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The Impact of Thalassemia Major on Dental Integrity and Development

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Abstract

Thalassemia major is no longer a disease of childhood. Life expectancy of these patients has increased as a result of the dramatic change in medical management of thalassemia major in the past two decades. As patients with thalassemia major become older, their needs also are changed. Patients now face new issues, such as having families, obtaining higher education, and securing employment, which need more care and attention for their appearance in general and dental health in special.

The aim of this study was to compare the dental maturity and integrity of a group of patients with β thalassaemia major with age and sex matched healthy controls in Baghdad.

For this cross sectional study, a convenient sample of 100 (72 males and 28 females) thalassemic patients who were attending the thalassemia centers in AL-Karama and Ebin-AL Balady hospital was involved. The age of the patients ranged from 6 to15 years. A similar number, of healthy individuals matching with age and gender, was selected as control.

Plaque, calculus, and gingival indices as well as decayed, missed and filled surfaces indicator are significantly different in thalaessaemic patients in comparison to control group. The thalaessaemic patients also demonstrated a delay in the development of their dentition.

The thalassemic patients demonstrated a delay in the development of their dentition. The mean difference between chronologic and dental age was found to be statistically significant

Keywords: Oral hygiene, Dental caries, Prevention.

Introduction

Hemoglobinopathies are the most commonly autosomal recessively inherited diseases in humans with an estimated 240 million carriers worldwide and 200 thousand homozygotes or compound hetrozygotes born each year [1]. One of these hemoglobinopathies is thalassemia. Thalassemias are a diverse group of genetic blood diseases

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characterized by the absence or decreased production of globulin protein chains. This results in microcytic anemia of varying degrees referred to as α and β types [2]. Based on their clinical and genetic orders thalassemias are classified mainly into major (homozygous) and minor (heterozygous) types [3]. Beta thalassemia major (Cooleys anemia) is the most severe form of congenital hemolytic anemia. It results from the abnormal synthesis of the β-chain hemoglobin usually starting to manifest as early as 4-6 months of prenatal life during the switch from HbF to HbA. Patients usually have a hematocrit of about 20%, and they usually develop all the complications of chronic anemia including growth retardation [4,5]. In Iraq, the total number of thalassemic patients is nearly 5000 according to record of Ministry of Health for the year 2003.

Although β thalassemia major is one of the most common genetic disorders causing major public health problems including dental problems, the literature shows dental development and situation in subjects with thalasaemia major are very few [6].Dental caries and periodontal diseases are a wide spread diseases and may affect any subject. Plaque accumulation is the main etiological factor of these two diseases [7]. In β-thalassemia major, dentofocial anomalies is a problem that may occur in thalassemic patients due to bone marrow hyperplasia [8]. A high prevalence of dental caries as well as periodontal disease is other problems among them [9, 10].

In Iraq, limited studies regarding dental development and integrity in medically compromised patients are present as among children with Down's syndrome by Faris (1990) [11], diabetes by AL-Dahan (1991) [12], respiratory tract allergies by Bezzo (2000) [13], congenital coagulation disorder by AL-Kubaisi (2000) [14], iron deficiency anaemia by AL-Dulayme (2003) [15], and among acute lymphoblastic leukemia by AL-Joboury (2003) [16]. At the time of preparing this study no Iraqi study regarding oral health status and dentofacial anomalies among thalassemic patients was able to be found, except by AL-Mashhadany (1994) [17] regarding periodontal health status of these patients.

For all of the above the aim of this study was to compare the dental maturity and integrity of patients with β-thalassemia major with age and sex matched healthy controls in order to increase the knowledge concerning this subject, compared to the normal population and perform a base line data among a group of medically compromised patients in our country to be used in planning and organization of dental health services for those patients.

Patients and Methods

The data for this cross sectional study were collected from patients in thalassemia centers in AL-karama (Al Karkh district) and Ebin-AL Balady (Al Resafa district) hospitals in Baghdad for the period from January, 1st 2004 till December, 31st 2005.

The number of thalassemic patients who were resident in Baghdad with an age range 6-15 years was 380 in Ebin-AL Balady center and 352 in AL-Karama center. A random sample consisted of 50 patients were selected from each hospital.

For the purpose of comparison and to attempt to determine the validity of the findings obtained from examining the thalassaemic patients, a total of 100 individuals in the control group matching in age and sex were selected

from the out patients of the same hospitals.

Examinations and oral health assessments were performed according to the basic method of the WHO for the year 1997 [18]. Subjects were examined in a suitable room and seated on a portable chair with a tall back on which the child head can be rested and artificial light source was used for illumination. Dental plaque, dental calculus, and gingival indices were recorded. Caries – experience was diagnosed and recorded as follow:

1- **Sound tooth:** A tooth is recorded as sound if there was no evidence of treated or untreated clinical caries that precede cavitations, as well as other conditions similar to the early stages of caries, are excluded because they cannot be reliably diagnosed.

2- **Decayed tooth:** Caries was recorded as present when a lesion in a pit or fissure, or on a smooth tooth surface, has a detectably softened floor, undermined enamel or softened wall. A tooth with temporary filling was also included in this category. For interproximal surfaces it was recorded as decayed when the explorer has entered the lesion. Where any doubt existed, caries lesion was not recorded as present.

3- **Filled tooth with decay:** A tooth was recorded as filled with decay when it contained one or more permanent restorations and one or more areas that were decayed. No distinction was made between primary and secondary caries [i.e. whether or not the carious lesion was in physical association with the restoration (s)].

4- **Filled tooth with no decay:** Teeth were considered filled without decay when one or more permanent restorations were present and there was no secondary (recurrent) caries or other area of the tooth with primary caries. A tooth with a crown

placed because of previous decay was recorded in this category.

5- **Tooth missing:** The teeth that had been extracted.

Information on the decayed, missing, and filled teeth index (DMFS) was calculated as the carious lesions were counted for all surfaces of the tooth involved. Missing teeth were counted as four (involved surfaces) for anterior teeth, and five (involved surfaces) for posterior teeth. Retained roots were counted as four decayed surfaces for the anterior teeth, and five decayed surfaces for the posterior teeth. Temporary crowns were recorded as four decayed surfaces for anterior teeth and five decayed surfaces for the posterior teeth [18].

In order to assess the degree of dental development and chronologic age, the thalassaemic patients were divided into two groups. In group I, the patient's age was 6-10 years old. In group II, the patient's age 11-15 years old. The panoramic radiographs were examined under ideal conditions including the use of subdued ambient room lighting, film masking, and a conventional viewing box (Exal-Type F.I.D-1, Basingstone, England) with a variable light intensity and a 2X magnifying lens (X-viewer, Malmo, Sweden). The panoramic radiographs were used to assess patient's dental ages by employing the method of Demirjian et al. [19].

Statistical Analysis was obtained using the Statistical Package for the Social Sciences (SPSS). Means and standard deviations were calculated for each group. The difference between chronological and dental age was tested by student's t-test. The correlation between amount of dental development and chronological age was also determined. A statistically significant difference was considered

to be present when P values were < 0.05.

Results

The distribution of the studied sample regarding their age and gender is shown in table below.

In both groups it was found that a very low percentage with plaque index score zero was recorded and the majority of subjects had moderate type of plaque indices. Plaque index among thalassemic group was higher than that seen in the control; difference was statistically highly significant (table 2).

Results showed that calculus index difference was statistically not significant between thalassemic and control group in age group 6-10 years, however the difference was statistically significant for age group 11-15 years.

In the thalassemic group, the higher percentage was those having moderate type of gingivitis while in the control group the higher percentage was those having mild gingivitis. The gingival index according to age groups for both study and control groups is seen in Table 4. Results showed that the gingival index among thalassemic group was higher than that seen in the control; difference was statistically significant in age group 6-10 years and highly significant in age group 11-15 years.

The differences in Decayed, Missed and Filled Surfaces (DMF) were studied according to age groups for each fraction alone and for the total index. Results showed that DMF values were higher in thalassemic group compared to the control. However, statistically no significant differences were observed between study and control groups in age 6-10 years as statistically highly significant differences were present in age (11-15) years as show in table below.

The thalassemic patients demonstrated a delay in the development of their dentition. The differences between dental and chronological ages in thalassemic group were 2.45 and 3.83 years in age groups 6-10 and 11-15 years respectively. The mean difference between chronologic and dental age was found to be statistically significant in both age groups. In contrast, there was no significant difference between the mean chronologic and dental age of the control group.

Discussion

Oral health status of patients with thalassaemic major disease was assessed in this study. Oral hygiene status was evaluated by the assessment of prevalence of dental plaque, calculus and gingivitis among these patients under study. Data of this study indicated moderate and severe types of plaque index among thalassemic patients. Plaque index among thalassaemic group was higher than that seen in the control; difference was statistically highly significant (P< 0.000),

Results showed that calculus index was higher in both age groups regarding moderate and severe types but the difference was statistically not significant between thalassaemic and control group in age group 6-10 years, however the difference was statistically significant for age group 11-15 years. The severity of gingivitis was found to be varying between the study and control groups. Moderate type of gingivitis was recorded among thalassaemic patients compared to a mild types in the control with statistically significant difference (P<0.02) regarding 6-10 years and highly significant (0.0001) for 11-15 years age groups). Regarding gingivitis which is also plaque related disease

(Carranza, 1996) [20], result of gingival index was disagreement with that found by Al-Wahdani et al. (2002) [21], who found no significant difference with that of the control group regarding gingival index value. Results regarding plaque, calculus and gingivitis, give as an idea that there may be another etiological factor responsible for this increase. This was related to the poor oral hygiene, oral and dental care neglect and a lack of dental knowledge among thalassaemic patients.

From the fact that dental caries is a plaque related disease, DMFT value represents the prevalence and severity of dental caries among sample under study which was 2.23 ± 0.2 for 6-10 years age group and 5.73 ± 0.4 for 11-15 years olds was found to be nearly in agreement with that reported by Mattia et al. (1996) [22]. (5.12 +4.76) and less than that reported by Hattab et al. (2001) [23] which was 6.26 and Luglie et al. (2002) [24] in Italy (10.3). The variation between these results could be attributed to the variation in the criteria and method used in the examination in addition to sample size as well as the standard of living and dietary habits. In comparison with the control, it was found that the thalassaemic patients significantly have more DMFT value than the control group which resembles the normal people (P<0.01) this was in agreement with Al- Wahdani et al (2002) [21] in Jordan. Regarding the severity of dental caries data of this study indicated that thalassaemic patient suffer more than the control and the difference was highly significant regarding age group 11-15 (P< 0.000), this was attributed to the general fact that prevalence of dental caries increased with increasing age, and that there were a predisposing factors lead to increase 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 in addition, further reduction in the size, as well as, the significant inverse correlation which was found between the effect of blood transfusion and dental caries (Mattia et al. 1996) [22], this was related to the variation in concentration of iron in serum which lead to changes in the concentration of iron in the teeth (Garfunkel et al. 1979) [25], which have an inverse correlation with severity of dental caries (Rosalen et al. 1996 [26]), where as Duggal et al.(1991) [27] reported a positive correlation. This was indicated that any variation in concentration of iron in teeth and morphology would possess an impact effect on the severity of dental caries.

The thalassemic patients demonstrated a delay in the development of their dentition. The mean difference between chronologic and dental age was found to be statistically significant in both age groups. In contrast, there was no significant difference between the mean chronologic and dental age of the control group. This was attributed to the effect of thalassemia on the bone, specially the jaws; this effect depends on several factors such as anaemia, patient age and duration of clinical symptoms in addition to timing of therapeutic blood transfusion and of splenectomy (Baccimitci et al., 1996) [28]. In addition, it has been suggested that these patients might have dento-facial abnormalities such as distal deviation from the normal antero-posterior molar relation (Mattia et al., 1996) [22], saggital over growth of maxilla due to bone marrow hyperplasia (Pasaksrikit et al., 1988) [29], class II skeletal relationship (Abu Alhaija et al., 2002) [30], this was explained by the half and/or full cusp distal deviation and increased over jet more than 5mm (McDonald, 1994) [31].

Other studies recorded crowding in incisal segments, this was depending on the size and form of the jaw and sizes of teeth, and this crowding was found to increase with advancing age (Jones and Oliver, 2000) [32]. Increase in the percentage of spacing among thalassaemic patients also found by other studies (Scutellari et al., 1994) [33], this will lead to reduction in the space needed for the tooth to erupted causing delayed eruption as found in this study. In conclusion, this study indicated that those patients suffer from increased prevalence of dental caries, gingivitis, and delayed eruption of their teeth with poor oral hygiene, dental knowledge and behaviors should be encourages and their abnormalities should be corrected and preventive dental health programs should be applied to prevent these problems in addition to treat their medical abnormalities.

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Table 1: Distribution of the total sample by age and gender.

Age group (years)	Thalassemic Group						Control Group						P Value
	Males		Females		Total		Males		Females		Total		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
6-10	48	48.0	16	16.0	64	64.0	43	43.0	15	15	58	58.0	0.913
11-15	24	24.0	12	12.0	36	36.0	22	22.0	20	20	42	42.0	0.201
Total	72	72.0	28	28.0	100	100.0	65	65.0	35	35	100	100.0	0.287

Table 2: Distribution of the study and control groups according to severity of plaque index

Age group (years)	Groups	Plaque Index								Total
		No plaque		Mild		Moderate		Sever		
		No.	%	No.	%	No.	%	No.	%	
6-10	Study	0	0.0	19	29.7	36	56.2	9	14.1	64
	Control	4	6.9	36	62.1	18	31.0	0	0.0	58
	$X^2=18.67, df= 3, p =0.000$									
11-15	Study	0	0.0	21	58.3	10	27.8	5	13.9	36
	Control	2	4.8	32	76.2	8	19.0	0	0.0	42
	$X^2=11.67, df= 3, p=0.001$									

Table 3: Distribution of the Study and Control Groups According to Severity of Calculus Index by Age Groups.

Age group (years)	Groups	Calculus Index								Total
		No calculus		Mild		Moderate		Severe		
		No.	%	No.	%	No.	%	No.	%	
6-10	Study	48	75.0	14	21.9	2	3.1	0	0.0	64
	Control	49	84.5	9	15.5	0	0.0	0	0.0	58
Fisher Exact p=0.273133										
11-15	Study	21	72.2	9	22.2	4	5.6	2	0.0	36
	Control	32	76.2	10	23.8	0	0.0	0	0.0	42
Fisher Exact p=0.00758										

Table 4: Distribution of the Study and Control Groups According to Severity of gingival Index by Age Groups.

Age group (years)	Groups	Gingival Index								Total
		Normal Gingiva		Mild Inflammation		Moderate Inflammation		Severe Inflammation		
		No.	%	No.	%	No.	%	No.	%	
6-10	Study	4	6.3	13	20.3	47	73.4	0	0.0	64
	Control	22	37.9	36	62.1	0	0.0	0	0.0	58
Fisher Exact p=0.0000										
11-15	Study	1	2.8	8	22.2	22	61.1	5	13.9	36
	Control	32	76.2	10	23.8	0	0.0	0	0.0	42
Fisher Exact p=0.0000										

Table 5: Decayed, Missed and Filled Surfaces (DS, MS, FS: Means and Standard deviation) of teeth in thalassemic and control group by Ages.

Age group (years)	Groups	DMF Surfaces (Mean±SD)			
		DS	MS	FS	DMF
6-10	Study	10.8 ± 0.9	8.16 ± 0.8	2.0 ± 0.0	2.23 ± 0.2
	Control	8.2 ± 0.42	5.6± 1.8	4.0± 0.6	2.12± 0.2
P value (t-test)		0.06	0.08	0.06	0.06
11-15	Study	14.6 ± 2.9	13.2 ± 2.4	5.0 ± 1	5.73 ± 0.4
	Control	3.86 ± 3.8	1.0± 0.0	1.5± 0.0	3.23 ± 0.3
P value (t-test)		0.000	0.000	0.001	0.01

Table 6: Dental development in thalassemic and control group regarding ages.

Age group (years)	Groups	Dental age (years) (Mean±SD)	Chronological age (years) (Mean±SD)	P value (t-test)
6-10	Study	5.98 ± 0.88	8.43 ± 0.66	0.000
	Control	7.68 ± 0.36	7.96 ± 0.54	0.42
P value (t-test)		0.001	0.07	
11-15	Study	8.65 ± 0.74	12.48 ± 0.86	0.000
	Control	12.98± 0.68	13.22 ± 0.48	0.68
P value (t-test)		0.001	0.08	