

## Dental Status and Oral Health-Related Quality of Life among Egyptian Children with B-Thalassemia Major: A Case-Control Study

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### ABSTRACT

**Objective:** This cross sectional case-control study aims to investigate the dental and oral health status of Egyptian children with  $\beta$ -Thalassemia major and its impact on their quality of life (OHRQoL) in comparison to their normal counterparts.

**Subjects and methods:** A total number of 105 children (53 in the  $\beta$ -Thalassemia major group and 52 in the control group) aged (2-14) years were selected from Hematology Clinic of the Children's Hospital, Faculty of Medicine, Ain Shams University. Data was gathered by oral interview (demographic data, medical and dental history), intraoral examination (DMFT, deft, dmft, OHI-S, Angle classification) and filling out OHRQoL questionnaires using Early Childhood Oral Health Impact Scale (ECOHIS) for children aged 2-7 years, Child Perception Questionnaire (CPQ<sub>8-10</sub>) for ages 8-10 years and Child Perception Questionnaire-short form 16 (CPQ<sub>11-14</sub>) SF16 for ages 11-14 years. Questionnaires were translated into Arabic by a certified translation center.

**Results:** Class II malocclusion, deft and OHI-S were significantly higher in thalassemic children than the control group ( $p=0.038$ ,  $0.044$  and  $0.015$ , respectively). No statistically significant differences were detected between thalassemic children and the control group in their total score of OHRQoL questionnaires except for the negative impact of oral health on the emotional well-being aspect in adolescent thalassemia group aged from 11-14 years ( $p=0.044$ ).

**Conclusion:** Thalassemic children had a worse dental status than controls, which caused a negative impact on the emotional wellbeing aspect of the adolescent thalassemia group but, there is no negative impact of thalassemia itself as a disease on OHRQoL. For that, patients with thalassemia should be advised about the importance of oral health care and its impact on improving quality of life, also more collaboration between pediatrics and pediatric dentist is needed.

**Keywords:**  $\beta$ -thalassemia major, OHRQoL, CPQ, ECOHIS, Oral hygiene level, Dental caries

**Abbreviations:**  $\beta$ -TM: Beta Thalassemia Major; OHRQoL: Oral Health Related Quality of Life; VAS: Visual Analogue Scale; DMFT: Decayed-Missing-Filled Teeth Index; dmft: decayed-missing-filled teeth index; deft: decayed-extracted-filled teeth index; OHI-S: Oral Hygiene Index Simplified; DI-S: Debris Index Simplified; CI-S: Calculus Index Simplified; ECOHIS: Early Childhood Oral Health Impact Scale; CPQ<sub>8-10</sub>: Child Perception Questionnaire (8-10 years); CPQ<sub>11-14</sub>-SF16: Child Perception Questionnaire (11-14 years)-Short Form 16

### INTRODUCTION

Thalassemia is one of the most common genetic disorders around the world, posing a major public health and social problem in the high incidence areas,  $\beta$ -thalassemia is the most commonly found thalassemia with an estimated 60-80 million people in the world, and about 3% of the world's population carries  $\beta$ -thalassemia gene [1]. It is also considered the most common chronic hemolytic anemia in Egypt [2].

The most common orofacial manifestation in  $\beta$ -thalassemia major ( $\beta$ -TM) include prominent frontal bossing and

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cheekbones, overgrowth of the maxilla, malocclusion [3,4] and delay in dental development [5].  $\beta$ -TM patients are at high risk of dental caries and periodontal disease [6]. The prevalence of dental caries and periodontal disease among  $\beta$ -TM patients may be explained on the basis of chronic nature of thalassemia, patients preoccupied with their main life-threatening problem and neglect basic preventive dental care. Lack of oral health knowledge, improper dietary habits and malocclusion are also attributable causes [7,8].

The health related quality of life of children and adult with thalassemia is reported to be unfavorable and poor as compared to their healthy peers by many research studies [9-12].

The previously mentioned studies addressed the general health of thalassemia patients but did not take the oral health status of children and its impact on their quality of life into consideration. On the other hand, other researchers only investigated the oral health status of those patients compared with their healthy peers without showing the relation between oral health and quality of life [7,8,13,14].

Oral health-related quality of life (OHRQoL) is a relatively new, but rapidly growing notion. This measure defines how oral status can affect daily activities [15].

The advances made in treatment over the past decades and longer life expectancies for patients with  $\beta$ -TM increased their chances to have improved quality of life same as healthy population.

However, the oral and dental health care as a part of general health care is necessary for those group of patients but, there are limited research studies around the world focusing on oral health status in thalassemic patients and its impact on QOL [16,17]. In addition, and up to the authors' knowledge, no research studies addressing oral health related quality of life in thalassemic patients were conducted in Egypt until the moment of writing this manuscript. Hence, this study was conducted and aimed to investigate the dental status of children with  $\beta$ -TM and its impact on their quality of life (OHRQoL) compared with their normal counterparts.

## SUBJECTS AND METHODS

It is a cross-sectional case-control study; the approval was obtained from the Ethical Committee of the Faculty of Dentistry, Ain Shams University (FDASU\_REC). A signed written consent was obtained from all participants and/or their parents or guardians after being informed of the study objectives and ensuring data confidentiality.

The total number of 105 subjects (53 in the  $\beta$ -Thalassemia major group and 52 in healthy control group) was calculated using Epicalc program version 1.02 assuming a power of 80% and  $\alpha=0.05$  and based on a percentage of excellent grade of OHI-S was 9 for cases (19.6%) versus 16 for controls (34.8%) based on a study conducted to investigate the oral health status of young patients with congenital

bleeding disorders and its consequent impact on their quality of life (OHR-QoL) compared to controls [18].

The cases group consisted of 53 children with  $\beta$ -TM aged from 2-14 years old, whose diagnosis was confirmed by the hematological characteristic blood film and high performance liquid chromatography (HPLC) and attended regularly at Hematology clinic of children Hospital, Faculty of Medicine, Ain Shams University.

The exclusion criteria were: Cognitive impairment, uncompensated organ failure, severe psychological disorders and any diseases or drugs that might cause changes in oral and dental health.

Ain Shams University for any complains other than dental or oral presentation and who did not suffer from any chronic diseases which might have affected the oral and dental health.

All of the participants or their caregivers underwent to the following respectively:

### Verbal interview and reviewing the healthy system files

One specific examination sheet was used and consisted of several questions for gathering thorough demographic data, medical history, dental and social history (any dental problem, tooth brushing frequencies, pattern of dental attendance, self-rating oral health status and perceived dental treatment needs). These questions were chosen in reference to a study conducted for assessment of OHRQoL in hemophilia patients [19]. The questions were modified to suit the thalassemia patients and any questions that were directly related to hemophilia were omitted.

### Intraoral examination

It was conducted by one examiner in a specific examination room at the Children's Hospital, Faculty of Medicine, Ain Shams University for both thalassemia and control groups with semi-supine position of the participant under the room light using gloves, mask, disposable dental mirror and a blunt explorer. Intraoral examination included evaluation of:

**Dental caries:** Assessed by Decayed-Missing-Filled Teeth Index (DMFT) for the permanent dentition in children aged 6-14 years old, decayed-missing-filled teeth index (dmft) for the primary teeth in children aged 2-5 years old and decayed, indicated for extraction due to caries-filled teeth index (deft) for primary teeth in mixed dentition in children aged 6-12 years old according to criteria described by the World Health Organization [20].

**Oral hygiene level:** Assessed by using oral hygiene index simplified (OHI-S) by Green and Vermillion [21]. It consists of two components, the simplified debris index (DI-S) and the simplified calculus index (CI-S). It uses only six teeth surfaces in the mouth either permanent teeth or corresponding primary teeth so it was applied to all ages participating in this study.

**Primary and permanent molar relationships:** Assessed by Angle's classification of malocclusion [22]. In case of primary molar in 2-5 years old children the molar relationships as follow (flush, mesial step and distal step). While the permanent molar in 6-14 years old children the relationship as follow (normal occlusion, class I, class II and class III).

#### Oral health-related quality of life questionnaires

For every age range there were different specific types of OHRQoL questionnaires, accordingly the participants were divided into three age groups where the minimum number of participants in each group was 12.

1. Early Childhood Oral Health Impact Scale (ECOHIS) [23] was applied to children aged 2-7 years old (18 children with  $\beta$ -TM and 21 controls).
2. Child Perception Questionnaire (CPQ) [24] was applied to 8-10 years old children (23  $\beta$ -TM and 16 controls)
3. Child Perception Questionnaire short form (CPQ) SF16 [25] was applied to 11-14 years old children (12  $\beta$ -TM and 15 controls)

Questionnaires were translated into Arabic by a certified translation center. First, the aim of using this type of questionnaires was elaborated and instructions were given on how to answer them. After that, the questionnaires were filled out by parents or guardians of young children who aged from 2 to 10 years old or by older children themselves who aged 11 years and older, then it was returned at the end of the meeting. Assistance was provided for some of the participants in case there was any an inapprehensible question by explaining or repeating it in a way that was clearer/more elaborate to them.

#### Oral health education session

This oral health education session was tailored to consider the general health status of the thalassemic children, the level of education and the socioeconomic status of all participants and their caregivers. The session was given in a short time, by using simple, clear words, teeth models and pictures. Affordable and available examples of healthy food and toothpaste were recommended.

The following oral care instructions were given:

1. The importance of oral health care.
2. The correct way of brushing was presented as follows: The horizontal scrub brushing technique was used for children aged 7 years old and younger 26 while modified bass brushing technique was used for children aged older than 7 years old [27].
3. The recommended number of times that people should brush their teeth daily was defined as three times a day especially before bedtime and after meals.

4. Keep a healthy diet supplied by fruit, vegetables and milk products and avoid foods with high sugar content, sticky foods, potato chips and soda drinks.
5. Visit the dentist regularly for a check-up and treat any dental problems like dental caries before it becomes worse.

All previously mentioned oral care instructions and others related to the early age children were illustrated in a child-friendly oral health promotion leaflet (containing pictures) given to the all children that participated in this study along with toothpaste and a brush.

#### STATISTICAL ANALYSIS

Data were collected, revised, coded and entered into the Statistical Package for Social Science (IBM SPSS) version 20. The comparison between the two groups was done using Chi-square test, Fisher exact test, independent t-test and Mann-Whitney test where appropriate. The comparison between more than two groups was done using One Way ANOVA and Kruskal-Wallis test when appropriate. The confidence interval was set to 95% and the margin of error accepted was set to 5%. The p values less than 0.05 were considered significant.

#### RESULTS

##### Demographic and clinical characteristics

The study included a total of 105 patients aged (2-14) years old, 53 patients with  $\beta$ -thalassemia major. They were 58.5% female and 41.5% male, the mean of age was  $9.23 \pm 4.00$  (2-14). The study also included 52 age and sex-matched controls, they were 51.9% female and 48.1% male and the mean age was  $7.98 \pm 3.49$  (2-14).

Results confirmed there was no statistically significant difference in the mean of age and gender between both groups. The majority of thalassemia (82.7%) and control (54.7%) group were from Cairo.

No statistically significant difference in the level of education of children and their mothers between thalassemia and control groups. Most of the children's fathers in thalassemia group attended school (50.9%) while most of them in the control group were illiterate (53.8%) with a statistically significant difference.

##### Dental health of the studied subjects

About 80.8% of thalassemia and 91.9% of control groups suffered from dental caries. A significantly higher percentage of the control group reported that they never brushed their teeth and most of the participants in both groups never visited a dental clinic although most of them were convinced that they needed dental treatment. VAS (visual analogues scale) scores of self-rating oral health status were significantly worse in thalassemia group compared to the control group as illustrated in **Table 1**.

**Table 1.** Dental history in studied subject.

Variables		Control group (No: 52)		Thalassemia group (No: 53)		Test Value	P-Value
Frequency of brushing	Never	39	75.0%	27	50.9%	8.818	0.012
	Irregular	12	23.1%	18	34.0%		
	Regular	1	1.9%	8	15.1%		
Visiting dental office	No	30	57.7%	30	56.6%	0.013	0.910
	Yes	22	42.3%	23	43.4%		
Last visit	<6 months	12	23.1%	10	18.9%	2.617	0.624
	6 months-1year	5	9.6%	4	7.5%		
	1-2 years	0	0.0%	2	3.8%		
	>2 years	5	9.6%	7	13.2%		
In your opinion do you need dental treatment	No	11	21.2%	9	17.0%	0.296	0.586
	Yes	41	78.8%	44	83.0%		
How do you rate your own oral health status (VAS)?	Mean ± SD (Range)	6.85 ± 1.98 (0-10)	5.68 ± 2.33 (0-9)	-2.763*	0.007#	Mean ± SD (Range)	6.85 ± 1.98 (0-10)

\*: Independent t-test  
#: P<0.05: Significant

**Intraoral examination**

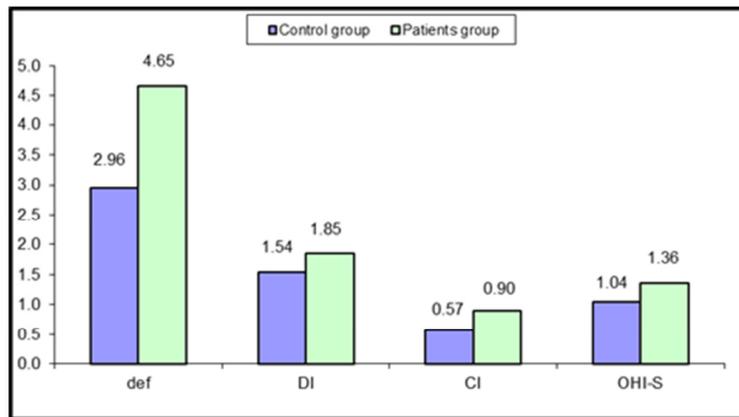
Class II malocclusion was higher in thalassemia group than controls with a statistically significant difference as

illustrated in **Table 2**. The deft index and OHI-S were significantly higher in the thalassemia group than the control group with p-value 0.044 and 0.015, respectively as illustrated in **Figures 1 and 2**.

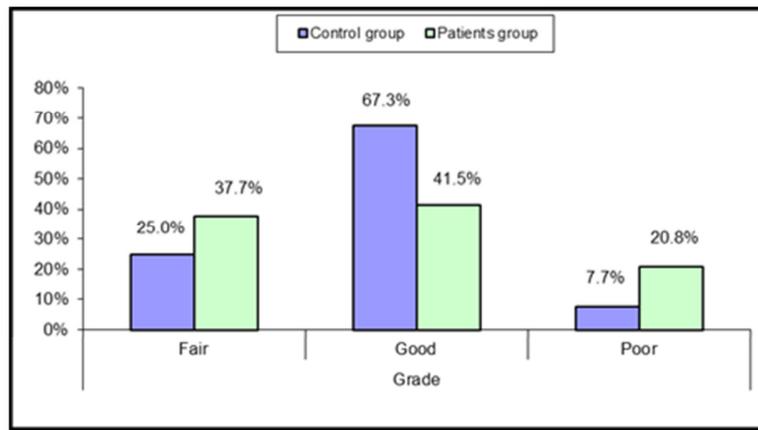
**Table 2.** Dental occlusion relationship in studied subjects.

Variables		Control group (No: 52)	Thalassemia group (No: 53)	Chi-square test	P-value
Deciduous molar relationship	Mesial step	20 (90.9%)	13 (92.9%)	0.043	0.837
	Flush	2 (9.1%)	1 (7.1%)		
	Normal	21 (70.0%)	18 (46.2%)		
Permanent molar relationship	Class I	6 (20.0%)	5 (12.8%)	8.408	0.038#
	Class II	3 (10.0%)	14 (35.9%)		
	Class III	0 (0.0%)	2 (5.1%)		

#: P<0.05: Significant



**Figure 1.** Dental caries (def) and oral hygiene levels in studied subjects.



**Figure 2.** Grades of oral hygiene levels OHI-S (oral hygiene index simplified) in studied subjects.

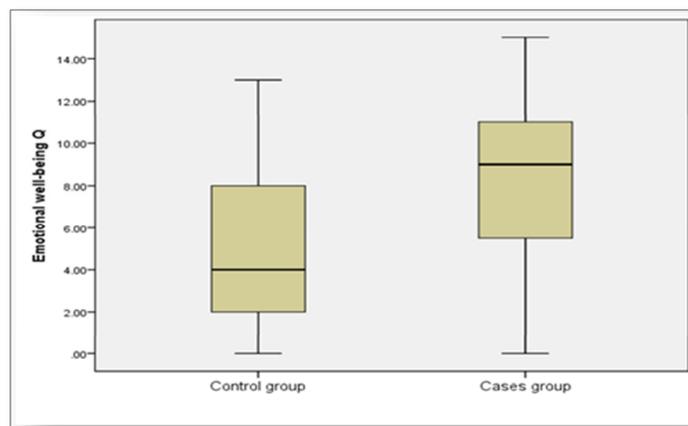
**Oral health-related quality of life in studied patients**

No statistically significant differences between thalassemia and control group of all age groups in their total score of

OHRQoL questionnaires except the negative impact of oral health on emotional well-being aspect in 11-14 age of thalassemia group as illustrated in **Tables 3 and 4** and **Figure 3**.

**Table 3.** Comparison between thalassemia and control groups aged from (2-7) years in total scores of ECOHIS and its domains.

Group aged 2-7 years		Control group scores	Thalassemia group scores	Mann-Whitney test	
				Z	P-value
Child symptoms domain	Median (IQR) (Range)	2 (2-4) (0-4)	2 (0-4) (0-4)	-0.308	0.758
Child function domain	Median(IQR) (Range)	5 (1-7) (0-13)	4.5 (2-8) (0-10)	-0.071	0.944
Child psychological domain	Median(IQR) (Range)	4 (0-6) (0-8)	2 (1-6) (0-8)	-0.200	0.842
Child self-image/social interaction domain	Median(IQR) (Range)	3 (0-6) (0-10)	1.5 (0-4) (0-10)	-0.622	0.534
Child impact	Median(IQR) (Range)	12 (7-20) (2-29)	11 (5-20) (1-30)	-0.466	0.642
Parent distress domain	Median(IQR) (Range)	4 (0-6) (0-8)	2 (1-7) (0-8)	-0.143	0.886
Family function domain	Median(IQR) (Range)	2 (0-6) (0-9)	1 (0-4) (0-8)	-0.556	0.578
Family impact	Median(IQR) (Range)	7 (0-12) (0-17)	4.5 (2-9) (0-15)	-0.484	0.629
Total scores of ECOHIS	Median(IQR) (Range)	24 (10-31) (4-42)	15.5 (10-30) (4-44)	-0.578	0.563



**Figure 3.** Comparison between thalassemia and control groups aged from (11-14) years in the scores of Emotional well-being domain.

**Table 4.** Comparison between control groups aged from (8-10) years in total scores of total scores of CPQ8-10 and its domains.

Group aged 8-10 years		Control group scores	Thalassemia group scores	Mann-Whitney test	
				Z	P-value
Oral Symptoms	Median (IQR) (Range)	11 (8-14) (2-16)	7 (5-13) (1-19)	-1.468	0.142
Functional Limitations	Median(IQR) (Range)	4 (1-7) (0-18)	4 (3-6) (0-11)	-0.07	0.944
Emotional well-being	Median(IQR) (Range)	6 (3-9) (0-17)	3 (0-7) (0-13)	-1.38	0.168
Social well-being	Median(IQR) (Range)	10 (3-15) (0-23)	5 (0-13) (0-20)	-1.082	0.279
Total scores of CPQ <sub>8-10</sub>	Median(IQR) (Range)	37.5 (21.5-57.3) (4-82.5)	22.8 (10-46) (3.5-63)	-1.37	0.171

When the relation was done between the oral hygiene grades and the median of total scores of OHRQoL among different age groups of thalassemic children, it was demonstrated that the adolescent children aged from 11-14 years with poor oral hygiene grade had a significantly higher median of total score of OHRQoL (36) than those with fair or good oral hygiene level who had 21 and 13 median total scores of OHRQoL, respectively (the higher scores means poor OHRQoL).

**DISCUSSION**

To our knowledge only a few studies in literature correlated between oral health and quality of life in thalassemia patients [16,17]. Due to this scarcity in literature, the present study combined between dental examination and using OHRQoL questionnaires that aimed to compare the OHRQoL and oral health status of children with  $\beta$ -Thalassemia major with that of their normal counterparts.

The results showed that there was a significant difference in the level of education of fathers among both groups, but it should not be considered relevant and it might have appeared due to the relatively small sample size.

Our results implied that the children with  $\beta$ -TM have a higher percentage of class II malocclusion (35.9%) than controls (10.0%) with a statistically significant difference. A similar finding was documented by Gupta et al. [28], Sakshi et al. [29] and Mehdizadeh et al. [30] who used Angle’s classification in evaluating the prevalence of malocclusion in thalassemia patients. The higher percentage of class II malocclusion in thalassemia children has been attributed by different authors to marrow hyperplasia occurring due to chronic anemia, resulting in maxillary prominence and failure of pneumatization of maxillary sinuses and also due to mandibular retrusion occurring because of generalized growth retardation in the thalassemia children [30,31].

By asking the participants during the interview part about the presence of any dental problems, it was demonstrated that dental caries was the major dental problem in both

groups in comparison to other dental problems as gingival bleeding or teeth sensitivity. By intraoral examination the mean of (dmft) in primary dentition and the mean of (DMFT) in permanent dentition were not statistically different between both groups; this result was similar to the results reported by Arora et al. [7] and Qureshi et al. [8]. The mean (deft) in mixed dentition was significantly higher in thalassemia children than controls, these results were similar to the results reported by Phrai-in et al. [16] in Thailand, Al-Wahadni et al. [32] in Jordan, Gomber and Dewan [33] and Kaur [34] in India, who found significantly higher dental caries in the thalassemia group compared to control group, this similarity of results could be due to the resemblance of these developed communities with Egypt in socioeconomic status and living conditions. On the other hand, our results were contradictory to the studies conducted in India and Pakistan by and Arora et al. [7] Qureshi et al. [8], respectively, and this dissimilarity might be attributed to the variation in sample size, age range and methods used for determining the prevalence of dental caries.

Dental caries prevalence in  $\beta$ -TM patients might be due to the fact that parents are more concerned about the serious physical problems and high financial burden associated with thalassemia and pay less attention to the dental status [7]. Moreover, our results exposed the presence of high percentage of thalassemic children who never brush their teeth and never visit the dental office (56.6%), which can be also assumed to be a cause of dental caries.

Furthermore, dental caries in thalassemia group can be attributed to the improper dietary habits, malocclusion, lack of dental knowledge, reduced urea concentration and salivary Immunoglobulin A (IgA) level [35].

Oral hygiene status was evaluated by the assessment of the prevalence of dental debris, and calculus among both groups by using OHI-S (DI & CI). Our results showed a significant difference found in debris index and calculus index between the two groups which were either “fair” or “poor” in children with thalassemia as compared to “good” in the

control group. The overall OHI-S showed a statistically significant difference, and the percentage of children who had “poor” oral hygiene was higher in the thalassemia group than the control group. These results were in agreement with Phrai-in et al. [16] in Thailand, Al-Wahadni et al. [32] and Hattab et al. [6] in Jordan who examined 81, 61 and 54 children with  $\beta$ -TM, respectively, and reported that the thalassemic children had poor oral hygiene in comparison to the healthy peers. The previously mentioned studies were done in developing countries as Egypt and with almost similar sample size. On the contrary, the results were in disagreement with studies conducted in Italy by Luglie et al. [36] and in Iran by Mehdizadeh et al. [30] who showed a similarity between both groups in oral hygiene level which might be explained by the subsection of thalassemia patients to transfusional therapy at very early ages in these countries, thus reducing the typical facial characteristics and related oral problems.

The poor oral condition revealed in our study could be attributed to either the oral structural physiological changes that take place in  $\beta$ -TM patients or to the low priority given to the basic preventive dental care for these children because of the parents’ preoccupation with main life-threatening problem [8].

From our study, we found that thalassemia has no negative impact on OHRQoL as the results showed that the overall score of OHRQoL questionnaires and its domains were not significantly different between thalassemia and control children except the higher impact of oral health on emotional wellbeing aspect in 11-14 age group in the thalassemia group.

These results go hand in hand with an Iranian study conducted by Motalebnejad et al. [17] who reported that the OHRQoL was not influenced by the disease of thalassemia but there was a negative effect of the oral health status of thalassemia patients on their psychological aspect. In contrast to these results, a study conducted in Thailand by Phrai-in et al. [16] reported that there was a higher impact of thalassemia and oral health condition on OHRQoL in thalassemic children for all age groups and that the most commonly affected aspect of life was the difficulty with eating (functional aspect).

When different age groups were considered we found that:  $\beta$ -TM has no negative effect on OHRQoL in 2-7 and 8-10 years age groups. The absence of negative impact of thalassemia and dental status on OHRQoL in thalassemic children in early age group, 2-7 and 8-10, years could be explained by the lack of concern of these age groups about their dental status and self-image around their peers due to their lack of maturity and hence their psychological development. In addition to that, many families do not take their children to dental clinics and depend on analgesics to stop any complaint like dental pain and this is due to their low socioeconomic level and unawareness about the effects

of dental status on quality of life. These results were similar to the results obtained by Salem et al. [18] on congenital bleeding disorder patients of same age groups.

The thalassemia patients aged from 11 to 14 years old showed more negative impact of oral health status on emotional wellbeing aspects of life (This was demonstrated in their answers to questions addressing their frustration or feeling shy or upset because of their teeth or mouth) which can be explained by increased maturity and awareness of this age group about their oral problems and its negative effects on their life, also as our results showed that many children of thalassemia group believed that they have bad oral status and needed dental treatment. In addition to that, the presence of class II malocclusion and poor oral hygiene among this age group may undermine their self-image and self-esteem.

The association found between poor oral hygiene status and poor OHRQoL in adolescent thalassemia patients emphasized that the thalassemic children could be able to have better OHRQoL by improving their oral hygiene level and regularly visiting the dental office as many studies concluded [8,14,16]. However, our study had some limitations. The sample size of children could be considered a limitation, it was only from just one hospital, also the cross-sectional study cannot relate an inference about casual relationships, but the study filled the gap about the relation between the oral health status and Quality of life in a group of thalassemia patients in Cairo.

## CONCLUSION

Within the limitations of this study, it can be concluded that:

Patients with  $\beta$ -thalassemia major have a high prevalence of class II malocclusion, dental caries level and worse oral hygiene level that result in negative impact on the emotional wellbeing aspect in the adolescent thalassemia group; however, there is no negative impact of thalassemia itself as a disease on OHRQoL.

Therefore, patients with thalassemia should be advised about the importance of oral care and its impact on improving quality of life. Also, more collaboration between pediatrics and pediatric dentist is needed.

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