background and Objectives :** A positive correlation between Salivary characteristics and caries resistance in adults has been reported in literature. Such a correlation is also observed in Down's syndrome population but lacks sufficient data support. **AIM:** The present study was conducted to Evaluate and correlate the Oral Health Status, S mutans level, Salivary Flow Rate, salivary pH, Buffering capacity, Calcium level, phosphorus level, IgA level of saliva, and Dental caries experience in Normal healthy children and Downs syndrome children. **Methodology:** The study population consisted of 60 subjects aged 8-14 years who were divided into two groups: 60 children (30 normal and 30 Down's syndrome children). Clinical examination was done and the study population was examined for the assessment of dental caries status (WHO 2004) and oral hygiene status (OHI -S Index). Unstimulated total saliva samples were collected. **Results & Conclusion:** In DS subjects, oral hygiene status and dental caries were insignificant whereas other parameters were highly significant prevalence of dental caries was high and oral hygiene status was not properly maintained when compared to the normal subjects. [Raurale A et al NJIRM 2013; 4(6) :59-65]

Key words: Down's syndrome, DMFS, OHI-S

Author for correspondence: Dr Ashish Raurale, Department ofPediatric & Preventive Dentistry, Rural Dental College, Pravara Institute of Medical Sciences, Loni – 413736, Tal: Rahata, Dist: Ahmednagar, Maharashtra. Email:- shrads88@gmail.com

Introduction: Also known as Trisomy 21, Trisomy G and Mongolism the first description of a child who presumably had Down's syndrome was provided by Esquirol in 1838. John L. Down in 1866 accurately described some of the characteristics of this syndrome that today bears his name.[1] It is the most frequent genetic disorder of mild to moderate mental retardation and associated medical problems and occurs in one out of 800 live births, in all races and economic groups.[2] In India, it has been reported that the incidence of Down's syndrome occurs in 1 per 700 births.[3] Prevalence of Down's syndrome is 0.88 to 1.09 percent and three children are reported to born every hour .[4,5,6] Oral findings that may be associated with Down's syndrome include mouth breathing, open bite, appearance of macroglossia, fissured lips and tongue, angular chelitis, delayed tooth eruption, missing and malformed teeth, small roots, crowding and periodontal diseases. [7]

Dental caries development is considered to involve a triad of indispensable factors in the form of bacteria in dental plaque, carbohydrates in the diet and susceptible teeth.[8] Theoretically saliva can affect incidence of dental caries by mechanical cleansing resulting in less accumulation of plaque, by reducing enamel solubility by means of calcium, phosphate and fluoride, by buffering and neutralizing the acids produced by cariogenic organisms or introduced directly through diet and also by anti-bacterial activity.[9]

A critical role in the prevention of dental caries has been documented as saliva controls the equilibrium between demineralization and remineralization in a cariogenic environment.[10] Salivary buffers can reverse the low pH in plaque and allows for oral clearance preventing the demineralization of enamel. It has been suggested that in addition to these properties, the flow rate and viscosity of saliva may influence the development of caries. In addition saliva manifests a variety of antibacterial and other anti-infectious properties, as it was noticed that salivary flow rate less than 0.7 ml/minute could increase the risk for tooth destruction.[11] Cariogenic pathogens like streptococcus mutans can colonize the tooth surface and produce acids at a faster rate than the capacity of neutralization of the biofilm in an oral environment below the critical pH resulting in the destruction of the tooth enamel .[12]

Saliva plays a key role in the post eruptive maturation of enamel. The inorganic phase of

enamel consists of crystalline hydroxyapatite in the form of calcium and phosphorus complexes which dissociates as pH drops and results in free active concentrations of ions. A calcium and phosphorus rich environment also facilitates remineralization of incipient lesion or demineralized zones of enamel. Under normal circumstances saliva is supersaturated with respect to enamel apatite, which not only prevents enamel from dissolving but also tends to precipitate apatite in the surface enamel of carious lesions. Thus calcium and phosphorus in saliva forms an important natural defense mechanism against dissolution of teeth.[14] Since saliva has many properties that may serve to maintain oral health, create an appropriate ecologic balance and play a great role in dental caries process it was of special interest to search incidence in the salivary constituents of Down's syndrome children and a study was conducted.

Material and Methods: Present study was carried out in department of pedodontics and preventive dentistry Rural Dental College Loni, India in association with Sai Chhatra School Sakori. In the present cross-sectional study, 60 children (30 normal and 30 Down's syndrome children) between the age 8-14 years were selected by simple random sampling method. Ethical committee of the Institute and school approved the study. Parental written consent was obtained for each participant.

The grouping was done as follows comprising of 30 children in each group,
Group - I (Control) - Normal healthy children
Group - II (Test) - Downs syndrome children

Inclusion criteria in Group I was children with normal general health & who had no history of any systemic illness or any preventive dental treatment for past six months. The patients included in the group II were known cases of Down's syndrome diagnosed with the help of karyotyping at civil hospital Ahmednagar, Maharashtra India between age group of 8-14 years. Children suffering from any systemic disease, with regular history of drugs intake, children who were with physical limitation and children with any significant oral soft tissue pathology based on visual examination and who didn't cooperate were excluded from the study.

Methodology: Before the collection of saliva samples, caries assessment was done using 'DMFT' index for Permanent Dentition and 'dft' index for Primary dentition according to WHO oral health surveys 2004. A standardized protocol according to WHO criteria 2004 to was used for the collection of saliva from the patients in study group and control group. Saliva was collected in the morning hours considering the circadian rhythms and each patient was instructed not to eat or drink anything for 1 hour before the collection of saliva sample. Each child was given a simple explanation as to the nature and reason for the test. For the collection of unstimulated saliva the patient was seated comfortably with his/ her eyes open on a chair. The child was seated with his/ her head bend forward after an initial swallow and instructed to spit out into a bottle approximately every 20seconds for 5 mins. After collecting 4ml saliva, the bottles were closed, stored at 4^0C and delivered to biochemistry lab in less than 30 minutes

Estimation of Salivary Flow Rate: All collections were performed between the hours of 8:00 a.m. and 10:00 a.m. Un-stimulated saliva (1.0 - 1.5ml) was collected by allowing the patient sit in the coachman position, the patient was asked to passively drool into a funnel inserted into a graduated cylinder for 5 min. The un-stimulated salivary flow (USF) rate was then calculated using the following formula as suggested by Lenander-Lumikari, Loimaranta in 2000. [11]

$$\text{USF} = \frac{\text{Total volume of collected saliva}}{\text{Time period for collection of saliva in minutes}}$$

Of the collected saliva one ml was used for testing electrolytes, two ml for testing pH and viscosity and one ml for culturing of the Streptococcus mutans bacteria.

Streptococcus Mutans Level Determination: Streptococcus mutans level was determined using saliva-check mutans kit (GC America Inc.). This kit provides a semi- quantitative evaluation of the level of mutans streptococci in saliva in 15 mins by using monoclonal antibodies.

Buffering capacity: It was determined by using saliva-check buffer kit (GC America Inc). By using a pipette, saliva was drawn from the tube and one drop was dispensed on each of the three test pads respectively. The test pads begin to change color immediately and after two minutes. The final result was calculated by adding the points according to the final color of each pad.

Salivary pH: Salivary pH was determined by means of pH meter (pHep. HANA instruments. ITALY). When pH meter is dipped in an aqueous solution it generates electromagnetic force which is proportional to the pH of the solution. Following the same guidelines Ph of saliva was determined.

Salivary Calcium Level Determination: This was done by commercially available kit Accurex biomedical Pvt Ltd. India.

Salivary Phosphorus Level: This was done by commercially available kit ERBA Transasia Biomedical Ltd.India. Inorganic phosphorus reacts with ammonium molybdate in the presence of sulfuric acid to form an unreduced phospomolybdate complex which is directly proportional to the amount of inorganic phosphorus present in the sample.

Results: The data obtained from the study was compiled, tabulated and subjected to statistical analysis using, Student unpaired t test and Statistical Packages for Social Sciences (SPSS) version 17 for MS Windows and by using statistical analysis software "SYSTAT" version 12 by Cranes Software, Bangalore. Table 1 shows the mean and standard deviation values obtained and their intergroup comparison.

Table 1. Distribution of mean and Standard Deviation values of all parameters In Group I and Group II

Parameters	Group I (n=30)	Group II (n=30)	'p' value
	Mean ± SD	Mean ± SD	
OHI-S	2.16±0.61	2.32±0.45	p>0.05
DMFT/deft	2.2±0.87	1.5±1.05	p<0.01
Flow Rate of Saliva	1.26±0.050	0.30±0.034	p>0.05
Calcium	4.383±1.236	4.876±0.760	p<0.01
Phosphate	2.700±0.716	3.277±0.458	p<0.01
PH	6.443±0.597	7.095±0.316	p<0.01
S Mutans	0±0	0±0	--
Buffering Capacity	9.653±1.627	10.89±0.910	p<0.01

Mean and standard deviation value of oral hygiene index calculated was 2.16±0.61in control group and 2.32±0.45 in Down's syndrome children respectively. Intergroup comparison showed that the differences in the results were statistically insignificant. Mean and standard deviation value of DMFT for control group was 2.2±0.87 and Down's syndrome children were 1.5±1.05 respectively. Intergroup comparison showed that the differences in the results were statistically significant. Mean and standard deviation value of flow rate calculated was 1.26±0.050 in control group and 0.30±0.034 in Down's syndrome children respectively. Intergroup comparison showed that the differences in the results were statistically not significant. Mean and standard deviation value of salivary calcium level calculated was 4.383±1.236 in control group and 4.876±0.760 in Down's syndrome children. Intergroup comparison showed that the differences in the results were statistically significant. Mean and standard deviation value of salivary phosphorus level calculated was 2.700±0.716 in control group children and 3.277±0.458 in Down's syndrome children respectively. Intergroup comparison showed that the differences in the results were statistically significant. Mean and standard deviation value of salivary pH level calculated was 6.443±0.597in control group children and 7.095±0.316 in Down's syndrome children respectively. Intergroup comparison showed that the differences in the results were statistically significant. Mean and standard deviation value of salivary buffering capacity level calculated was 9.653±1.627 in control group children and

10.89±0.910 in Down's syndrome children respectively. Inter group comparison showed that the differences in the results were statistically significant.

Discussion: Inadequate oral hygiene has been a universal finding in the institutional based studies. There is no evidence that institutional or community based persons with Down's syndrome experience a different level of oral hygiene than other persons with mental retardation and there has been no reported difference in the presence of calculus in these persons. However, a severe, early onset, often dramatic fulminating periodontal disease is a universal finding with an incidence of 90-96% in these individuals.15,16 More recent studies continue to support the lower decay rate in persons with Down's syndrome, but the difference is shown to be far less than previously reported.16

Recent studies have revealed a large number of salivary functions, mediated by both the inorganic and organic components of saliva that should be considered in assessments of the effects of human saliva on dental caries. Some of these studies have introduced a new approach to dental caries from being a bacterially induced multifactorial disease to a disease, which may also be influenced by inherited salivary factors. Such genetically regulated salivary components may influence both the colonization and the clearance of microorganisms from the oral cavity.[17] The role of saliva in preventing caries is mainly due to

- Mechanical cleansing, diluting and eliminating sugars and other substances,
- Reducing enamel solubility by means of supplementing calcium and phosphate ions,
- Buffering and neutralizing the acids produced by cariogenic organisms and
- Anti-microbial action.

Saliva as a diagnostic tool is easy to obtain and corelate between many parameters.[17,18] The caries process requires the establishment of the necessary physiochemical conditions for the tooth mineral dissolution which may be the result of the production of organic acids and subsequent lowering of the pH at the tooth surface.

In the present study Oral hygiene status was determined by OHI-S index as defined by Greene and Vermillion in 1964. No significant difference in the maintenance of oral hygiene between both the groups was observed. There was a significantly positive correlation of OHI-S scores in Down's syndrome children with OHI-S scores in the control group. The studies on dental caries prevalence in Down's syndrome have been less informative.[18] Present study revealed significantly less prevalence in Down's syndrome children when compared to controls. However, the precise cause of the lower prevalence of dental caries in Down's syndrome children is still unclear.[19,20] A number of studies have revealed significantly less caries prevalence in Down's syndrome children when compared to normal children.[21,22] Most studies have suggested that the reduction of dental caries in Down's syndrome children may be explained by congenital oligodontia, delayed eruption, a different salivary composition (salivary IgA, salivary pH, buffering capacity and flow rate) or a difference in eruption times as the teeth of children with Down syndrome often erupt one to two years later than that of normal children.[23]

The decision to collect unstimulated saliva in this study was because, unstimulated whole saliva often yields valuable information and usually correlates to clinical conditions more accurately than stimulated saliva.[24] In the present study unstimulated morning whole saliva samples were collected between 9am to 11am because, this period has been reported to have less diurnal variations in the flow rate and composition of saliva. Like many other authors,[25] in the present study unstimulated salivary flow of the Down's syndrome children was lower than control group children.

The factors that regulate the hydroxyapatite balance are free calcium and phosphate ions. Calcium is found in greater quantities in unstimulated saliva.[26] Calcium and phosphorus should be supersaturated in saliva to have effect on demineralization and remineralization.[27] In the present study salivary calcium was determined by photometric method like other investigators and

phosphorus by phospomolybdate/UV method.[26, 27] It was found that the salivary calcium level were significantly higher in control group compared to Down's syndrome group. However the salivary phosphorus level was statistically higher in Down's syndrome children group than control group. These results coincide with the study done by Winer and Feller in mongoloid patients[28] but in contradiction to results obtained by study done by Siqueira et al.[10]

In the present study, the pH values were in normal range but higher in Down's syndrome subjects. The differences were statistically significant. These results coincided with the study done by Yarata A [29]in Down's syndrome children. Salivary pH of children who were immune to caries was higher than in those who were susceptible. This showed an inverse correlation between DMF and pH value. The statistically significant inverse correlation between pH value and DMF coincide with the work of Mandel 1974 and Zhou 2007[30,31] as both reported a higher pH in saliva of persons immune from caries than in those who were susceptible.

Specific types of acid producing bacteria, especially Streptococcus mutans colonize the dental surface and cause damage to the tooth structure in the presence of fermentable carbohydrates.[32,33] In the present study SALIVA CHECK MUTANS (G C Corporation) chair side test kit was used to determine Streptococcus mutans and found that all samples were tested negative in control as well as downs children. As the salivary mutans counts was not significant this could explain the reason for less dental caries prevalence in both the groups.

The ability of saliva to buffer acids is essential for maintaining pH values in the oral cavity.[26] The salivary buffering system facilitates neutralization of acids produced by bacteria in the oral cavity. The buffering capacity of both stimulated and unstimulated saliva involves three major buffering systems, namely the bicarbonates, phosphates and proteins.[34] In our study we determined the buffering capacity by saliva –check buffer kit. Buffering capacity of Down's syndrome group was significantly higher than control group. Probably this could have been the reason for the low prevalence of caries in Down's syndrome children in our study. The results of present study coincided with the results shown by Siqueira WL et al[35] where buffering capacity was found to be high in Down's syndrome children compared to control group.

Conclusion: From the results of the present study, the following conclusions can be drawn:

- The prevalence of dental caries in Down's syndrome subjects tends to be less when compared to the normal healthy subjects.
- The low caries index observed in Down's syndrome children compared to normal healthy children is associated to the higher pH, lower St. mutans count and higher concentration of salivary electrolytes.
- Higher pH level, increased inorganic ions and high buffering capacity could be attributed for low DMFT in Down's syndrome children.

The results of these studies and its implications can be correlated to other on going extensive research in special children.

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