European Journal of Orthodontics 31 (2009) 477–484
doi:10.1093/ejo/cjp031
Advance Access Publication 28 May 2009

Malocclusion and occlusal traits in an urban Iranian population. An epidemiological study of 11- to 14-year-old children

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SUMMARY The aim of this cross-sectional study was to determine the prevalence of malocclusions, occlusal traits, and their gender distribution in urban Iranian school children. Five hundred and two subjects (253 females and 249 males, aged 11–14 years) were examined. Molar relationship, overjet (OJ), overbite, midline deviation, crossbite, and crowding/spacing were recorded. Gender dimorphism was evaluated by the chi-square test.

According to the classification of Angle, the prevalence of Class I, Class II division 1, Class II division 2, and Class III malocclusions was 41.8, 24.1, 3.4, and 7.8 per cent, respectively. Symmetric molar relationship was present in 69.5 per cent. An OJ of at least 3.5 mm or more was present in 28.1 per cent; an OJ of more than 6 mm in 3.6 per cent, and 4.2 per cent had a reverse OJ. A normal overbite was observed in 60.4 per cent, while 34.5 per cent had an increased and 2.2 per cent a very deep overbite. An anterior open bite (AOB) was present in 1.6 per cent and a scissor bite or anterior crossbite in 2 and 8.4 per cent, respectively. A posterior crossbite was observed in 12.4 per cent (8.4 per cent unilateral, 2 per cent bilateral, and 2 per cent in association with an anterior crossbite). Midline deviation was present in 23.7 per cent. Severe crowding (≥5.1 mm) was observed in 16.7 and 10.8 per cent and spacing in 18.9 and 20.7 per cent of the maxillary and mandibular arches, respectively. Significant gender differences were found for overbite ($P < 0.001$), midline deviation ($P < 0.05$), and maxillary and mandibular arch crowding/spacing ($P < 0.05$). The prevalence of Class II malocclusions was comparable with Caucasians; however, the most severe forms of Class II malocclusions were rare in this Iranian population. The relative prevalence of Class III malocclusions in the present study was greater than in Caucasians. Crowding was the most common dental anomaly in both arches.

Introduction

Malocclusion is a manifestation of normal biological variability. This is a continuum ranging from an ideal occlusion to considerable deviation from normal. Studies of the incidence of malocclusion in particular populations date back to the early 1900s. Angle (1907) first established his classification of occlusion based on the molar relationship that is still used today. In his sample of 1000 Caucasians, 69 per cent had a normal occlusion or a Class I malocclusion, 19 per cent a Class II division 1, 4 per cent a Class II division 2, 3.4 per cent a Class III malocclusion, and the remaining an asymmetric occlusion. Thilander *et al.* (2001) reviewed previous studies and showed that the prevalence of malocclusions ranged from around 40 to 93 per cent and varied for different ethnic groups, different age groups, and different methods of registration. The results suggest that studies, even those conducted in the same population, may show great variability. Variables such as the differences in classification of occlusal relationships, the developmental status of the cohort, examiner differences in determining the boundaries of normal occlusion, and differences in sample sizes can affect the results.

In every country, there is a need to identify different malocclusions, their incidence, and the need for treatment so that appropriate manpower arrangement can be made. In this context, the primary aim of the present epidemiological study was to determine the prevalence of malocclusions and occlusal traits in 11- to 14-year-old children in an urban Iranian population and to compare the findings with other ethnic groups. A second aim was to investigate the gender distribution of occlusal traits and to evaluate whether occlusal traits are independent of gender.

Subjects and methods

Permission to undertake the survey was obtained from the Ministries of Health and Education. Ethical approval was given by the Research Ethics Committee and Faculty of Community Dentistry, School of Dentistry, Isfahan University of Medical Sciences.

The target population for the present cross-sectional study consisted of urban Iranian school children aged 11–14 years in the city of Isfahan, Iran. This age represents the period of eruption of the permanent canines and premolars when the majority of potential orthodontic problems become evident. Isfahan is the capital city of Isfahan province and Iran's third largest city. The city of Isfahan is located in the central part of Iran and houses 3 per cent of the whole

population. The city had a population of 1 986 542 and the Isfahan metropolitan area a population of 3 430 353 in the 2006 census, the second most populous metropolitan area after the capital.

Exclusion criteria for this study were subjects with craniofacial anomalies (clefts and syndromes) and non-Iranian nationals. To ensure random selection, using a stratified selection technique, six public schools were chosen from different geographic locations in the city of Isfahan. A total of 502 subjects (249 male and 253 female subjects) were examined, including six subjects who were undergoing orthodontic treatment at the time of the survey (one female and five males, treatment started 2–7 months before the examination). To avoid inter-examiner bias, the first author conducted the clinical examination. A mouth mirror, ruler, and a sliding digital caliper [Mitutoyo Digimatic®, Mitutoyo (UK) Ltd Andover, Hampshire, UK] were used. For every child, a registration chart related to malocclusion was designed which included all variables. The following parameters and criteria were used in the present study.

Sagittal dimension. Angle's classification was used to define the molar relationship: Angle's Class I, II, or III. The right and left antero-posterior (AP) molar relationships were scored in one-quarter unit increments. A half unit Class II or half unit Class III was considered as Class II or Class III, respectively.

Overjet (OJ) was defined as the distance from the most labial point of the incisal edge of the maxillary incisors to the most labial surface of the corresponding mandibular incisor and measured to the nearest half millimetre, parallel to the occlusal plane. A reverse OJ (negative) was registered when the lower incisors were in front of the upper incisors. OJ was recorded as follows: < -3.5, $-3.5 \leq$ to < -1, $-1 \leq$ to < 0, $0 \leq$ to ≤ 3.5, $3.5 <$ to ≤ 6, $6 <$ to ≤ 9, and > 9 mm.

An anterior crossbite (centrals and canines) also included subjects with a reverse OJ.

Vertical dimension. Overbite was considered as the vertical overlap of the incisors when the posterior teeth were in contact. An edge-to-edge incisor relationship was recorded if the maxillary and mandibular incisors occluded on their incisal edges. The normal range was determined at one-third coverage of the upper and lower incisors and recoded as follows:

Edge-to-edge, up to one-third coverage, one to two-thirds coverage, two to three-thirds coverage (without gingival or palatal trauma), and deep overbite (full coverage with gingival or palatal trauma).

An open bite was registered if the upper and lower incisors were vertically separated. Recorded as follows: ≤1, 1.1–2, 2.1–4, and >4 mm.

Transverse dimension. A posterior crossbite was registered when the buccal cusps of the maxillary premolars and/or molars occluded lingual to the buccal cusps of the mandibular antagonists (at least one pair of teeth, uni- or bilateral). Teeth in an edge-to edge position were also included.

A scissor bite was recoded when any of the maxillary premolars or molars occluded with the buccal surface of the mandibular antagonist teeth.

The position of the maxillary midline was assessed relative to the mandibular midline (measured in lower incisor widths) to establish any discrepancy. No judgements were made regarding the position of the lower midline with respect to the facial midline, recorded as follows: coincident, one-quarter to one-half (lower incisor width) and more than one-half (lower incisor width).

Alignment anomalies. The amount of crowding or spacing was recorded in both maxillary and mandibular arches. The difference between the sums of the mesio-distal tooth diameters and available arch circumferences was calculated for the upper and lower arches. Different components of the Index of Complexity, Outcome and Need (Daniels and Richmond, 2000) were used for measuring crowding/spacing. However in line with the orthodontic literature, crowding/spacing was also categorized as follows: no crowding or spacing, mild crowding (≤2 mm), moderate crowding (2.1–5 mm), and severe crowding (≥5.1 mm).

Any tooth movement due to previous extractions was taken into account. The criteria for defining a normal occlusion were a Class I canine and molar relationship, a positive OJ up to 3.5 mm, overbite up to one-third coverage, and well-aligned arches. Slightly irregular arches and crowding or spacing up to 0.5 mm in the upper or lower arch were included within normal limits.

Statistical analysis

All analyses were carried out using the Statistical Package for Social Sciences version 16 (SPSS Inc., Chicago, Illinois, USA). The absolute difference in right and left molar classification was calculated to determine the prevalence and severity of AP molar asymmetry. Sexual dimorphism was evaluated by the chi-square test (Angle Classes, molar relationship symmetry, OJ, overbite, crossbite, scissor bite, midline discrepancy, and crowding/spacing). Where necessary, Fisher's exact test was used. Any values less than $P < 0.05$ were interpreted as statistically significant. To assess examiner reliability, 5 per cent repeat examinations were undertaken throughout the period of data collection. None of the recorded variables showed any statistically significant difference ($P > 0.05$) between the original and repeated values.

Results

The prevalence of Class I, Class II division 1, Class II division 2, and Class III malocclusions was 41.8, 24.1, 3.4,

and 7.8 per cent, respectively (Table 1). A normal occlusion was found in 22.9 per cent of the subjects. The prevalence of a Class I molar relationship in female and male subjects was 64.4 and 65.1 per cent, respectively. The prevalence of Class I malocclusions in males (45 per cent) was higher than in females (38.7 per cent); however, there was no statistically significant difference between the genders with regard to malocclusion type ($P > 0.05$).

A symmetric molar relationship was found in 69.5 per cent of the subjects, while 12.2 per cent had an AP discrepancy of up to a one-quarter unit between the right and left molars (Table 2). The remaining 18.4 per cent had at least a half unit AP molar discrepancy. Of the symmetric AP molars, 50.7 per cent were Class I bilaterally. There was no significant difference between the genders with regard to molar relationship ($P > 0.05$). An asymmetric molar relationship of at least a half unit (AP discrepancy) was seen in 54.5, 41.1, and 48.7 per cent of Class II division 1, Class II division 2, and Class III subjects, respectively (Table 3). An asymmetric molar relationship was least prevalent among Class I malocclusion subjects and most prevalent among those with a Class II division 1 malocclusion. A lack of midline coincidence was documented in 23.7 per cent. There was a significant difference between the genders with regard to deviation of the maxillary midline relative to the mandibular midline ($P < 0.05$).

OJ values between 0 and 3.5 mm were found in 67.7 per cent of subjects (Table 4 and Figure 1). An OJ of at least 3.5 mm or more was observed in 28.1 per cent and of more than 6 mm in 3.6 per cent of the subjects. A reverse OJ was found in 4.2 per cent. No subject had a reverse OJ of more than 3.5 mm. There was no significant difference between the genders with regard to OJ values ($P > 0.05$). In 60.4 per cent, a normal OJ was present (Figure 2), while in 34.5 per cent the overbite was increased and 2.2 per cent had a very deep overbite. An anterior open bite (AOB) was observed in 1.6 per cent of the subjects. There was a significant difference between the genders with regard to overbite values ($P < 0.001$).

Posterior crossbites were found in 12.4 per cent of the subjects, unilaterally in 8.4 per cent and bilaterally in 2 per cent (Table 4). Ten (2 per cent) children had a crossbite in both the anterior and posterior segments. An anterior crossbite was registered in 8.4 per cent. There was no significant difference in the occurrence of a crossbite or scissor bite between the genders (Table 4). A crossbite was more prevalent in those with a Class III malocclusion with an occurrence rate of 61.5 per cent (Table 5). A scissor bite was observed in 2 per cent and was more prevalent in Class II division 2 subjects (23.5 per cent). Mild crowding (≤2 mm) was present in 38 and 41 per cent, severe crowding (≥5.1 mm) in 16.7 and 10.8 per cent, and spacing in 18.9 and 20.7 per cent of the maxillary and mandibular arches, respectively (Table 6 and Figures 3 and 4). There was a significant difference between the genders with regard to the maxillary and mandibular arch crowding and spacing ($P < 0.05$).

Table 1 Gender distribution of different malocclusions (percentages) according to Angle classification.

Malocclusion type	Male	Female	Total
Normal occlusion	20.1	25.7	22.9
Class I	45	38.7	41.8
Class II division 1	23.7	24.5	24.1
Class II division 2	4.4	2.4	3.4
Class III	6.8	8.7	7.8
Total (*n*)	249	253	502

Chi-square = 5.04, *df* = 4, $P > 0.05$.

Table 2 Gender distribution (percentages) of molar relationship symmetry and maxillary midline deviations relative to mandibular midlines.

	Male	Female	Total
Molar relationship symmetry*			
Symmetric	64.3	74.7	69.5
One-quarter cusp difference	16.1	8.3	12.2
One-half cusp difference	12.0	11.1	11.6
Three-quarters cusp difference	3.2	2.8	3
Full cusp difference	4.4	2.8	3.6
> One cusp difference	0	0.4	0.2
Maxillary midline deviations relative to mandibular midlines**			
Coincident	71.5	81	76.3
1/4–1/2 (lower incisor width)	22.5	13.4	17.9
>1/2 (lower incisor width)	6	5.5	5.8
Total (*n*)	249	253	502

*Chi-square = 10.32, *df* = 5, $P > 0.05$. **Chi-square = 7.28, *df* = 2, $P < 0.05$.

Discussion

For this cross-sectional study, a group of 11- to 14-year-old subjects were selected to provide preliminary information on the prevalence of malocclusions in an Iranian population. As the prevalence of malocclusions in different studies varies according to the methods of assessment, racial differences, and the chronological age of the sample, the findings should be compared with caution (Thilander *et al.*, 2001). The original classification according to Angle (1907) was used to categorize the malocclusions. Angle's classification has been the topic of many discussions in the literature because it does not incorporate vertical and transverse abnormalities (Du *et al.*, 1998; Brin *et al.*, 2000). However, it is a universally acceptable system that reduces subjectivity and provides an easy way of classifying malocclusions.

The prevalence of a Class I malocclusion in males (45 per cent) in this study was higher than that of females (38.7 per cent); however, the difference was not significant. Similar trends were found by Helm (1968). Contrary to the present result, Goose *et al.* (1957) and Wood (1971) showed

Table 3 Distribution of asymmetric molar relationship (percentages) according to malocclusion type.

Molar relationship symmetry	Malocclusion type					
	Normal	Class I	Class II division 1	Class II division 2	Class III	Total
Symmetric	94.8	84.3	33.9	47.1	35.9	69.5
One-quarter unit difference	5.2	15.7	11.6	11.8	15.4	12.2
One-half unit difference	0	0	38	23.5	20.5	11.6
Three-quarter unit difference	0	0	9.1	5.9	7.7	3
Full unit difference	0	0	7.4	11.8	17.9	3.6
> One unit difference	0	0	0	0	2.6	0.2
Total (*n*)	115	210	121	17	39	502

Table 4 Gender distribution (percentages) of overjet, overbite, crossbite, and scissor bite in the study sample.

	Male	Female	Total
Overjet*			
>9 mm	0.4	0	0.2
6 < to ≤ 9 mm	4.4	2.4	3.4
3.5 < to ≤ 6 mm	26.1	22.9	24.5
0 ≤ to ≤ 3.5 mm	64.3	71.1	67.7
−1 ≤ to < 0 mm	2.8	3.6	3.2
−3.5 ≤ to < −1 mm	2	0	1
Reverse overjet overall	4.8	3.6	4.2
Overbite**			
≤1/3 coverage	51.4	69.2	60.4
1/3 < to ≤ 2/3 coverage	25.7	21.3	23.5
2/3 < to ≤ full coverage (without gingival or palatal trauma)	14.1	3.6	8.8
Deep overbite, full coverage (with gingival or palatal trauma)	4	0.4	2.2
Edge to edge	3.6	3.6	3.6
Anterior open bite			
≤1 mm	0.8	1.2	1
1.1–2 mm	0	0	0
2.1–4 mm	0.4	0	0.2
>4 mm	0	0.8	0.4
Anterior open bite, overall	1.2	2	1.6
Crossbite***			
Anterior	8.8	7.9	8.4
Posterior unilateral (right)	6.4	2.8	4.6
Posterior unilateral (left)	4.8	2.8	3.8
Bilateral posterior	2	2	2
Anterior and posterior	2.8	1.2	2
Scissor bite****	2.4	1.6	2
Total (*n*)	249	253	502

*Chi-square = 9.26, *df* = 4, exact test, $P > 0.05$. **Chi-square = 34.03, *df* = 7, exact test, $P < 0.001$. ***Chi-square = 7.94, *df* = 5, $P > 0.05$. ****Continuity correction = 0.11, d*f* = 5, Fisher's exact test, $P > 0.05$.

female predominance in Class I malocclusions. The present sample had fewer normal and Class I malocclusions and more Class III malocclusion subjects compared with white American children (Proffit *et al.*, 1998). However in comparison with Danish children (Helm, 1968), Iranian children had more normal and Class III malocclusions and fewer Class I malocclusions. Class II malocclusions are less prevalent (5–10 per cent) in isolated populations such as American Indians (Grewe *et al.*, 1968), Eskimos (Wood, 1971), and native Australians (Homan and Davies, 1973). In the present study, Class II malocclusions were found in 27.5 per cent (24.1 per cent division 1 and 3.4 per cent division 2). The prevalence of Class II malocclusions was higher than in white Americans (Proffit *et al.*, 1998) and was comparable with western Europeans (Sclare, 1945; Goose *et al.*, 1957; Helm, 1968; Thilander and Myrberg, 1973). The more severe expression of Class II malocclusions was rare in the present sample. Iranian children also showed a higher prevalence of Class II malocclusions compared with Turks (Demir *et al.*, 2005), Egyptians (El-Mangoury and Mostafa, 1990), Lebanese (Saleh, 1999), and blacks and black Africans (Isiekwe, 1983; Diagne *et al.*, 1993; Ng'ang'a *et al.*, 1996).

The prevalence of Class III malocclusions varies among different ethnic groups and in Caucasians ranges between 1 and 4 per cent (Sclare, 1945; Gardiner, 1957; Goose *et al.*, 1957; Helm, 1968; Haynes, 1970; Foster and Day, 1974; Proffit *et al.*, 1998) and in Africans and African Americans between 4.6 and 8 per cent (Altemus, 1959; Isiekwe, 1983;

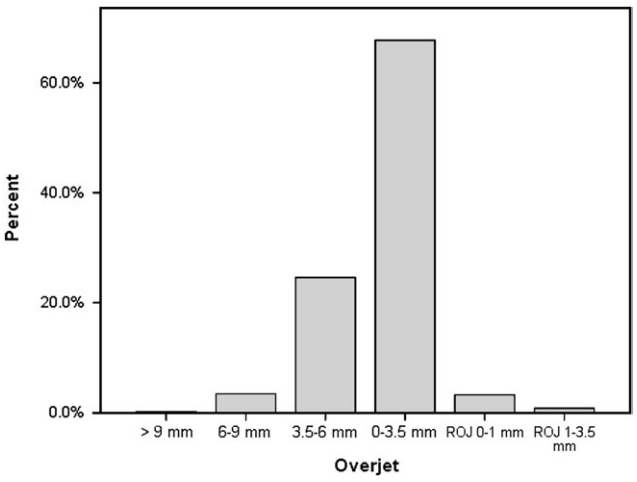

Figure 1 Distribution of overjet values (mm) in the study sample, ROJ = reverse overjet.

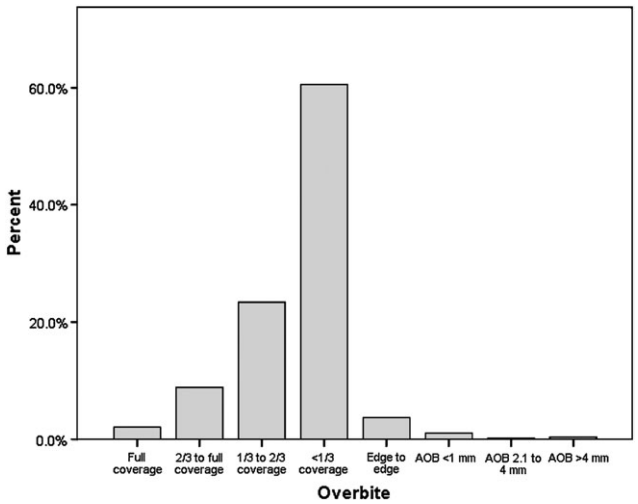

Figure 2 Distribution of overbite values in the study sample, AOB = anterior open bite.

Aggarwal and Odusanya, 1985; Garner and Butt, 1985; Otuyemi and Abidoye, 1993). In Asian societies, the frequency of Class III malocclusions is higher than in Caucasians and the incidence ranges between 4 and 13 per cent among Japanese (Ishii *et al.*, 1987) and between 4 and 14 per cent among Chinese (Allwright and Burndred, 1964; Lew *et al.*, 1993). Comparison of the findings of the current research with two similar studies previously carried out in Iran is shown in Table 7. The reported prevalence of subjects with a Class I molar relationship in those studies was comparable with the present result. However, they reported a higher prevalence of Class III malocclusions and lower prevalence of Class II malocclusions. Overall, the prevalence of Class III malocclusions in the present and a previous studies in Iran was greater than in Caucasians and was comparable with Latinos (Silva and Kang, 2001) and black Americans (Garner and Butt, 1985). This is probably due to the ethnic differences. Previous studies in Lebanon (Saleh, 1999) and Egypt (El-Mangoury and Mostafa, 1990) also yielded a higher prevalence of Class III malocclusions compared with white Americans or Caucasians. The difference between the prevalence of Class I and normal occlusions in the present and previous studies could be due to the overlap between normal occlusion and malocclusion (Moorrees and Gron, 1966). This factor might have resulted in some subjects with normal occlusion being classified as Class I malocclusions and *vice versa*.

The Class II division 1 and Class III malocclusion subjects showed the highest occurrence of an asymmetric molar relationship. Non-coincident midlines were observed in 23.7 per cent. Non-coincident midlines could have occurred when the maxillary, mandibular, or both midlines were deviated from the facial midline. It is also possible that the dental midlines were coincident and both were deviated from the facial midline, but the scoring system does not permit identification of these cases. In white Americans, 8.3 per cent of the individuals presented with a severe OJ of more than 6 mm (Brunelle *et al.*, 1996). In the present study, 67.7 per cent had OJ values between 0 and 3.5 mm, 28.1 per cent an OJ of at least 3.5 mm or more, and 3.6 per cent an OJ of more than 6 mm. Based on the distribution of OJ values, it seems that the most severe forms of Class II malocclusions are less prevalent in an Iranian population. A reverse OJ (negative) was found in 4.2 per cent of the studied subjects. In white Americans (Brunelle *et al.*, 1996), less than 1 per cent had a reverse (negative) OJ, suggesting a relatively higher prevalence of Class III malocclusions in the Iranian population.

The occurrence of a posterior crossbite has been reported in 4.6–16 per cent of children (Thilander *et al.*, 1984, 2001; Brunelle *et al.*, 1996). The prevalence of anterior and posterior crossbites in the present study was 8.4 and 12.4 per cent, respectively. Ravanmehr and Rashidi-Birgani (1998) in a study of malocclusions in Tehran, Iran, reported corresponding values of 6.6 and 10.8 per cent which are comparable with the current findings. Demir *et al.* (2005) studied 10- to 19-year-old Turkish subjects and reported a prevalence rate of 5.6 and 9.8 per cent for anterior and

Table 5 Distribution of subjects (percentages) with crossbite, and scissor bite according to different malocclusions.

	Malocclusion type					
	Normal	Class I	Class II division 1	Class II division 2	Class III	Total
Crossbite						
Anterior	0	11.9	5.8	0	25.6	8.4
Posterior unilateral (right)	0	2.9	9.9	5.9	10.3	4.6
Posterior unilateral (left)	0	5.2	5	0	5.1	3.8
Bilateral posterior	0	1.9	2.5	0	7.7	2
Anterior and posterior	0	1	2.5	0	12.8	2
Crossbite, overall	0	22.9	25.6	5.9	61.5	20.7
Scissor bite	0	1	2.5	23.5	2.6	2
Total (*n*)	115	210	121	17	39	502

Table 6 Gender distribution (percentages) of maxillary and mandibular arch crowding/spacing.

	Male	Female	Total
Maxillary arch*			
Spacing	22.1	15.8	18.9
Crowding			
No crowding or spacing	2.8	8.7	5.8
Mild (≤2 mm)	37.8	38.3	38
Moderate (2.1–5 mm)	20.5	20.6	20.5
Severe (≥5.1 mm)	16.9	16.6	16.7
Mandibular arch**			
Spacing	24.1	17.4	20.7
Crowding			
No crowding or spacing	2.8	8.3	5.6
Mild (≤2 mm)	39.4	42.7	41
Moderate (2.1–5 mm)	22.9	20.9	21.9
Severe (≥5.1 mm)	10.8	10.7	10.8
Total (*n*)	249	253	502

*Chi-square = 10.15, *df* = 4, $P < 0.05$.
**Chi-square = 10.06, *df* = 4, $P < 0.05$.

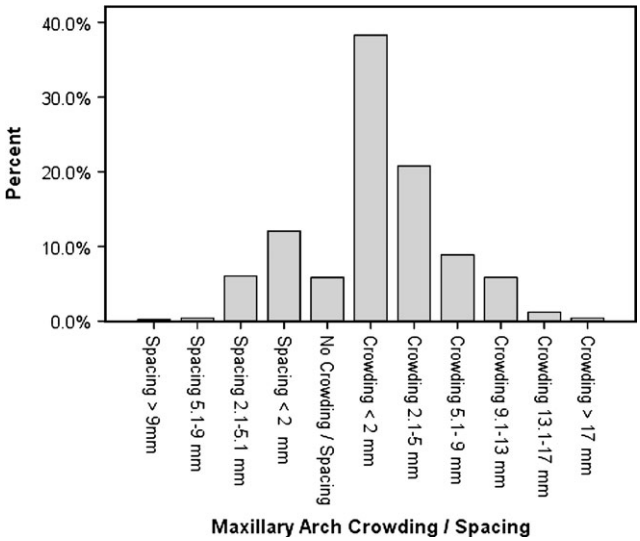

Figure 3 Distribution of the maxillary arch crowding/spacing in the study sample.

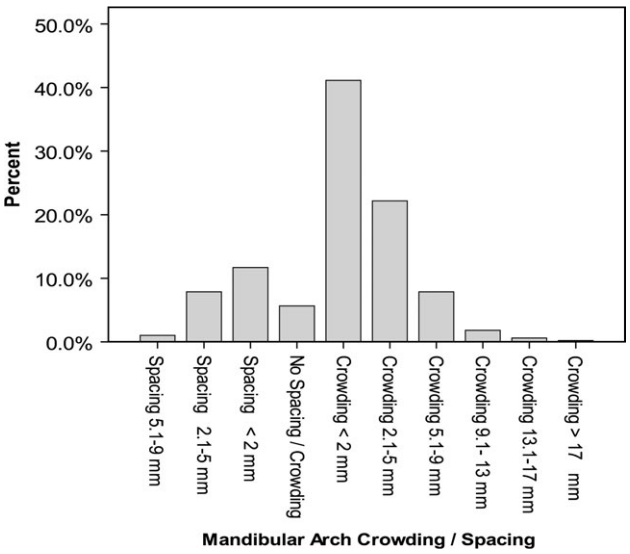

Figure 4 Distribution of mandibular arch crowding/spacing in the study sample.

posterior crossbites, respectively. Recently, Josefsson *et al.* (2007) in an investigation of 12- and 13-year-olds of Swedish and immigrant backgrounds reported values of 11.6 and 16.6 per cent, respectively.

A deep bite was more prevalent than an AOB in the present study with 34.5 per cent having an increased overbite and 2.2 per cent a very deep overbite (the upper incisors fully covered the lower incisors with gingival or palatal trauma). An AOB has been found to be more prevalent in black American adolescents (10 per cent). In white Americans, an overall prevalence of less than 5 per cent has been reported (Brunelle *et al.*, 1996). The prevalence of an AOB in Turks (Demir *et al.*, 2005) and north Jordanians (Abu Alhaija *et al.*, 2005) has been reported to be 7 and 2.9 per cent, respectively. In the present study, an AOB was present in 1.6 per cent of the studied subjects. Previous studies in Iran found a significantly higher prevalence of 6.6 (Ravanmehr and Rashidi-Birgani, 1998) and 7.3 (Ramezanzadeh and Hosseiny, 2005) per cent. This difference cannot be explained but may be due to the study sample differences.

The frequency of maxillary and mandibular crowding in different populations may provide valuable information about the characteristics of malocclusions and treatment strategies. Crowding was the most common dental anomaly in the maxillary and mandibular arches with a prevalence rate of 75.2 and 73.4 per cent, respectively. Nearly 40 per cent of the subjects had mild crowding (≤2 mm); however, severe crowding (≥5.1 mm) was only present in 16.7 and 10.8 per cent of the maxillary and mandibular dental arches, respectively. Spacing was less than one-third as common as crowding and was present in 18.9 and 20.7 per cent of the maxillary and mandibular arches, respectively. The results of present study are useful for public health planning and for the generation of hypotheses for future studies. As the incidence of malocclusion may change or fluctuate in populations with time, follow-up studies are required.

Conclusion

The prevalence of Class I, Class II division 1, Class II division 2, and Class III malocclusions was 41.8, 24.1, 3.4, and 7.8 per cent, respectively. A normal occlusion was found in 22.9 per cent of the subjects. The prevalence of subjects with Class II malocclusions in the present study was comparable with white Americans and western Europeans; however, there are some indications that the

Table 7 Reported prevalence of malocclusion (percentages) in Iranian children.

Authors (age range)	Malocclusion type					
	Normal	Class I	Class II division 1	Class II division 2	Class III	Sample size
Ravanmehr and Rashidi-Birgani (12–14 years)	16	48	15.6	5.2	15.2	500
Ramezanzadeh and Hosseiny (12–15 years)	13.7	54	16.4	6.8	9.2	469
Present study (11–14 years)	22.9	41.8	24.1	3.4	7.8	502

most severe forms of Class II malocclusions are rare in an Iranian population. The prevalence of a Class III malocclusion was greater than in Caucasians. Crowding was the most common dental anomaly in both arches.

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Acknowledgements

The authors would like to acknowledge the valuable assistance of Professor Stephen Richmond of Cardiff University, Wales, UK, and the support of Professor A. Khademi, Dean, School of Dentistry, Isfahan University of Medical Sciences, Iran.

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