Correlation between Socioeconomic Level and Oral Health Related Quality of Life in Egyptian Schoolchildren: An Observational Cross-sectional Study

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Abstract

AIM: This observational and cross-sectional study aimed to assess the orthodontic treatment need, oral health-related quality of life (OHRQoL), and self-esteem in relation to socioeconomic level as well as investigate the incidence of malocclusion and orthodontic treatment need in Egyptian school children.

MATERIALS AND METHODS: Three hundred and twenty-four schoolchildren from governmental, private, and international schools representing different socioeconomic levels ranging from 11 to 14 years were recruited. Self-esteem and OHRQOL were measured using validated questionnaires. Clinical examination was used to assess the orthodontic treatment need represented by the index of orthodontic treatment need (IOTN) score as well as Angle’s classification of occlusion.

RESULTS: International schools showed the lowest total IOTN scores than governmental and private schools (p = 0.031). Governmental scores showed the statistically significantly highest mean CPQ11-14 score (Worst OHR-QOL) followed by private schools then international schools (p = 0.035). There was no statistically significant difference between Angle’s classes of malocclusion as well as self-esteem between the three different socioeconomic level groups.

CONCLUSION: Lower socioeconomic status (SES) was associated with higher orthodontic treatment need according to the total IOTN score and worst OHRQoL. Socioeconomic status did not affect the distribution of malocclusion according to Angle’s classification nor did it affect self-esteem.

Introduction

Malocclusion is a condition in which the teeth deviate from their normal relationship or alignment with other teeth within the same arch and/or teeth in the opposite arch [1]. It is one of the most common oral cavity defects, with significant functional and esthetic consequences. Periodontal health, caries incidence, teeth impactions, occlusal interferences, incisal vulnerability, and mandibular dysfunction may all be affected.

Malocclusion has a direct impact on the appearance of the face and smile. Compromised appearance can increase negative stereotyping and can pose detrimental impacts on the quality of life and self-esteem of the individual, hence affecting social and psychological well-being [2], [3], [4].

The quality of life is highly subjective and it is the degree to which a person is healthy, comfortable, and able to participate in or enjoy life events. The word “quality of life” is inherently ambiguous because it can apply to both, an individual’s personal experience of life as well as the living situations in which they find themselves. Oral health-related quality of life (OHRQoL) is a phrase used to assess how oral pain or discomfort impacts a person’s well-being in physical, psychological, and social activities. Numerous studies have linked OHRQoL to malocclusion [3], [5].

There is a potential relationship between early life socioeconomic status (SES) and the incidence of malocclusion as a low socioeconomic level was reported to be a risk factor for the prevalence of malocclusion and higher orthodontic treatment need [6], [7]. In addition, low SES was reported to be linked to worse OHRQoL and self-esteem [8], [9], [10], [11]. This study aimed to assess the orthodontic treatment need, OHRQoL, and self-esteem in relation to socioeconomic level as well as investigate the incidence of malocclusion and orthodontic treatment need in Egyptian school children.

Material and Methods

The total number of Egyptian schoolchildren from 11 to 14 years of age attending schools in the fifth Settlement, New Cairo Educational Administration
during the academic year 2019/2020 was 2015 students. Governmental, private, and international schools were all categorized representing different socioeconomic levels. Each category had one school picked at random. The total target population in that educational administration (students aged 11–14 years) was determined within each school. There were 1040 students in governmental school, 656 students in private school, and 319 students in international school according to the central agency for public mobilization and statistics (CAPMAS). The website http://www.raosoft.com/samplesize.html was used to calculate the sample size. With a 5% margin of

**A few questions about you**

- Would you say the **health** of your teeth, lips, jaws and mouth is:
  - □ Excellent
  - □ Very good
  - □ Good
  - □ Fair
  - □ poor

- How much does the condition of your teeth, lips, jaws or mouth affect your life overall?
  - □ Not at all
  - □ Very little
  - □ Some
  - □ A lot
  - □ Very much

**Questions about oral problems**

In the past 3 months, how often have you had:

| Question                                                                 | Never | Once or twice | More than twice | Every day or almost everyday |
|--------------------------------------------------------------------------|-------|---------------|-----------------|-----------------------------|
| 1- Pain in your teeth, lips, jaws or mouth?                              |       |               |                 |                             |
| 2- Bleeding gums?                                                        |       |               |                 |                             |
| 3- Sores in your mouth?                                                  |       |               |                 |                             |
| 4- Bad breath?                                                           |       |               |                 |                             |
| 5- Food stuck in or between your teeth?                                  |       |               |                 |                             |
| 6- Food stuck in the top of your mouth?                                  |       |               |                 |                             |
| 7- Breathed through your mouth?                                          |       |               |                 |                             |
| 8- Taken longer than others to eat a meal?                               |       |               |                 |                             |
| 9- Had trouble sleeping?                                                 |       |               |                 |                             |
| 10-Difficulty in biting or chewing hard foods like apples?               |       |               |                 |                             |
| 11-Difficulty in opening your mouth wide?                                |       |               |                 |                             |
| 12-Difficulty in saying any words?                                       |       |               |                 |                             |
| 13-Difficulty in eating foods you would like to eat?                     |       |               |                 |                             |
| 14-Difficulty in drinking with a straw?                                  |       |               |                 |                             |
| 15-Difficulty in drinking or eating hot or cold foods?                   |       |               |                 |                             |

Figure 1: CPQ$_{11-14}$, page 1
error, a 95% confidence interval, and a 50% response distribution, a 5% margin of error was chosen. The minimal sample size was 322 students, but this was increased to 324 students to account for the division by three (108 students from each school).

This investigation used structured questionnaires and clinical dental examinations to collect data after obtaining the required permissions from CAPMAS as well as obtaining permissions from the school principals and informed consent from the schoolchildren and their parents. The school types determined the different socioeconomic levels in Egypt. An internationally applied Child Perception Questionnaire for 11–14-year-old children and adolescents (CPQ$_{11-14}$) [12] was used to assess the OHRQoL of students participating in this study (Figures 1-3). CPQ$_{11-14}$ is a 37-item questionnaire that assesses oral health-related quality of life (OHRQoL) from four perspectives: Oral symptoms, functional limits, and emotional as well as social well-being. This questionnaire has been used extensively in the previous studies and was proved to have excellent validity and reliability [12], [13].

Harter’s self-perception profile for children [14], [15] was used to evaluate the student’s self-esteem (Figures 4 and 5). This is a self-report magnitude estimation scale that assesses children’s general sense of self-worth and self-competence in the academic abilities’ domain. It was created specifically to assess children’s self-esteem between the ages of 8 and 14. Scholastic, athletic, and social competence, as well as physical appearance and behavioral conduct, are the five self-concept areas that this measure delves into. A sixth subscale, Global Self-Worth (or self-esteem), is also included. There are 36 items in total, six for each subscale.

A children psychiatrist evaluated the questionnaires to ensure better applicability to the Egyptian culture and the sample age range. It was additionally translated from English to Arabic in a professional translation facility to meet the common Egyptian language and minimize any potential misunderstandings.

### Questions about school

Have you had these experiences because of your teeth, lips, jaws or mouth? If it was for another reason, answer “NEVER”.

| Question | Never | Once or twice | More than twice | Every day or almost everyday |
|----------|-------|---------------|-----------------|-----------------------------|
| 16-Missed school because of pain, appointments or surgery? |
| 17-Had a hard time paying attention in school? |
| 18-Had difficulty doing your homework? |
| 19-Not wanted to speak or read out loud in class? |

### Questions about feelings

Have you had these feelings because of your teeth, lips, jaws or mouth? If you felt this way for another reason, answer “NEVER”.

| Question | Never | Once or twice | More than twice | Every day or Almost Everyday |
|----------|-------|---------------|-----------------|-------------------------------|
| 20-Felt irritable or frustrated? |
| 21-Felt unsure of yourself? |
| 22-Felt shy or embarrassed? |
| 23-Been concerned about what other people think about your teeth, lips, mouth or jaws? |
| 24-Worried that you are not as good-looking as others? |
| 25-Been upset? |
| 26-Felt nervous or afraid? |
| 27-Worried that you are not as healthy as others? |
| 28-Worried that you are different than other people? |

Figure 2: CPQ$_{11-14}$ page 2
A quick clinical examination was done and the student’s occlusion was categorized according to Angle’s classification of malocclusion [16]. The orthodontic treatment need was evaluated by the index of orthodontic treatment need (IOTN) [17] with its two components, the dental health component (DHC) and esthetic component (AC). The first component of the IOTN scale to be evaluated was the dental health component, which has five grades ranging from “no need” for treatment to “severe need.” The single worst occlusal feature was given a grade. If the student received a grade of 3, indicating a need for treatment on the borderline, the esthetic component score was taken into account, and the student received a grade between 3.1 and 3.10.

The AC is intended to supplement the DHC by recording the severity of anterior esthetic tooth arrangement using ten images that are evaluated from 1 to 10 in terms of tooth esthetics, with Grade 1 indicating no esthetic need and Grade 10 indicating a severe esthetic need for treatment [18].

According to the British orthodontic society’s recommendations, a DHC of 4 or 5 suggests orthodontic treatment need, and a DHC of 3 (combined with an AC of higher than 6) also indicates orthodontic treatment need or severe malocclusion. A DHC of <4 and an AC score of <7 do not appear to necessitate treatment, according to most experts.

**Statistical analysis**

Qualitative data were presented as frequencies and percentages. Numerical data were explored for normality by checking the distribution of data and using tests of normality (Kolmogorov–Smirnov and Shapiro–Wilk tests). IOTN and Harter’s self-esteem as well as CPQ11–14 questionnaire scores data showed non-normal (non-parametric) distribution. Quantitative data were presented as mean and standard deviation (SD) values.

For qualitative data, the Chi-square test or Fisher’s Exact test was used for comparisons between groups. For non-parametric data, Kruskal–Wallis’s test was used to compare between the groups. Dunn’s test was used for pair-wise comparisons when Kruskal–Wallis’s test is significant. The significance level was set at P ≤ 0.05. Statistical analysis was performed with IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp.

**Results**

**Distribution of malocclusion according to angle’s classification**

There was no statistically significant difference between classes of malocclusion in the three groups (Table 1 and Figure 6).

**Assessment of detailed IOTN in the three groups/socioeconomic levels**

There was a statistically significant difference between IOTN scores in the three groups. Pair-wise comparisons between the groups revealed that there

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**Questions about your spare-time activities & being with other people**

Have you had these experiences because of your teeth, lips, jaws or mouth? If it was for another reason, answer "NEVER".

| Question                                                                 | Never | Once or twice | More than twice | Every day or almost everyday |
|-------------------------------------------------------------------------|-------|---------------|-----------------|-----------------------------|
| 29-Avoided taking part in activities like sports, clubs, music or school trips? |       |               |                 |                             |
| 30-Not wanted to talk to other people?                                  |       |               |                 |                             |
| 31-Avoided smiling or laughing when around other people?                |       |               |                 |                             |
| 32-Had difficulty playing a musical instrument such as a flute, clarinet or trumpet? |       |               |                 |                             |
| 33-Not wanted to spend time with other children?                        |       |               |                 |                             |
| 34-Argued with other people?                                           |       |               |                 |                             |
| 35-Been teased or called names?                                        |       |               |                 |                             |
| 36-Felt left out?                                                      |       |               |                 |                             |
| 37-Been asked questions about your teeth, lips, jaws or mouth?          |       |               |                 |                             |

Figure 3: CPQ11–14, page 3
was no statistically significant difference between governmental and private schools; both showed statistically significantly higher median IOTN scores than international schools. The comparison between IOTN scores in the three groups is shown in Table 2.

**DHC components of IOTN**

There was no statistically significant difference between DHC components of IOTN in the three groups. A comparison between the DHC components of IOTN in the three groups is shown in Table 3 and the bar chart representing the DHC components of IOTN in the three groups is shown in Figure 7.

**AC components of IOTN**

There was no statistically significant difference between AC components of IOTN in the three groups. The total number of participants is changed because these are the cases with DHC 3 only and not all cases. A comparison between AC components of IOTN in the three groups is shown in Table 4 and represented by a bar chart in Figure 8.

**CPQ11-14 scores in the three groups**

Regarding the total CPQ11-14 scores as shown in Table 5, there was a statistically significant difference between the three groups. Pair-wise comparisons between the groups revealed that governmental scores showed the statistically significantly highest mean CPQ11-14 score (Worst OHR-QOL). Private schools showed statistically significantly lower mean scores.

International scores showed the statistically significantly lowest mean CPQ11-14 score (Best OHR-QOL).

**Discussion**

The current observational and cross-sectional study investigated whether the socioeconomic status affected the incidence of malocclusion according to Angle’s classification as well as the orthodontic treatment need evaluated by the IOTN score. Moreover, the study investigated the oral health-related quality of life (OHRQoL) and self-esteem in relation to the socioeconomic level.

Regarding the distribution of the occlusal status in the current sample, normal occlusion was found in 12% of the total sample. There was no statistically significant difference between classes of malocclusion in the three school groups. Class I was the most prevalent type of malocclusion at 58.3% followed by Class II division 1 at 21.3% then Class III at 5.9% and the least class of malocclusion in prevalence was Class II division 2 which was 2.4%. There were no significant differences between the school types in the distribution of malocclusion classes which suggests that...
The prevalence of Class III malocclusion in the present study was in agreement with an Egyptian socio-economic level likely does not affect malocclusion through Angle’s classification.

### Table 1: Descriptive statistics and results of Fisher’s exact test for comparison between classes of malocclusion in the three groups

| Classes of malocclusion | Total (n = 324), n (%) | Governmental (n = 108), n (%) | Private (n = 108), n (%) | International (n = 108), n (%) | p  | Effect size (v) |
|------------------------|------------------------|-------------------------------|--------------------------|--------------------------------|----|-----------------|
| Normal                 | 39 (12)                | 8 (7.4)                       | 12 (11.1)                | 19 (17.6)                     | 0.426 | 0.115          |
| Class I                | 189 (58.3)             | 64 (59.3)                     | 65 (60.2)                | 60 (55.5)                     |     |                |
| Class II Division 1    | 69 (21.3)              | 25 (23.1)                     | 22 (20.4)                | 22 (20.4)                     |     |                |
| Class II Division 2    | 8 (2.4)                | 5 (4.6)                       | 2 (1.8)                  | 1 (0.9)                       |     |                |
| Class III              | 19 (5.9)               | 6 (5.6)                       | 7 (6.5)                  | 6 (5.6)                       |     |                |

### Table 2: Descriptive statistics and results of Kruskal–Wallis’s test for comparison between index of orthodontic treatment need scores in the three groups

| Mean (SD) | Median (range) | Mean (SD) | Median (range) | Mean (SD) | Median (range) | p  | Effect size (eta squared) |
|-----------|----------------|-----------|----------------|-----------|----------------|----|---------------------------|
| Governmental (n = 108) | Private (n = 108) | International (n = 108) | 3.13 (1.14) | 3.4 (1–5) | 3.11 (1.27) | 3.0 (1–5) | 2.89 (1.23) | 3.2 (1–5) | 0.031 | 0.016 |

*Significant at p ≤ 0.05. Different superscripts indicate statistically significant differences according to Dunn’s test. SD: Standard deviation.

### Table 3: Descriptive statistics and results of Chi-square test for comparison between dental health component of index of orthodontic treatment need in the three groups

| DHC grades | Governmental (n = 108), n (%) | Private (n = 108), n (%) | International (n = 108), n (%) | p  | Effect size (v) |
|------------|-------------------------------|--------------------------|--------------------------------|----|-----------------|
| 1          | 8 (7.4)                       | 12 (11.1)                | 19 (17.6)                     | 0.289 | 0.122          |
| 2          | 27 (25)                       | 25 (23.1)                | 28 (25.9)                     |     |                |
| 3          | 31 (28.7)                     | 27 (25)                  | 31 (28.7)                     |     |                |
| 4          | 25 (23.1)                     | 27 (25)                  | 22 (20.4)                     |     |                |
| 5          | 17 (15.7)                     | 17 (15.7)                | 8 (7.4)                       |     |                |

*Significant at p ≤ 0.05. DHC: Dental health component.

### Table 4: Descriptive statistics and results of Fisher’s exact test for comparison between aesthetic component of index of orthodontic treatment need in the three groups

| AC grades | Governmental (n = 31), n (%) | Private (n = 27), n (%) | International (n = 31), n (%) | p  | Effect size (v) |
|-----------|-------------------------------|--------------------------|--------------------------------|----|-----------------|
| 1          | 4 (12.9)                      | 3 (11.1)                 | 2 (6.5)                        | 0.995 | 0.192          |
| 2          | 4 (12.9)                      | 2 (7.4)                  | 5 (16.1)                       |     |                |
| 3          | 3 (9.7)                       | 6 (22.2)                 | 6 (19.4)                       |     |                |
| 4          | 8 (25.8)                      | 5 (18.5)                 | 5 (16.1)                       |     |                |
| 5          | 2 (6.5)                       | 4 (14.8)                 | 4 (12.9)                       |     |                |
| 6          | 1 (3.2)                       | 1 (3.7)                  | 1 (3.2)                        |     |                |
| 7          | 1 (3.2)                       | 0 (0)                    | 1 (3.2)                        |     |                |
| 8          | 1 (3.2)                       | 1 (3.7)                  | 2 (6.5)                        |     |                |
| 9          | 4 (12.9)                      | 3 (11.1)                 | 3 (9.7)                        |     |                |
| 10         | 3 (9.7)                       | 2 (7.4)                  | 2 (6.5)                        |     |                |

*Significant at p ≤ 0.05. AC: Esthetic component.

The prevalence of Class III malocclusion in the present study was in agreement with an Egyptian socio-economic level likely does not affect malocclusion through Angle’s classification.
survey study evaluating the prevalence of malocclusion among schoolchildren in Cairo by Fasifis et al. [19] (5.9%). However, compared to the same study, there was a tendency toward a decrease in the prevalence of accepted occlusion (25.7%) and an increase in Angle Class I (51.5%) and II (16.4%) malocclusion.

In the present study, the distribution of IOTN DHC and AC components in the studied sample showed the highest prevalence of DHC3 and AC4 which is considered borderline orthodontic treatment need. Moreover, 36% of the population aged 11–14 years old required orthodontic treatment, according to the IOTN DHC. As regards the AC, according to the results of the present investigation, 25% were assigned to the need for treatment in AC Grades 7–10. The results showed comparable results to a study investigating the orthodontic treatment need in urban Iranian schoolchildren aged 11–14 years which showed 36.1% had definite need according to the IOTN DC and 17.9% according to the IOTN AC [20].

The results of the present study revealed that the total IOTN score was lower in international schools than in governmental and private schools. In other words, orthodontic treatment need (IOTN) was greater in the lower socioeconomic level groups and this agrees with findings and conclusions by the previous studies [21], [22]. Participants with a higher socioeconomic level and those living in comparative social deprivation are likely to have different social norms in relation to oral health, which possibly leads to oral health inequality. Parents with a higher education level and socioeconomic status are more likely to pay greater attention to children’s dental care as well as keeping their teeth healthy and influencing them to maintain their oral health and avoid early childhood caries and extractions.

Regarding the oral health-related quality of life (OHR-QoL), total CPQ11-14 scores in the current study showed that the OHR-QOL was worst in governmental schools and the best in international schools which indicates that socioeconomic status (SES) plays an important role in the OHRQoL. These findings are in accordance with the findings of a meta-analysis study by Knorst et al. [23] which concluded that individuals with low SES had poorer OHRQoL, regardless of the country’s economic classification, SES indicator, and age group.

On the other hand, the self-esteem of the students, according to the current questionnaire results, was not likely affected by the difference in socioeconomic level as it showed no significant differences between the school types. The link between self-esteem and SES is possibly weaker in children than in adults and we would have likely come to quite different findings if the current investigation had studied different age groups.

### Conclusions

1. Lower SES was associated with higher orthodontic treatment need according to the total IOTN score and worst OHRQoL.
2. Socioeconomic status did not affect the distribution of malocclusion according to Angle’s

### Table 5: Descriptive statistics and results of Kruskal–Wallis’s test for comparison between CPQ11-14 questionnaire scores in the three groups

| CPQ11-14 domains | Governmental (n = 108) | Private (n = 108) | International (n = 108) |
|------------------|-----------------------|------------------|------------------------|
|                  | Mean                  | SD               | Mean                   | SD               | Mean                   | SD               | p        | Effect size (Eta squared) |
| Oral symptoms    | 5.12                  | 2.15             | 4.88                   | 2.31             | 4.6                    | 2.11             | 0.218   | 0.018                      |
| Functional limitation | 3.89                | 1.5              | 3.31                   | 1.34             | 3.11                   | 1.26             | 0.175   | 0.033                      |
| Emotional well-being | 5.34                 | 2.29             | 5                      | 3.1              | 4.75                   | 2.81             | 0.328   | 0.012                      |
| Social well-being | 4.31                  | 2.06             | 4.16                   | 2.45             | 3.92                   | 1.94             | 0.206   | 0.017                      |
| Total score      | 16.65<sup>a</sup>     | 9.13             | 17.35<sup>b</sup>       | 10.09            | 16.38<sup>c</sup>     | 9.67             | 0.035<sup>d</sup> | 0.108                      

<sup>a</sup>Significant at p ≤ 0.05, different superscripts in the same row indicate statistically significant differences according to Dunn’s test. SD: Standard deviation.

### Table 6: Descriptive statistics and results of Kruskal–Wallis’s test for comparison between Harter’s self-esteem scores in the three groups

| Harter’s self-esteem domains | Governmental (n = 108) | Private (n = 108) | International (n = 108) |
|-----------------------------|-----------------------|------------------|------------------------|
|                             | Mean                  | SD               | Mean                   | SD               | Mean                   | SD               | p        | Effect size (Eta squared) |
| Scholastic competence       | 2.39                  | 1.2              | 2.55                   | 1.18             | 2.79                   | 1.06             | 0.152   | 0.04                       |
| Social competence           | 2.42                  | 1.30             | 2.6                    | 0.84             | 2.88                   | 1.34             | 0.215   | 0.021                      |
| Athletic competence         | 2.55                  | 1.31             | 2.71                   | 1.07             | 2.79                   | 1.64             | 0.247   | 0.011                      |
| Physical appearance         | 2.3                   | 1.15             | 2.45                   | 1.24             | 2.68                   | 1.17             | 0.195   | 0.026                      |
| Behavioral conduct          | 2.42                  | 1.42             | 2.75                   | 1.36             | 2.9                    | 1.27             | 0.087   | 0.094                      |
| General mean                | 2.41                  | 1.38             | 2.61                   | 1.42             | 2.81                   | 1.42             | 0.090   | 0.105                      

<sup>a</sup>Significant at p ≤ 0.05. SD: Standard deviation.
classification nor did it affect self-esteem.

3. There was a tendency toward decrease in the prevalence of accepted occlusion in the total sample and an increase in Angle Class I and II malocclusion.

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