Variation in Salivary Parameters with Respect to Caries Status among Study Subjects

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Introduction

Saliva is a complex biological fluid containing several compounds which collaborate to prevent dental caries by mechanical washing, antimicrobial function, remineralisation and regulating oral pH by its buffering capacity. Protection against dental caries is dependent on both salivary quantity and composition of the secretions. With the former being the strongest, the quantity of saliva is the stronger risk indicator for dental caries.

Abstract

Statement of Problem: Saliva is a complex biological fluid containing several compounds which collaborate to prevent dental caries by mechanical washing, antimicrobial function, remineralisation and regulating oral pH by its buffering capacity. Protection against dental caries is dependent on both salivary quantity and composition of the secretions. With the former being the strongest, the quantity of saliva is the stronger risk indicator for dental caries.

Purpose: To access the variation in salivary parameters with respect to caries status among study subjects.

Material and Methods: A sample of 200 school children aged 12-15 years were recruited in the study from the private and government schools of Moradabad city. A specially prepared questionnaire was designed for collecting all the required and relevant information regarding socio-demographic status, caries status and salivary parameters. Assessment of all salivary parameters was conducted at the school premises, 1 hour after the study samples consumed afternoon lunch.

Result: Salivary flow, pH, and buffering action in carious and non-carious subjects was found to be statistically significant, with non-carious group having higher salivary flow, pH and buffering action. Statistical significant difference was found between unstimulated and stimulated salivary flow and salivary pH, whereas buffering action was found to be non-significant.

Conclusion: Quantitative saliva assessment is useful as a screening method to identify patients with a low salivary flow rate, pH and buffering capacity. Such patients are at a higher risk for dental caries and other mucosal disorders, and if properly screened, preventive measures can be taken.

Keywords: Saliva; Caries status; Salivary parameters
Materials and Method

A cross sectional analytical study was conducted among school children aged 12-15 years of Moradabad city to know the variation in salivary parameters with respect to caries status. Ethical clearance was obtained from institutional ethics and review board Kothiwal Dental College & Research Centre Moradabad. Approval from school authorities and informed consent from the parents were obtained. A sample of 200 school children who fulfilled the inclusion and exclusion criteria were recruited in the study from the private and government schools of Moradabad city. The sample was divided equally into 2 Groups i.e. carious and non-carious groups. Children taking medication linked to alteration of saliva or having any systemic disease, wearing orthodontic appliances, having psychological disorders, motor disorders were excluded. A specially prepared questionnaire was designed for collecting all the required and relevant information. The questionnaire included questions regarding socio-demographic status i.e. name, age, father’s name, mobile no, caries status, and salivary parameters. Responses of study subjects to the questionnaire will be assessed by the examiner. Salivary parameters such as, salivary flow, salivary pH and buffering action were assessed with the help of GC saliva check kit. Manufacturer instructions were strictly followed. Before the ingredient been chewed, baseline salivary parameters of unstimulated saliva were measured, then the study samples were given paraffin wax to be chewed for 5 minutes and later on stimulated salivary parameters were assessed at the time interval of 5–10 minutes.

Method of Assessing Unstimulated Saliva

The child will sit in an upright position with his head inclined forward so that the production of saliva is collected in the floor of mouth and then flows out over the lip. Saliva formed is let to drip into the graduated test tube or measuring cup for 5 minutes. The results of this collection are expressed as millilitre per minute.

Method of Assessing Stimulated Saliva

The child will chew the paraffin wax for five minutes, before the collection the first portion of saliva is swallowed. Start the timer and chewing is continued for 5 minutes. The saliva is spit out in a measuring cup for 5 minutes. The collected saliva is then measured; measurement should not include the foam which is formed during collection. The results are expressed as millilitre per minute. Assessment of all salivary parameters was conducted at the school premises, 1 hour after the study samples consumed afternoon lunch. The statistical analysis was done using SPSS (Statistical Package for Social Sciences) Version 16.0 Statistical Analysis Software. Statistical significant value was set at p-value <0.05.

Results

On comparing salivary flow, pH, and buffering action among carious and non-carious groups in both stimulated and unstimulated saliva, it was found to be statistically significant, with non-carious group having higher salivary flow, pH and buffering action (Table 1 & 2). On comparing the salivary flow rate and salivary pH of unstimulated and stimulated saliva, the results were found to be highly significant with the p-value (0.0001), whereas buffering action was found to be non-significant i.e. p-value (1.000). (Table 3).

Table 1: Salivary parameters in unstimulated saliva among carious and non-carious groups

| Caries Status | N  | Mean | Std. Deviation | T-Value | P-Value |
|---------------|----|------|----------------|---------|---------|
| Baseline Flow | C  | 98   | 2.6            | 0.63    | 10.1    | <0.001 |
|               | NC | 102  | 3.4            | 0.49    |         |        |
| Baseline pH   | C  | 98   | 6.23           | 0.2     | 18.13   | <0.001 |
|               | NC | 102  | 6.76           | 0.21    |         |        |
| Baseline Buffering Action | C | 98 | 5.84 | 0.89 | 29.31 | <0.001 |
|               | NC | 102  | 10.83          | 1.44    |         |        |

Table 2: Salivary Parameters in Stimulated Saliva among Carious and Non-Carious Groups

| Caries Status | N  | Mean | Std. Deviation | T-Value | P-Value |
|---------------|----|------|----------------|---------|---------|
| Baseline Flow | C  | 98   | 4.93           | 0.67    | 6.79    | <0.001 |
|               | NC | 102  | 5.57           | 0.67    |         |        |
| Baseline pH   | C  | 98   | 6.5            | 0.19    | 16.24   | <0.001 |
|               | NC | 102  | 6.97           | 0.22    |         |        |
| Baseline Buffering Action | C | 98 | 6.34 | 0.89 | 29.31 | <0.001 |
|               | NC | 102  | 11.23          | 1.44    |         |        |

Table 3: Comparison of unstimulated and stimulated salivary parameters with caries status.

| Salivary Parameters | Caries Status | Un stimulated Saliva | Stimulated Saliva | T-Value | P-Value |
|---------------------|---------------|----------------------|-------------------|---------|---------|
| Flow                | C             | 2.6                  | 4.93              | 25.08   | 0.0001* |
|                     | NC            | 3.4                  | 5.57              | 26.402  | 0.0001* |
| pH                  | C             | 6.23                 | 6.5               | 9.689   | 0.0001* |
|                     | NC            | 6.76                 | 6.97              | 6.973   | 0.0001* |
| Buffering Action    | C             | 5.84                 | 6.34              | 0       | 1       |
|                     | NC            | 10.83                | 11.23             | 0       | 1       |

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Discussion

Saliva is a most valuable oral fluid that often is taken for granted. It is critical to the preservation and maintenance of oral health, yet it receives little attention until quantity or quality is diminished. Etiology and pathogenesis of dental caries is multi factorial. Role of plaque properties in relation to caries formation has been recognized for a long time [11]. One of the property of dental plaque is its ability to concentrate inorganic constituents, such as calcium and inorganic phosphates [12]. The fermentation of dietary carbohydrates by oral microorganisms, particularly Mutans Streptococci (MS) in the dental plaque plays a key role in the development of dental caries [13]. The contribution of saliva to the demineralization remineralisation process points to the importance of monitoring salivary flow [14]. The current study was done to know the variation in salivary parameters with respect to caries status among study subjects. On comparing salivary flow, pH, and buffering action among carious and non-carious groups in both stimulated and unstimulated saliva, it was found to be statistically significant, with non-carious group having higher salivary flow, pH and buffering action. Saliva consists of various organic and inorganic compounds like bicarbonate, calcium, phosphate ions etc, to maintain its saturation. The consequence of this saturation establishes thermodynamic driving force, which is favourable for remineralisation and unfavourable for demineralization. Dental plaque is a structure of vital significance as a contributing factor, at least to the initiation of caries lesion [15]. Increased Calcium and Phosphorous, that would pass into a solution with a fall in pH i.e. critical pH would be lowest of all in non-carious group will maintain the aqueous phase in saturated condition [16]. If the fluid adjacent to the tooth is supersaturated with calcium and phosphorous ions at a given pH the enamel certainly cannot undergo demineralization at its surface [17] and this is one of the reason of higher salivary flow rate, pH and buffering action among non-carious group in both stimulated and unstimulated saliva. Shaw et al. [18] also showed that the level of calcium and phosphorous are significantly high in plaque of the children with no caries experience than those who are caries susceptible. Low salivary buffering capacity, low calcium and phosphate levels show a pronounced link to increased caries. Lower salivary flow rate found in carious group might be associated with a number of predisposing factors such as lack of raw material (water), lack of stimulus to salivary gland or could be a problem with salivary gland itself. As a result of low salivary flow rate, salivary pH and salivary buffering action will also get reduced [19]. Reduced salivary flow rate and the concomitant reduction of oral defense systems may cause severe caries and mucosal inflations [10]. On comparing the salivary flow rate and salivary pH of unstimulated and stimulated saliva, the results were found to be highly significant with the p-value (0.0001). Saliva bathes the oral cavity 90 percent of the time, and its pH usually is higher in stimulated saliva [20]. The higher the flow rate, the faster the clearance [10] and the higher the pH and buffer capacity [21]. The protective effect of saliva are increased greatly by stimulation strategies. For salivary stimulation it should be considered as part of an overall preventive regime for an at-risk patient. These may include eating patterns which leads to saliva stimulation, as well as the use of stimulants e.g. Toffees, lozenges, lollipops, chewing gums etc. however toffees, lozenges etc. increases the salivary flow but has more deleterious effects due to sugar content and sticky nature [22]. Bots has hypothesized that the initial increase in flow rate is probably induced by the gustatory stimulus by chewing the products, however, during the continued chewing the loss of flavour and less quantity of the product can lead to a reduced stimulation of periodontal mechanoreceptors, which may contribute to the decrease in salivary flow rate, which ultimately will decrease the pH and buffering action of saliva [23].

Conclusion

Caries is a multi factorial disease and other risk factors including saliva exists are, socio-economic status and lack of access to dental care were shown to be risk factors for caries. The infectious nature of dental caries has already been known for decades. Ever since the recognition of Streptococcus mutans as the main microbial factor in the etiology of caries disease, a vast amount of work and effort has been devoted to the characterization of this bacterium. Saliva is one of the most important factors in prevention of dental caries. Therefore, physical and chemical changes in saliva composition and particularly changes in its buffering capability play an important role on development and progression of caries. Quantitative saliva assessment is useful as a screening method to identify patients with a low salivary flow rate, pH and buffering capacity. Such patients are at a higher risk for dental caries and other mucosal disorders, and if properly screened, preventive measures can be taken.

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