Selected salivary constituents among 16-18 years patients with β thalassemia major in relation to oral diseases

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ABSTRACT

Background: Thalassemias constitute a form of anemia that has clear problems in relation to oral health. The purpose of this study was to investigate the occurrence and severity of dental caries among patients with beta-thalassemia major in relation to salivary physicochemical characteristic and to compare results with healthy subjects.

Materials and Method: 41 β-thalassemia major patients (31 male, 10 female) and 41 healthy control subjects matching in age and gender the β-thalassemia patients were examined using the decayed, missing, and filled surfaces (DMFS index). Oral health status was recorded by application of plaque index (PI), gingival index (GI) and calculus index (Cal I). Stimulated salivary samples were collected for the determination of salivary flow rate and pH of saliva in addition to the determination of concentration of calcium, phosphorus, and magnesium.

Results: Results showed that β-thalassemia group had higher (DMFS), plaque, gingival, calculus, and phosphorus values as compared to control group, while β-thalassemia group had lower salivary flow rate, pH, calcium and magnesium values compared to control group with statistically highly significant differences. A negative significant correlation was found between DMFS with salivary pH and flow rate (p<0.05). A negative highly significant correlation was found between salivary constituents (calcium, phosphorus, magnesium) and DMFS (p<0.01).

Conclusion: Patients with β- thalassemia major showed highly significant differences in dental and periodontal diseases as compared to control group and therefore a special preventive program needed for this target group.

Key words: β-thalassemia, salivary constituents, dental diseases. (J Bagh Coll Dentistry 2011;23(124-127).

INTRODUCTION

The thalassemias are a diverse group of genetic blood diseases characterized by absent or decreased production of globulin protein chains, resulting in microcytic anemia of varying degrees. Based on their clinical and genetic orders, thalassemias are classified mainly into major (β-thalassemia) which exhibits the most severe clinical symptoms and minor (α-thalassemia) which is mild and considered to be clinically asymptomatic. An intermediate form of thalassemia may also occur. Such conditions are increasingly causing an obvious problem in the Mediterranean-bounding countries. (1,2)

Saliva is the fluid produced by the salivary glands and it’s armed with various defense mechanisms such as the immunological and enzymatic defense systems and saliva has the ability to protect the mucosa against mechanical insults and to promote its healing via the activity of epidermal growth factor. (3,4) It can influence the carious process in several ways. The flow of saliva can reduce plaque accumulation on the tooth surfaces and also increase the rate of carbohydrate clearance from the mouth. 2

Saliva has another function of major importance from caries – remineralizing effects. Saliva is ‘supersaturated’ using the ions which make up the mineral content of the teeth (calcium, phosphate and hydroxy ions) when the pH is above a ‘critical’ value, about 5.5. Below this value (e.g. after an intake of sugar) saliva and plaque are unsaturated, and the tooth dissolves. Above this value, the calcium and phosphate ions from saliva start to repair the damaged mineral crystals from the enamel – the process of remineralization. (5) A small number of clinical studies have analyzed the status of the oral cavities in thalassemic patients, considering both dental and periodontal conditions. (6,7,8) Delayed eruption of both deciduous and permanent teeth and high frequency of caries were observed; moreover, dental caries disease was related to the severity of systemic disease. A significant inverse correlation was observed between transfusion requirements and caries in mixed dentition. (9) The theoretical risk of oral and dental diseases in thalassemia major (TM) patients remains high.

For all of above it was decided to conduct this study to gain knowledge regarding oral health problems of this target group which may allow setting a preventive program for these medically comprised subjects.

MATERIALS AND METHODS

In this study 41 TM patients (31 males, 10 females) aged from 16–18 years and 41 healthy controls subjects matching in age and gender the
TM group were examined for dental caries using the decayed, missing, and filled surfaces (DMFS) index following the criteria described by WHO (10), for plaque accumulation using plaque index by Sillness and Löe (11), for gingival inflammation using the gingival index system by Löe and Sillness (12) and dental calculus using calculus index component of the simplified oral hygiene index of Greene and Vermillion (13).

The collection of stimulated salivary samples was performed under standard condition following instruction cited by Tenovuo and Lagerlof (3) and saliva was collected in a sterile screw capped bottle salivary pH was measured using an electronic pH meter after adjustment of it and flow rate of saliva was expressed as milliliter per minute (ml / min). Samples were centrifuged at 4000 rpm for 30 minutes; the clear supernatant for phosphorus and magnesium were determined in the salivary supernatant samples and this done through different biochemical tests and according to manufacturer’s instructions. The concentration level of each constituent was expressed as (mmol/L) unit.

Data processing and analysis were carried out using SPSS package version 10. Student’s t-test was applied for testing the significant differences between study and control groups and correlation coefficients were applied at the 0.05 level of significance.

RESULTS
Table 1 illustrates the mean, standard deviation and statistical difference between TM and control groups of (DMFS, plaque, gingival and calculus indices). The TM group had a higher DMFS compared to control group with statistically highly significant difference (P<0.01). Plaque (Pl), gingival (Gl) and calculus (Cal) values were higher in TM group as compared to control group with statistically highly significant difference (P<0.01). In regard to salivary physicochemical characteristic, salivary flow rate and pH were found to be lower in TM group with statistically highly significant difference (P<0.01). Results showed that salivary calcium(Ca) and magnesium(Mg) were higher in control group as compared to TM group with statistically highly significant difference (P<0.01),while salivary phosphorus was found to be highly significant lower in control group as compared to TM group as seen in Table 2.

In this study an inverse correlation had been observed between DMFS with both flow rate and pH and this correlations were statistically significant (P<0.05), also highly significant inverse correlation had been observed between DMFS and all salivary constituents and this correlations were statistically (P<0.01) in TM group as shown in Table 3.

DISCUSSION
The present study showed that DMFS was significantly higher in thalassemic patients than in age matched healthy controls and the results are in disagreement with some studies (9,14,15).

Certain oral structural changes that take place in thalassemic patients due to maxillary enlargement result in protrusion of anterior teeth, over-bite or open-bite and varying degrees of malocclusion, which further predispose to caries according to Al-Wahadni et al (16).

Colonization with Streptococcus mutans in thalassemics has been found to be higher which may also have a role in the higher caries incidence seen in them (17).

Highly significant plaque, gingival, calculus indices were recorded among TM group than that control and these results were in agreement with other studies (8,16,18). This increase in plaque and calculus indices among the TM group may be related to the oral neglected condition present in the TM group who place a low priority on dental care and cleansing of their teeth.

The incidence of gingivitis in patients with thalassemia major seems likely related to local factors such as poor oral hygiene, malocclusion and drying of the gingivae through the patient’s inability to close his mouth over the protruding teeth, the chronic anoxemia may in some cases predispose to gingival disorders (2). Higher prevalence of gingivitis would be correlating the maxillofacial characteristics of thalassemic disease. It is well known that orthodontic problems such as crowding, extreme maxillary overjet, crossbite, and oral breathing are mainly implicated in gingival disease (7).

Flow rate and the pH of saliva were found to be significantly lower among TM group compared to control group, this result was disagreed with Siamopoulou et al (6). This reduction in salivary flow rate might be due to the fact that iron deposits in thalassemic patients can directly affect the salivary glands, causing important and painful inflammation, with either normal or diminished salivary flow (19).

There were highly significant reduction in the concentration of salivary calcium and magnesium in TM group as compared to control group, these results agree with Ghasempour et al
and disagree with the results obtained by Luglie et al (17) which found them very similar in both groups, while concentration of phosphorus found to be significantly higher in the TM group as compared to the control and this result agree with Ghasempour et al (18) and disagree with Luglie et al (17) which found that there was no difference in concentration of phosphorus between two groups and with Siamopoulou et al (6) which found salivary phosphorus lower in the TM group. These differences in salivary constituents among thalassemic patients might be related to differences in their level in serum as a result of disease process since frequent blood transfusion for thalassemic patients can lead to iron overload which may result in hypogonadism, diabetes mellitus, hypothyroidism, hypoparathyroidism and other endocrine abnormalities (20).

In present study there was significant negativity correlation between salivary flow rate and dental caries. Salivary flow rate may play an important role in relation to dental caries in which the physiological function of saliva namely the cleansing activity is very important in the clearance of not food but also bacteria (21). There is reasonably good evidence that the risk for caries is significantly increased when salivary flow rate is pathologically low (hyposalivation and xerostomia) and this evidence indicates that clinically relevant chronic reduction in salivary flow rate is a strong risk factor for caries prevalence and incidence (22).

The other important physicochemical characteristic in saliva in relation to dental caries is its constituents. Saliva mainly composed of water in addition to a low percentage of electrolytes (23). Calcium and phosphorus are the main component of teeth; their presence in saliva may greatly affect remineralization of teeth. The caries process involves a progressive and an ultimately irreversible alteration in the hydroxyapatite structure of the affected tooth. In this regard it seems logical to expect that the salivary concentrations of ions that comprise hydroxyapatite should be correlated with caries status in some way (5). In the present study, there were strong and highly significant negative correlations between salivary calcium and phosphorus with dental caries in both groups which was agree with EL-Samarrai (24). studies which agree with present study. The higher caries experience among TM patients could be explained by reduction in concentration of electrolytes in saliva that was shown to negatively associate with dental caries in present study as well as others (24).

REFERENCES

Table 1: Oral health status (mean and standard deviation) between TM and control groups

<table>
<thead>
<tr>
<th>Parameters</th>
<th>TM group Mean±SD</th>
<th>Control group Mean±SD</th>
<th>t-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DMFS</td>
<td>9.29±7.66</td>
<td>2.54±2.44</td>
<td>5.38</td>
<td>0.000**</td>
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<tr>
<td>PII</td>
<td>1.35±0.50</td>
<td>0.94±0.35</td>
<td>4.16</td>
<td>0.000**</td>
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<tr>
<td>GI</td>
<td>1.46±0.56</td>
<td>0.86±0.38</td>
<td>5.54</td>
<td>0.000**</td>
</tr>
<tr>
<td>CalI</td>
<td>0.07±0.03</td>
<td>0.00±0.01</td>
<td>7.84</td>
<td>0.000**</td>
</tr>
</tbody>
</table>

** Highly significant

Table 2: Salivary parameters (mean and standard deviation) between TM and control groups

<table>
<thead>
<tr>
<th>Salivary parameters</th>
<th>TM group Mean±SD</th>
<th>Control group Mean±SD</th>
<th>t-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow rate</td>
<td>0.53±0.20</td>
<td>0.81±0.12</td>
<td>7.61</td>
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<tr>
<td>pH</td>
<td>7.17±0.96</td>
<td>8.23±0.30</td>
<td>6.70</td>
<td>0.000**</td>
</tr>
<tr>
<td>Calcium</td>
<td>1.72±0.50</td>
<td>2.41±0.45</td>
<td>6.50</td>
<td>0.000**</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>4.10±2.05</td>
<td>2.29±0.60</td>
<td>5.42</td>
<td>0.000**</td>
</tr>
<tr>
<td>Magnesium</td>
<td>0.42±0.16</td>
<td>0.98±0.58</td>
<td>5.93</td>
<td>0.000**</td>
</tr>
</tbody>
</table>

** Highly significant

Table 3: Correlation coefficient between salivary physicochemical characteristic and caries experience

<table>
<thead>
<tr>
<th>Salivary parameters</th>
<th>DMFS</th>
<th>TM group r-value</th>
<th>Control group r-value</th>
<th>P-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow rate</td>
<td>-0.343</td>
<td>0.028*</td>
<td>-0.309</td>
<td>0.049*</td>
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</tr>
<tr>
<td>pH</td>
<td>-0.327</td>
<td>0.037*</td>
<td>-0.371</td>
<td>0.017*</td>
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<tr>
<td>Calcium</td>
<td>-0.620</td>
<td>0.000**</td>
<td>-0.398</td>
<td>0.010*</td>
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<tr>
<td>Phosphorus</td>
<td>-0.539</td>
<td>0.000**</td>
<td>-0.433</td>
<td>0.005**</td>
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<tr>
<td>Magnesium</td>
<td>-0.634</td>
<td>0.000**</td>
<td>-0.347</td>
<td>0.026*</td>
<td></td>
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* Significant ** Highly significant