Estimation of Salivary urea levels and its relation with dental caries in children with chronic renal failure

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Abstract
Aims: To estimate salivary urea levels and relate it with dental caries in children with chronic renal failure and to compare the salivary urea levels along with dental caries of chronic renal failure patients with healthy controls. Methods: Study population consisted of 30 children undergoing dialysis/renal transplantation and 30 healthy children in the age range of 7-12 years. Caries status in the primary and permanent dentition was determined by decayed, missing and filled teeth index. Unstimulated saliva from both groups was collected and submitted to the laboratory immediately for urea examination. Results: The mean salivary urea concentration of the study group was found to be significantly greater than the control group. In study group, mean caries experience in primary dentition was 0.60±0.62 and in control group, it was 1.67±2.28, the difference being statistically significant (p<0.05). Similarly, the mean caries experience in the permanent dentition of the study group (0.43±0.68) was significantly (p<0.05) lower than the control group (1.17±1.29). In the study group, there was a significant (p<0.05) negative correlation found between salivary urea levels and dental caries experience in the permanent dentition. Conclusions: Caries experience in both the deciduous and permanent dentition of the chronic renal failure patients was significantly lower than the healthy controls. There was a significant decrease in dental caries experience in the permanent dentition with increase in salivary urea levels among the chronic renal failure subjects. Key words: Chronic renal failure; Salivary urea; Dental caries

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Introduction

Chronic renal failure is an insidious and irreversible condition that eventually progresses to end stage renal failure. It is an important cause of morbidity and mortality in children worldwide (1). It is a syndrome caused by a pathophysiologic process with multiple etiologies, resulting in progressive destruction of nephrons and associated with loss of the ability of the kidneys to excrete wastes, concentrate urine and conserve electrolytes. In normal conditions, urea is formed in the liver as the end product of protein metabolism. This urea makes its way into the blood and it is ultimately eliminated in the urine by the kidneys. With kidney failure, blood urea levels go chronically high and accumulate. Chronic kidney disease may also be identified when it leads to one of its recognized complications, such as cardiovascular disease, anemia or pericarditis (2).

The global incidence of end stage renal disease (ESRD) is growing at about eight percent annually (3). Advances in pediatric nephrology during the last two decades have resulted in a marked increase in the number of children surviving with chronic renal failure (4). Patients with chronic renal failure who are in end stage can be treated with renal replacement therapy by dialysis or transplantation.

There are a number of reports on the oral changes in patients with chronic renal failure. Among these are enamel hypoplasia, enamel opacities, uremic stomatitis, reduced salivary flow, xerostomia, and an increased tendency for calculus deposition (5). Almost, all the studies on CRF patients have concluded that the subjects with CRF have poor oral hygiene, gingivitis and destructive periodontal disease. Moreover, renal failure is also associated with a reduced prevalence of dental caries. Urea is a buffer present in total salivary fluid that causes a rapid increase in biofilm pH (6). The low caries rate in patients with CRF could be related to elevated urea levels in the saliva.

The following study was conducted to estimate salivary urea levels and relate it with dental caries in children with chronic renal failure and to compare the salivary urea levels along with dental caries of chronic renal failure patients with healthy controls

Material and methods

The subjects in the present study constituted of 30 children with chronic renal failure and similar number of age as well as gender matched healthy controls. All the subjects were between the ages of 7 to 12 years. The study group consisted of 30 children with chronic renal failure who will be undergoing dialysis/renal transplantation treatment in Pediatric Unit of Smt. Gulabben Rasiklal Doshi and Smt. Kamlaben Mafatlal Mehta Institute of Kidney Disease and Research Centre, Ahmedabad and Muljiibhai Patel Urological Hospital, Nadiad, India.

The control group consisted of 30 healthy primary school children who were matched for age and gender with the study group. In addition, the socio-economic status and oral hygiene habits of the control group resembled that of the study group. Ethical committee approval was obtained from the concerned authorities of the above hospitals. Written informed consent was obtained from the parents of the children. The study was carried out by a single examiner to rule out interexaminer bias. Proforma was prepared to gather adequate information of each child of study and control group. Part A consisted of general information i.e., name, age, gender and residential address. Part B of the proforma was meant to record DMFT/dmft index for evaluation of dental caries and estimation of salivary urea (in mg/dl).

Oral examination was carried out using a mouth mirror and a probe according to the criteria of the World Health Organization, 1997 (7) in study as well as control group. Caries status was determined by recording the number of decayed (d, D),
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missing (m, M), and filled (f, F) teeth in the primary and permanent dentitions per patient and were referred to as dmft and DMFT scores, respectively.

Saliva was collected from study as well as the control group. In study group, saliva was collected prior to hemodialysis and renal transplantation. Patients without any antibiotic therapy in the last week before the sample collection were included in the study. Unstimulated saliva was collected in sterile vials between 10-11 am in order to prevent any bias in the concentration of the saliva due to the circadian rhythm. Children were asked to pool the saliva in the floor of their oral cavity and spit into a sterile vial intermittently (8). Salivary samples were sent immediately to Pathology Laboratory (Supratech Micropath, Laboratory & Research Institute, Ahmedabad) for Urea estimation. Urea estimation was done by automated analyzer (9) (Coba’s Integra 400, Roche).

Chi square test was used to estimate the statistical difference for prevalence of dental caries between the study and control groups. Comparisons between control and test groups for salivary urea levels and caries experience were made using unpaired t test. Pearson correlation test was used to assess the relationship between the salivary urea levels and dental caries experience.

Results

In the study and control groups, there were 16 males and 14 females. Table 1 reveals that there were 16 (53.4%) children with dental caries in study group compared to 25 (83.4%) in control group. A significantly greater proportion of chronic renal failure children were found to be caries free (n=14, 46.6%) than control group (n=5, 16.6%).

It is evident from table 2 that, the mean salivary urea concentration of the study group (92.3±15.27 mg/dl) was approximately thrice that of the control group (27.73±7.75 mg/dl) and this difference between the study and control groups was found to be significant (p<0.05).

Table 1: Prevalence of dental caries in control as well as in study group

<table>
<thead>
<tr>
<th>Groups</th>
<th>No. of children with dental caries n (%)</th>
<th>No. of caries free children n (%)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>25 (83.4%)</td>
<td>5 (16.6%)</td>
<td>30 (100%)</td>
</tr>
<tr>
<td>Study</td>
<td>16 (53.4%)</td>
<td>14 (46.6%)</td>
<td>30 (100%)</td>
</tr>
</tbody>
</table>

*Chi square test, p=0.001*

Table 2: Comparison of salivary urea (in mg/dl), dmft and DMFT in control and study groups

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urea</td>
<td>Control</td>
<td>27.73</td>
<td>7.75</td>
</tr>
<tr>
<td>Study</td>
<td>92.30</td>
<td>15.27</td>
<td></td>
</tr>
<tr>
<td>Dmft</td>
<td>Control</td>
<td>1.67</td>
<td>2.28</td>
</tr>
<tr>
<td>Study</td>
<td>0.60</td>
<td>0.62</td>
<td></td>
</tr>
<tr>
<td>DMFT</td>
<td>Control</td>
<td>1.17</td>
<td>1.29</td>
</tr>
<tr>
<td>Study</td>
<td>0.43</td>
<td>0.68</td>
<td></td>
</tr>
</tbody>
</table>

*Unpaired ‘t’ test*

In study group, mean caries experience in primary dentition was 0.60±0.62 and in control group, it was 1.67±2.28, the difference being statistically significant (p<0.05). Similarly, the mean caries experience in the permanent dentition of the study group (0.43±0.68) was significantly (p<0.05) lower than the control group (1.17±1.29).

Table 3 shows the correlation between salivary urea and DMFT in study and control groups. There was a negative correlation found between salivary urea levels and DMFT in control and study groups. This means that there was a decrease in DMFT with increase in salivary urea levels. The decrease in DMFT with increase in salivary urea levels in study group was found to be statistically significant (p<0.05).
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Table 3: Correlation between salivary urea and DMFT in control and study groups

| Groups | Pearson’s Coefficient | DMFT  
|--------|------------------------|--------
| Control | Correlation Coefficient | -0.396 |
|         | p value                | 0.03   |
| Study   | Correlation Coefficient | -0.292 |
|         | p value                | 0.12   |

Table 4: Correlation between salivary urea and dmft in control and study groups

| Groups | Pearson’s Coefficient | DMFT  
|--------|------------------------|--------
| Control | Correlation Coefficient | -0.215 |
|         | p value                | 0.3    |
| Study   | Correlation Coefficient | -0.280 |
|         | p value                | 0.11   |

Table 4 shows the correlation between salivary urea and caries experience in primary dentition of study and control groups. Though insignificant, there was a negative correlation found between salivary urea levels and dmft in both control and study groups which means that there was a decrease in dmft with increase in salivary urea levels.

Discussion

There is a little information on the oral health of children with chronic renal failure from the present study area. There has been studies documenting the low prevalence of dental caries in these patients and it has been supposed to be due to higher salivary urea levels. In this study, we have tried to find a relation between salivary urea levels and dental caries in children with chronic renal failure before undergoing dialysis/renal transplantation.

In the present study, salivary urea levels and its relation with dental caries were analyzed. Urea is a buffer present in total salivary fluid which is a product of aminoacid and protein catabolism that causes a rapid increase in biofilm pH by releasing ammonia and carbon dioxide when hydrolyzed by bacterial ureases. It has also been postulated that salivary urea elevates the pH of saliva, possibly negating the effect of any acid formation by cariogenic bacteria. Urea also inhibits caries because of its antibacterial properties and its inhibitory effect on plaque formation. A study similar to the present investigation was carried out by Al Nowaiser et al. They found that there was a significantly lower mean dmft (0.3±0) and DMFT (1.5±2.6) in patients undergoing hemodialysis and kidney transplant. They concluded that saliva can be used as a non-invasive diagnostic tool.

In the present study, caries experience in deciduous and permanent dentition of children with CRF was significantly lower than that of controls. This significant decrease in DMT and dmft could be attributed to increase in the salivary urea levels in the study group. Urea is a buffer present in total salivary fluid which is a product of aminoacid and protein catabolism that causes a rapid increase in biofilm pH by releasing ammonia and carbon dioxide when hydrolyzed by bacterial ureases. It has also been postulated that salivary urea elevates the pH of saliva, possibly negating the effect of any acid formation by cariogenic bacteria. Urea also inhibits caries because of its antibacterial properties and its inhibitory effect on plaque formation. A study similar to the present investigation was carried out by Al Nowaiser et al. They found that there was a significantly lower mean dmft (0.3±0) and DMFT (1.5±2.6) in
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children undergoing renal transplantation. In a study conducted by Ertugrul et al., (4) on 38 children of age group 4-17 years suffering from end stage renal failure (ESRD) in pediatric nephrology units at three different hospitals in Izmir (Turkey), it was observed that dmft was lower for the study group than the controls.

A significant greater proportion of chronic renal failure children were found to be caries-free (n=14, 46.6%) than control group (n=5, 16.6%) in the present study. A study was conducted by Nakhjavani et al (13) on 53 children with chronic renal failure aged 5-18 years in Tehran Hospitals for children. They found that significantly greater proportion of the chronic renal failure children were caries-free (33%). A similar study (12) on 24 children undergoing renal transplantation aged 4-13.2 years in Great Ormond Street Hospital for children concluded that a significant greater proportion of children undergoing transplantation were caries free i.e. 61% compared to 8.3% of controls.

It was observed that there was a significant decrease in dental caries experience in the permanent dentition as the salivary urea level decreased in the study group which explains that the increased salivary urea in CRF patients causes decreased caries experience (6).

Conclusions
Caries experience in both the deciduous and permanent dentition of the chronic renal failure patients was significantly lower than the healthy controls. The salivary urea levels in chronic renal failure patients were significantly higher than the healthy controls. There was a significant decrease in dental caries experience in the permanent dentition of chronic renal failure patients with increase in salivary urea levels.

These findings show that there is a relatively less restorative and dental treatment need in children with chronic renal failure due to the presence of less dental caries. Although dental treatment need is not high, these children should receive dental health education, including oral hygiene instruction, in order to improve their overall oral health.

References
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