Prevalence of Orthodontic Treatment Need and Occlusal Traits in Schoolchildren

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Background. Widespread use of the IOTN along with detailed study of occlusal traits is suitable for planning community dental health resources. Objectives. The aim of current study was to assess the need for orthodontic treatment among school children of Tehran by means of the Dental Health Component (DHC) of the Index of Orthodontic Treatment Need (IOTN) and also to evaluate the occlusal traits of the subjects. Methods. 684 (343 boys and 341 girls) school children, 15 to 17 years of age, were selected at random from 12 schools to represent the four main areas of Tehran. The final sample who met the inclusion criteria comprised 643 subjects (322 males and 321 females). Malocclusion was determined with the Index of Orthodontic Treatment Need. The IOTN grades were statistically compared in the two genders using chi-square test. Results. Orthodontic treatment need, using the DHC, was found in only 9.0 per cent of the children. The prevalence of Angle Class I malocclusion in this study was higher than other malocclusions (65.2 per cent), followed by crowding in 62.7 per cent of the subjects. Conclusion. Orthodontic treatment need for Tehran high school students was relatively lower than that reported in most recent studies in Europe.

1. Introduction

Malocclusion in itself is neither a disease nor a life threatening condition [1]; nevertheless, the appearance of the mouth and smile plays a significant role in judgments regarding facial attractiveness. Thus, malocclusion has large physical, social, and psychological impact on the individual and society [2, 3]. Several studies have attempted to provide epidemiological reports of the prevalence of malocclusions in different ethnic groups [4–6]. In the last four decades scientists have proposed several indices for scoring how much the teeth deviate from the normal, as indicators of orthodontic treatment need. Grainger’s Treatment Priority Index (TPI) [7] which was proposed in 1960s can be named as one of the most prominent ones since it was widely used in the 1965–1970 US population surveys. Recently, the Index of Treatment Need (IOTN) was proposed by Brook and Shaw [8] in the United Kingdom as a scoring system for estimating treatment need of patients with various degrees of malocclusion. This index places patients in five grades from “no need for treatment” to “extreme treatment need” (Table 1).

A few investigations have evaluated the prevalence of malocclusion in Tehran, but none of these investigations studied the details of malocclusions. Therefore, the purpose of the present epidemiologic study was to evaluate the orthodontic variables of 15–17 year-old schoolchildren in Tehran by means of the IOTN.

2. Material and Methods

This study received approval from the Human Research Ethics Committee of IAU of Medical Sciences. Twelve schools...
### Table 1: IOTN treatment grades.

| Grade 5 (extreme/need treatment) | Grade 4 (severe/need treatment) | Grade 3 (moderate/borderline need) | Grade 2 (mild/little need) | Grade 1 (no need) |
|---------------------------------|---------------------------------|-----------------------------------|---------------------------|------------------|
| 5⋅i Impeded eruption of teeth (except for third molars) due to crowding, displacement, the presence of supernumerary teeth, retained deciduous teeth and any pathological cause | 4⋅h Less extensive hypodontia requiring prerestorative orthodontics or orthodontic space closure to obviate the need for a prosthesis | 3⋅a Increased overjet greater than 3.5 mm but less than or equal to 6 mm with incompetent lips | 2⋅a Increased overjet greater than 3.5 mm but less than or equal to 6 mm with competent lips | 1⋅ |  |
| 5⋅h Extensive hypodontia with restorative implications (more than 1 tooth missing in any quadrant) requiring prerestorative orthodontics | 4⋅a Increased overjet greater than 6 mm but less than or equal to 9 mm | 3⋅b Reverse overjet greater than 1 mm but less than or equal to 3.5 mm | 2⋅b Reverse overjet greater than 0 mm but less than or equal to 1 mm |  |  |
| 5⋅a Increased overjet greater than 9 mm | 4⋅b Reverse overjet greater than 3.5 mm with no masticatory or speech difficulties | 3⋅c Anterior or posterior crossbites with greater than 2 mm discrepancy between retruded contact position and intercuspal position | 2⋅c Anterior or posterior crossbite with less than or equal to 1 mm discrepancy between retruded contact position and intercuspal position |  |  |
| 5⋅m Reverse overjet greater than 3.5 mm with reported masticatory and speech difficulties | 4⋅c Reverse overjet greater than 1 mm but less than or equal to 3.5 mm with recorded masticatory and speech difficulties | 3⋅d Contact point displacements greater than 2 mm but less than or equal to 4 mm | 2⋅d Contact point displacements greater than 1 mm but less than or equal to 2 mm |  |  |
| 5⋅p Defects of cleft lip and palate and other craniofacial anomalies | 4⋅l Posterior lingual crossbite with no functional occlusal contact in one segment or both buccal segments | 3⋅e Lateral or anterior open bite greater than 2 mm but less than or equal to 4 mm | 2⋅e Anterior or posterior open bite greater than 1 mm but less than or equal to 2 mm |  |  |
| 5⋅s Submerged deciduous teeth | 4⋅d Severe contact point displacements greater than 4 mm | 3⋅f Deep overbite complete on gingival or palatal tissues but no trauma | 2⋅f Increased overbite greater than or equal to 3.5 mm without gingival contact |  |  |
|  | 4⋅e Extreme lateral or anterior open bites greater than 4 mm | 3⋅g Pre- or postnormal occlusions with no other anomalies (including up to half a unit discrepancy) | 2⋅g Pre- or postnormal occlusions with no other anomalies (including up to half a unit discrepancy) |  |  |
|  | 4⋅f Increased and complete overbite with gingival or palatal trauma |  |  |  |  |
|  | 4⋅t Partially erupted teeth, tipped and impacted against adjacent teeth |  |  |  |  |
|  | 4⋅x Presence of supernumerary teeth |  |  |  |  |

were selected among all high schools in east, west, north, south, and center of Tehran (Iran) by table of random numbers and 684 of the children attending these schools were also selected by table of random numbers. The study subject included 343 boys and 341 girls with the age range of 15–17 years. Parents of sampled children were notified about purposes of the study and informed written consent was obtained from each study participant and their parents. This study has been approved by the appropriate ethics committee and has therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

Each patient was examined for orthodontic treatment need with Dental Health Component (DHC) of the Index of Orthodontic Treatment Need (IOTN). The examination lasted approximately 15 minutes per child, following the World Health Organization guidelines [9]. The clinical examination was carried out by a dentist who had previously undergone calibration by two orthodontists to standardize his procedures. The examinations were conducted at school
The Statistical Package for Social Sciences, Version 20 (SPSS Inc., Chicago, IL, USA) was used to analyze the data. Chi-square test was used to analyze the data and P value was set at \( P < 0.05 \).

3. Results

A total of 684 students (15 to 17 years) from 12 secondary schools in Tehran were examined. 41 students were excluded because they either had received orthodontic treatment or were currently undergoing orthodontic treatment. The final sample comprised 643 subjects (322 males and 321 females).

Table 2 shows the age distribution of the samples. The distribution of grades of treatment need according to the IOTN is shown in Table 3. Orthodontic treatment was required by 9.0 percent of the population (grades 4 to 5). The prevalence of Angle Class I malocclusion in this study was higher than other malocclusions (65.2 per cent); Angle Class II and Class III prevalence rates were 24.1 and 10.7 per cent, respectively. 22.7 per cent of the subjects had an overjet greater than 4 mm and 5.9 per cent had a negative overjet. Crowding had the second highest prevalence after Class I malocclusion (62.7%).

Table 4 shows the prevalence of each occlusal trait in the total sample. The prevalence of Angle Class I malocclusion in this study was higher than other malocclusions (65.2 per cent); Angle Class II and Class III prevalence rates were 24.1 and 10.7 per cent, respectively. 22.7 per cent of the subjects had an overjet greater than 4 mm and 5.9 per cent had a negative overjet. Crowding had the second highest prevalence after Class I malocclusion (62.7%).

4. Discussion

In the present study, IOTN was used to record the orthodontic treatment need of the subjects [8]. According to the index, only 10 percent of the total subjects were in severe and extreme need of treatment (IOTN grades 4 and 5). This finding is relatively lower than most European surveys. Chestnutt et al. [10] found that 35% of 12-year-olds and 21% of 15-year-olds across UK had definite need for orthodontic treatment. Perillo et al. [4] reported that 27.3 percent of their sample, which included 703 schoolchildren, was in need of orthodontic treatment. Joseffson et al. [11] compared the frequency of malocclusion and orthodontic treatment need in 12- and 13-year-olds of Swedish and immigrant background and found a high frequency of treatment need in the Swedish group, with 39.5 per cent classified as grades 4 and 5. Puertas-Fernández et al. [12] reported that orthodontic treatment was required by 18.1 per cent of the Saharan population (grades 4-5). In another study conducted to determine the prevalence of malocclusion and orthodontic treatment need in 12- to 16-year-old Spanish schoolchildren, one in every five to six schoolchildren presented an orthodontic treatment need [13]. Nevertheless, they have pointed to the fact that one in four children in their initial sample was receiving or had received orthodontic treatment which might have affected their results. Higher results were also found in nearby regions in the Middle East. Hamdan [14] assess the need for orthodontic treatment among Jordanian schoolchildren and reported that a “definite need” for treatment was recorded in 28% of schoolchildren aged 14 to 17 years.

Nevertheless, the findings of this study are higher than East Asian countries. Esa et al. [15] found that only about 7% of 12-13-year-old schoolchildren in Malaysia had handicapping malocclusion that needed mandatory treatment. However, it must be noted that in the study of Esa et al. [15] Dental Aesthetic Index (DAI) was used to assess perceptions of need for orthodontic treatment. Joseffson et al. [11] reported that the orthodontist’s estimate of treatment need by means of IOTN was significantly higher than the subjects’ self-assessed need in all of their subjects. Puertas-Fernández et al. [12] also noted that assessment of particular occlusal features by dentists might lead them to overestimate the treatment need.

With regard to the occlusal findings, the highest prevalence was for crowding, which affected more than 62.7% of the subjects. This was similar to the findings of Perillo et al. [4] who also found crowding to have the highest prevalence of occlusal problems which affected 45.9% of their subjects.
Table 4: Prevalence of occlusal variables in the total sample ($N = 643$) (male = 322/female = 321).

| Occlusal variables                      | Male (%) | Female (%) | Total (%) | 95% confidence interval |
|-----------------------------------------|----------|------------|-----------|-------------------------|
| Class I                                 | 160 (49.7) | 259 (80.7) | 419 (65.2) | 61.52–68.88             |
| Class I—incisal relationship 1          | 132      | 202        | 334 (51.9) | 9.7–14.9                |
| Class I—incisal relationship 2          | 21       | 57         | 78 (12.1)  | 0.1–1.3                 |
| Class I—incisal relationship 3          | 3        | 0          | 3 (0.4)    | 0.17–1.5                |
| Class I—edge to edge                   | 4        | 0          | 4 (0.6)    |                         |
| Class II                                | 116 (36) | 39 (12.1)  | 155 (24.1) | 21.8–27.6               |
| Class II division 1                     | 94       | 34         | 128 (19.9) | 16.9–23.2               |
| Class II division 2                     | 22       | 5          | 27 (4.2)   | 2.8–6                   |
| Class III                               | 46 (14.3)| 23 (7.2)   | 69 (10.7)  | 8.31–13.09              |
| Class III subdivision                   | 9 (2.8)  | 33 (10.3)  | 42 (6.5)   | 4.7–8.7                 |
| Overjet                                 |          |            |           |                         |
| Overjet > 4 mm                          | 91 (28.3)| 55 (17.1)  | 146 (22.7) | 19.5–26.1               |
| Overjet 0–4 mm                          | 183 (56.8)| 248 (77.3)| 431 (67)   | 63.3–70.7               |
| Overjet < 0 mm                          | 31 (9.6) | 7 (2.2)    | 38 (5.9)   | 4.2–8                   |
| Edge to edge                            | 17 (5.3) | 11 (3.4)   | 28 (4.4)   | 2.9–6.2                 |
| Overbite                                |          |            |           |                         |
| Overbite > 4 mm                         | 11 (3.4) | 13 (4)     | 249 (3.7)  | 2.4–5.5                 |
| Overbite 0–4 mm                         | 195 (60.6)| 253 (78.8)| 448 (69.7) | 66–73.2                 |
| Overbite < 0 mm                         | 116 (36) | 55 (17.1)  | 171 (26.6) | 23.2–30.2               |
| Crossbite                               |          |            |           |                         |
| Unilateral posterior crossbite (left)   | 26 (8.1) | 26 (8.1)   | 52 (8.1)   | 6.1–10.5                |
| Unilateral posterior crossbite (right)  | 21 (6.5) | 25 (7.8)   | 46 (7.1)   | 5.2–9.4                 |
| Bilateral posterior crossbite           | 29 (9)   | 19 (5.9)   | 48 (7.5)   | 5.6–9.8                 |
| None                                    | 246 (76.4)| 251 (78.2)| 497 (77.3) | 73.9–80.5               |
| Crowding                                |          |            |           |                         |
| Upper                                   | 28 (8.7) | 20 (6.2)   | 48 (7.5)   | 5.6–9.8                 |
| Lower                                   | 103 (32) | 104 (32.4) | 207 (32.2) | 28.5–36                 |
| Both                                    | 72 (22.3)| 76 (23.7)  | 148 (23)   | 19.8–26.5               |
| None                                    | 119 (37) | 121 (37.7) | 240 (37.3) | 33.6–41.2               |
| Lip competency                          |          |            |           |                         |
| Competent                               | 281 (87.3)| 261 (81.3)| 542 (84.3) | 81.5–87.1               |
| Incompetent                             | 41 (12.7)| 60 (18.7)  | 101 (15.7) | 12.9–18.6               |
| TMD                                     |          |            |           |                         |
| Present (yes)                           | 44 (13.7)| 37 (11.5)  | 81 (13.0)  | 10.4–15.6               |
| Absent (no)                             | 278 (86.3)| 284 (88.5)| 562 (87) 87 (87.0) | 84.4–89.6           |
| Diastema                                |          |            |           |                         |
| 0 mm                                    | 272 (84.5)| 277 (86.3)| 549 (85.4) | 82.7–88.1               |
| 2 mm                                    | 19 (5.9) | 28 (8.7)   | 47 (7.3)   | 5.3–9.3                 |
| 3 mm                                    | 21 (6.5) | 8 (2.5)    | 29 (4.5)   | 2.9–6.1                 |
| 4 mm                                    | 5 (1.6)  | 3 (0.9)    | 8 (1.2)    | 0.4–2                   |
| 5 mm                                    | 5 (1.6)  | 5 (1.6)    | 10 (1.6)   | 0.62–2.57               |

5. Conclusion

Widespread use of the IOTN along with detailed study of occlusal traits is suitable for planning community dental health resources. In the population of Tehran only 1 in 11 schoolchildren presented an orthodontic treatment need, which is relatively lower than most European countries. However, it should be noted that about 7% of the students had already received orthodontic treatment.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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