Comparative Assessment of Dental Caries Status and Selected Salivary Constituents in Children with Beta Thalassemia

Venkatesh Babu* • Pooja M. Gowda • Ishadeep Kaur

Department of Pedodontics and Preventive dentistry, V.S Dental College and Hospital Bangalore, Karnataka, India.
drnsvbabu@gmail.com

ABSTRACT

Aim: To compare the dental caries status and selected salivary constituents in β thalassemic and healthy children.

Methods: A total of 100 children were included in the study, study group consisted of 50 diagnosed cases of Thalassemia attending the Indira Gandhi Institute of Child Health, Bangalore and control group consisted of 50 healthy children who visited the Department of Pediatric and Preventive dentistry, V S dental college, Bangalore for routine dental check-up. Salivary constituents like calcium, potassium, phosphorous, sodium, urea and magnesium were assessed using salivary kits and dental caries was recorded according to WHO criteria 2013.

Results: Salivary calcium, sodium, urea and magnesium levels were lower and salivary potassium and phosphorous levels were higher in thalassemic children when compared to that of healthy children and the results were statistically significant only for salivary urea levels. There was a positive correlation between salivary parameters and dental caries.

Conclusion: Thalassemic children are more prone to dental caries which could be attributed to poor oral hygiene, poor motivation, endocrine problems, malocclusion, frequent blood transfusion, and immune deficiency. In the present study reduced salivary calcium, sodium, urea, and magnesium levels and increased salivary potassium and phosphorous levels in thalassemic children, could be the causative factors for the increased incidence of dental caries in these children.

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1. Introduction:

Thalassemia is a diverse group of inherited hematological defects characterized by absent or decreased production of haemoglobin, a protein present in red blood cells responsible for carrying oxygen through the body leading to microcytic anemia of varying degrees. It is classified based on clinical and genetic orders into major or β-thalassemia or Cooley's anaemia which exhibits the most severe clinical symptoms and minor or α-thalassemia which is mild and considered to be clinically asymptomatic (Dhote, Thosar, Baliga, 2015).

Thalassemia along with affecting the patient also leaves a devastating psychological effect on the family of the patient. Oral health status of children suffering from the life-threatening systemic disease is neglected as parents focus more on the medical procedures required to overcome this disease during early childhood. So, this poor oral health in turn leads to further deterioration of systemic health in these children (Dhote, Thosar, Baliga, 2015; Arora, Malik, Arora, Malik, 2014)

Dental caries is a multifactorial, infectious disease involving internal defense factors such as saliva, tooth morphology, general health, nutritional and hormonal status, and external factors like diet, microbial flora, oral hygiene and fluoride availability (Kuriakose, Sundaresan, Mathai, Khosla, Gaffoor, 2013). There are many different agents within saliva and plaque that serve to protect the tooth surface against caries development (Kuriakose, Sundaresan, Mathai, Khosla, Gaffoor, 2013).

The major function of saliva is its remineralizing effect. When the pH is above 5.5, saliva is 'supersaturated' with calcium, phosphate and hydroxyl ions, which make up the mineral content of the tooth and repairs the damaged mineral crystal from the enamel process of the

mineralization. Below this value the saliva and plaque are unsaturated, and the tooth dissolves. Other inorganic components like sodium and magnesium when increased in hydroxyapatite crystals will result in increased solubility of enamel on the acid attack. Potassium helps in the transport of active compounds through the cell membrane. Non-protein nitrate compound like urea plays a significant role in the buffer system (Al-Jobouri & Al-Casey, 2011; Kidd & Bechal, 2002).

Any change in the values of these salivary constituents will result in progression of dental caries and in turn poor oral health. Hence the purpose of this study was to assess the prevalence and distribution of dental caries due to changes in selected salivary biochemical composition of the total saliva in children affected by thalassemia major (Luglie, Campus, Deiola, Mela, Gallisai, 2002).

2. Methodology:

A total of 100 children aged 5 – 18 years were included in the study out of which 56% were males and 44% females (Table 1), study group consisted of 50 diagnosed cases of Thalassemia attending the Indira Gandhi Institute of Child Health, Bangalore and control group consisted of 50 healthy children who visited the Department of Pedodontics and Preventive dentistry, V S dental college for a routine dental check-up. Ethical clearance was obtained from the Institutional ethical committee. Signed written informed consent was obtained from the parents/guardians of the children participating in the study. Children with other systemic disorders and special children were excluded from the study.

Caries evaluation was performed under the standardized condition, using optimal artificial light, mouth mirror and probe and recorded according to the World Health Organization (2013). Decayed, missing and filled teeth was evaluated using the DMFT/dmft index for permanent and primary dentition.

Saliva collection was carried out in the day time and children were asked not to eat or drink anything at least 60 minutes before the collection. The collected saliva was sent to the laboratory, Department of Biochemistry, KIMS for assessment of salivary constituents (calcium, potassium, phosphorous, sodium, urea and magnesium) in a screw-capped bottle.

The study consisted of an interview, intraoral examination and collection of saliva sample after which the saliva samples were sent for biochemical analysis. Autoclaved plain mouth mirror and probe was used for examining the oral cavity. All the children were examined under standardized conditions by a single qualified examiner. Statistical analysis was done using appropriate statistical software. Chi-square test and Mann-Whitney U test was used for the comparison of study and control groups. The level of significance was set at $p<0.05$.

Table 1: *Age and Gender Distribution*

VARIABLE	HEALTHY	THALASSEMIA
Age (In Years) (Mean ± S.D)	9.6±2.4	8.14±3.3
Gender [N(%)]		
Male	28(56)	28(56)
Female	22(44)	22(44)

3. Results:

A total of 100 children were examined for DMFT/dmft score and salivary biochemical levels of calcium, potassium phosphorus, sodium, magnesium and urea that included 50 thalassemic children and 50 healthy children. It was found that DMFT/dmft score was found to be higher in thalassemic children compared to healthy children. It was statistically significant (p-0.003, p- 0.64 respectively) (Table 2, Table 3). The decayed component (D) of the DMFT was found to be higher in thalassemic children as compared to that of healthy children and the difference was statistically significant (p- 0.001) (Table 2). The filling component (f) of the dmft was found to be lower in thalassemic children as compared to that of healthy children, with statistically significant difference (p- 0.04) (Table 3). After assessing the salivary parameters, salivary urea levels were lower in thalassemic children with statistically significant difference ($p<0.05$) (Table 4).

Table 2: *Comparison of mean DMFT between the groups*

V	Group	MEAN±SD.	Mean Rank	Mann-Whitney U	*P*
D	Healthy	0.74±1.17	41.65	807.5	**0.001**
	Thalassemia	1.70±1.66	59.35		
M	Healthy	0	50.50	1250.0	1
	Thalassemia	0	50.50		
F	Healthy	0.04±0.19	51.50	1200.0	0.15
	Thalassemia	0	49.50		
DMF	Healthy	0.78±1.29	42.43	846.5	**0.003**
	Thalassemia	1.62±1.65	58.57		

V= Variable.

4. Discussion:

Thalassemia is characterized by various degrees of ineffective hematopoiesis and increased hemolysis and is the most common single gene abnormality. From early infancy, most patients are transfusion- dependent and they demonstrate severe anemia and hepatosplenomegaly.

Table 3: *Comparison of mean DMFT between the groups*

V	Group	Mean±SD.	Mean Rank	Mann-Whitney U	*P*
D	Healthy	0.80±1.27	46.42	1046.0	0.12
	Thalassemia	1.48±2.2	54.58		
M	Healthy	0.16±0.54	51.12	1219.0	0.62
	Thalassemia	0.06±0.2	49.88		
F	Healthy	0.32±0.84	53.58	1096.0	0.04
	Thalassemia	0.04±0.2	47.42		
DMF	Healthy	1.28±1.6	49.26	1188.0	0.64
	Thalassemia	1.58±2.3	51.74		

V= Variable.

Table 4: *Comparison of salivary constituents between the groups*

V	Group	Mean±SD.	Mean Rank	Mann-Whitney U	*P*
Ca	Healthy	5.30±2.7	49.45	1197.5	0.71
	Thalassemia	4.98±1.7	51.55		
Mg	Healthy	0.66±0.7	51.11	1219.5	0.83
	Thalassemia	0.46±0.2	49.89		
Na	Healthy	15.80±8.7	55.68	991.0	0.07
	Thalassemia	12.80±5.0	45.32		
K	Healthy	21.31±4.3	47.73	1111.5	0.34
	Thalassemia	21.70±6.2	53.27		
P	Healthy	16.06±3.3	45.54	1002.5	0.08
	Thalassemia	19.02±6.8	55.46		
UREA	Healthy	32.54±15.0	58.68	841.0	**0.005**

V=Variable; Ca=Calcium; Mg= Magnesium; Na= Sodium; K= potassium; P= Phosphorus.

Saliva is secreted by the salivary glands and has immunological and enzymatic defense systems. It also protects the mucosa against mechanical insults and promotes its healing via the activity of epidermal growth factor. The flow of saliva reduces plaque accumulation on the tooth surfaces and also increase the rate of carbohydrate clearance from the mouth thereby preventing dental caries (Al-Jobouri & Al-Casey, 2011). It also plays an important role in buffering the pH and thereby maintaining the health of oral tissues.

Dental caries is a multifactorial disease, its prevalence and severity are affected by several factors, which includes diet, age, gender, and socioeconomic factors. Also, some illnesses predispose to high risk of dental caries, in addition to some medications. Caries index is reported to be high in thalassemic not only because of oral hygiene neglect but also because of variations in the biochemical composition of saliva.

In the present study, there was a highly significant reduction in the salivary urea concentration in children suffering from Thalassemia compared to normal children with a statistically significant difference. Dhote, et al. (2015) and Luglie et al (2002) also have reported lower salivary urea levels in thalassemic children.

In healthy individuals' urea is secreted in saliva and gingival crevicular fluids continuously in the range of 3–10 mMol in of as a product of salivary gland metabolism. Urea is rapidly metabolized by the oral microflora in the presence of urease enzymes releasing ammonia and carbon dioxide, which combines with an excess of H^+ ions and promotes remineralization of tooth structure. According to the literature, Ureolysis also plays a major role in plaque pH homeostasis. Urea hydrolysis results in net production of base and prevents the pH from becoming acidic and neutralizes plaque acid thereby inhibiting the outgrowth of aciduric, cariogenic micro-organisms and decreased dental caries (Dhote, et al. 2015).

Other salivary constituents like calcium, sodium, and magnesium levels were lower and salivary potassium and phosphorous levels were higher in thalassemic children when compared to that of healthy children but the results were not statistically significant. These findings were similar to the studies done by Al-Jobouri, et al. (2011). All these variations might be because of the differences in their level in serum because of disease process due to frequent blood transfusion that can lead to iron overload which may result in hypogonadism, diabetes mellitus, hypothyroidism, hypoparathyroidism, and other endocrine abnormalities also (Al-Jobouri, et al., 2011).

With regard to the status of dental caries in the permanent and primary dentition, the mean DMFT/dmft was found to be significantly higher in patients with thalassemia compared to healthy children in the present study. Many Studies reported that dental caries was significantly higher in patients with thalassemia (Dhote, et al. 2015; Arora, Nayeemuddin, Ghatak, Singh, 2014; Al-Jobouri, et al., 2011; Gomber, & Dewan, 2006; Siamopoulou et al. 1992). This could be attributed to the fact that there are predisposing factors which lead to increase in the severity of dental caries in thalassaemic patients which include the difference in morphological properties of their teeth including; pits, fissures, tubercles,

prominence, and protuberances also with variations in salivary constituents.

There is a significant correlation between the effect of blood transfusion and dental caries, which is related to the variation in concentration of iron in serum which leads to changes in the concentration of iron in the teeth. When there is an increase in the concentration of iron in saliva and teeth it leads to increased severity of dental caries. And also due to the fact that iron deposits in thalassemic children can directly affect the salivary glands and in turn affecting the quality of saliva leading to dental caries.

In the present study, the main difference between thalassemic and healthy children was in the filled component (F/f) of mean DMFT/dmft index. The filled component was found to be lower in thalassemic children when compared to that of healthy children. Qureshi, and colleagues, (2010) reported that the F component was found to be significantly lower in thalassemic children when compared to that of healthy children.

This observation in relation to dental caries in thalassemic children could be attributed to neglect on the part of caregivers, as these children require frequent blood transfusion which is very expensive and preventive and restorative dental care programmes also increases the financial burden of the family.

5. Conclusion:

High prevalence of dental caries in thalassemic children, when compared to healthy children, could be due to poor oral hygiene, poor motivation, endocrine problems, malocclusion, frequent blood transfusion, and immune deficiency. Also adding to it is the changes in the levels of salivary biochemical constitutions in these children.

Thalassemic children and their parents should be educated about the prevention and management of dental caries, right from the detection of the disease. Timely dental treatment and regular follow up visits help in the prevention of the further progression of the disease process.

Corresponding Author:
Venkatesh Babu**,** Prof.
Department of Pedodontics and Preventive dentistry, V.S Dental College and Hospital Bangalore, Karnataka, India.
E-mail: drnsvbabu@gmail.com

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