Incisor crowding evaluation in children aged 7-11 years attending orthodontic clinics of the college of dentistry at Hawler Medical University

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Background and Objective: This study aimed to assess the permanent incisor region's crowding in both maxillary and mandibular arches among schoolchildren in Erbil city.
Method: Eighty-two dental casts of schoolchildren, aged 7 to 11 years, who attended orthodontic clinics in the dentistry college at Hawler Medical University, Erbil, Iraq, were studied by one examiner.
Results: (Around 47.6% of the children had crowding in the maxillary arch, 60.97% in the mandibular arch, and 32.92% of the children had crowding in both maxillary and mandibular arches.
Conclusion: It can be concluded that incisor crowding varies significantly (p <0.05) between the maxillary and mandibular arches in girls, and it also varies significantly (p <0.05) when comparing the data of boys and girls.
Keywords: Incisor crowding, Mixed dentition.

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Introduction

Incisor crowding is one of the most frequent types of malocclusion in young children during the early and middle mixed dentition periods. Incisor crowding has been a subject of increasing concern for children and their parents, and it is among the most common reasons patients seek orthodontic treatment.[1] Anterior crowding can be defined as the discrepancy between mesiodistal tooth widths of central and lateral permanent incisors and the available space in the anterior part of basal bone .[2]

Interceptive orthodontic treatment can be a practical approach when permanent incisor crowding is recognized early.[3] Several factors assumed to affect the development and severity of crowding, such as early loss of deciduous molars,[4] mesiodistal tooth and arch dimensions (large-sized teeth, small bony bases, or combination of them both), or as the result of an evolutionary trend towards a reduced facial skeletal size without a corresponding decrease in tooth size.[5]

Melo et al.,[6] found that the mesiodistal dimension of the deciduous canines, maxillary, and mandibular dental arch length as factors in the early mixed dentition could be crowding indicators. When the permanent lateral incisors erupt, an average of 1.6 mm of additional space is required for the perfect alignment of the four permanent incisors.[7] This slight crowding has been reported to be solved by a slight increase in inter- canine width and labial positioning of the permanent incisors relative to the primary incisors.[8] Children with crowding of the deciduous incisors are likely to develop crowding of the permanent incisors.[9] In paediatric dentistry and orthodontics, it is essential to distinguish between young children who will develop future problems of deficiency of space for the maxillary or mandibular incisors and children who only have tempo-

rary problems.[10]
The present study aimed to determine the presence of permanent incisor crowding in the upper and lower arches of 7 to 11 years old schoolchildren attending orthodontic clinics and receiving orthodontic treatment.

Methods

The case sheets of more than 200 schoolchildren were reviewed. Those schoolchildren attended the orthodontic clinic of the college of dentistry in Hawler medical university in Erbil city in Iraq for receiving treatment by the fifth-year student under the supervision of a senior orthodontist as part of their clinical credits requirement for the study year 2017-2018. In the first place, 98 cases were selected, and their casts were evaluated. Of those, maxillary and mandibular casts of 82 cases (36 girls and 26 boys) were included in this study, 16 cases were excluded as they did not meet the inclusion criteria or the quality of the casts was poor. These subjects were selected according to the following inclusion criteria:

- Age range from 7 to 11 years.
- Fully erupted permanent incisors and deciduous canines.
- No congenitally missing permanent incisors or premature loss of deciduous canines.
- No loss of tooth dimension by caries or attrition.
- No interproximal tooth abrasion.
- No supernumerary

The dental casts were numbered for ease of identification. The measurements were done as careful as possible to avoid any damage to beaks contact.
The measurements were carried out directly on plaster dental casts with a digital caliper (Rocky Mountains Inc., Denver, CO, USA) to the nearest 0.01 mm. The digital caliper has two fine tips to improve access interproximally (mesiodistally). Calculation of the available incisor space
Available incisor space was measured between mesial surfaces of the deciduous canines by dividing the incisor region of the dental arch into two straight line segments on the dental casts. If space exists between the central incisors, the anterior arch length segments are measured from the lateral incisors' distogingival surfaces to a midline point on the alveolar crest between the central incisors. The midline point is marked on the alveolar crest between the central incisors with a sharpened pencil to ensure that the two anterior segmental measurements are accurate (Figure 1).[11]

Calculation of the required incisor space

The crown's mesiodistal dimension was measured wherever possible, with the calipers' points parallel to the tooth's long axis and on the normal contact areas (Figure 2). The dividers or calipers were inserted from the buccal (labial), while the instrument is held at a right angle to the long axis in most cases. However, in some instances, the measurements were necessarily made with insertion from the occlusal (incisal), with the instrument is held in a plane parallel to the tooth's long axis instead. In cases of linguoversion, a lingual insertion was used. When teeth were rotated, the normal contact areas were chosen.[12]

Calculation of the crowding in the permanent incisor region

Total incisor widths were subtracted from available incisor space to calculate the degree of the crowding.

Statistical Analysis

All the data of the sample were subjected to computerized statistical analysis. The data were entered into the computer using Microsoft excel 2013 software in the first instance, and later the data were analyzed using the Statistical Package for the Social Science (Version 24; SPSS Inc., Chicago, IL, USA). Measurements were described as Frequencies, Means, standard deviations (SD), and minimum and maximum values were calculated for each measurement. The Shapiro Wilk test Wilk test ssessed the normal distribution fitness of the variables. Because the data of this study were not normally distributed, a non-parametric test of Mann-Whitney was used for the comparison of the degree of crowding of upper incisor, and lower incisor segments between both genders in the statistical evaluation, the following levels of significance are used:
Non-significant NS $p > 0.05$
Significant * $0.05 \geq p > 0.01$
Highly significant ** $0.01 \geq p > 0.001$
Very highly significant *** $p \leq 0.001$and statistical analysis was carried out using the

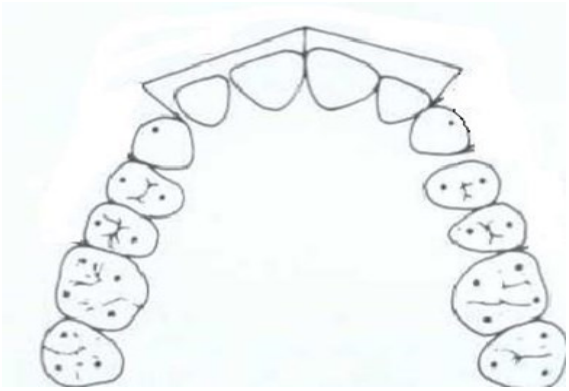

Figure 1. Segmental arch length measurement.

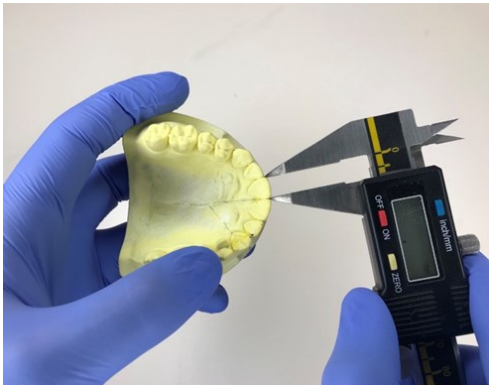

Figure 2. Mesiodistal tooth width measurement.

same package.

Method error

Method error was estimated by randomly choosing ten pairs of dental casts from the study sample. Measurements were recorded twice by the same operator after four weeks intervals. Intraclass Correlation Coefficient (ICC) was described by Shrout and Fleiss,[13] where the ICC ranges from 0 to 1, with 1 indicating perfect agreement, was used to test operators' (intra-examiner reliability).

Results

Intra-class correlation (ICC) results for intra-examiner measurements showed high levels of agreement (>0.9).

Of the 82 selected children whose dental casts were studies, 46 (56.1%) were girls, and 36 (43.9%) were boys, as shown in Table 1. 39 (47.56%) of the children had crowding in the maxillary arch, 50 (60.97%) in the mandibular arch, and 27 (32.92%) of the children had crowding in both maxillary and mandibular arches (Table 2).

In the girl group, the prevalence of incisor crowding was higher in the mandibular arch than the maxillary arch, and it was higher than the prevalence of incisor crowding in the mandibular arch in the boy group. The prevalence of incisor crowding was higher in the boys' maxillary arch than in the girl group. The prevalence of crowding in both arches was similar among boys. Detailed descriptive statistics of the maxillary and mandibular incisor crowding in both genders are shown in Table 3. Comparing the crowding in the maxillary incisor arch, boys and girls did not differ significantly from each other (p = 0.536). However, in boys, the crowding in the mandibular incisor arch was significantly less than that of girls (p < 0.03).

Boys showed significantly (p < 0.034) a higher degree of incisors crowding in the maxillary arch than the mandibular arch. Girls showed no significant differences (p = 0.334) between the incisor crowding of maxillary and mandibular arches. Table 4 illustrates the detail of these comparisons.

Table 1. Distributing of the sample by gender

Gender	Frequency	Percentage
Girl	46	56.10%
Boy	36	43.90%

Table 2. The prevalence of incisor crowding by gender in both arches

	Incisor crowding (Maxilla)		Incisor crowding (Mandible)		Incisor crowding (Maxilla & Mandible)	
	N	%	N	%	N	%
Children (82)	39	47.56	50	60.97	27	32.92
Boy (36)	19	52.78	19	52.78	11	30.56
Girl (48)	20	43.48	31	67.39	16	34.78

Table 3. Descriptive statistics of the maxillary and mandibular incisor crowding in both genders

	N	Mean	Maximum	Minimum	Std. Deviation
Girl - Maxillary Incisor crowding	20	-4.69	-7.01	-2.59	1.65
Girl lower incisor crowding	31	-5.29	-9.34	-1.16	2.36
Boys - Maxillary incisor crowding upper	19	-5.43	-10.81	-2.84	2.89
Boys lower incisor crowding	19	-3.81	-6.92	-1.50	2.01

Table 4. Comparison of incisor crowding by gender and arch using a non-parametric test

	Compared groups			
Statistics	Girl (upper vs. lower)	Boy (upper vs. lower)	Boy (lower) vs. Girl(lower)	Boy (upper) vs. Girl(upper)
Mann-Whitney U	261.000	108.000	186.500	168.000
Z	-0.947	-2.119	-2.166	-0.619
Asymp. Sig. (2tailed)	0.344	0.034	0.030	0.536

Discussion

Several methods have been suggested for the assessment of crowding. These methods include; the use of a brass wire,[14] calipers,[15] digitizers and stylus,[16] and three-dimensional recording devices.[17] The current study utilized a digital caliper.

Some previous studies identified the caliper as a reliable method for assessing dental crowding.[12,15] Most previous investigators used plaster casts to assess dental crowding, while few of them did measurements directly on the teeth.[18,19] This study's main findings are that the crowding in the mandibular incisor arch in boys was significantly less than that of girls, and boys showed significantly a higher degree of incisors crowding in the maxillary arch than the mandibular arch.

When comparing the results of the current study to previous studies, a higher prevalence of maxillary and mandibular incisor crowding is reported than that by Keski-Nisula et al.[20] They showed incisor crowding of 11.6% in the maxillary arch, 38.9% in the mandibular arch, and 8% in both arches in children with early mixed dentition. In the current study, the prevalence of mandibular incisor crowding and that of both arches in our sample was very similar to that of Saudi schoolchildren,[21] yet a high maxillary rate of incisor crowding was recorded in our study. On the other hand, Da Silva & Gleiser[10] have demonstrated a lower prevalence (29%) of crowding in mixed dentition mandibular incisor crowding in Brazilian children compared to the current study's finding.

The higher prevalence showed by the present study can be attributed to some factors such as the smaller sample size compared to other studies and sample selection from children attending orthodontic clinics; that is expected to have a comparatively higher prevalence of incisors crowding.

Other factors, such as the difference in race and ethnicity and early loss of deciduous molars, could impact anterior dental crowding's development and severity. As the first permanent molars drift mesially after premature loss of primary molars, they exert a greater force on the anterior segment (incisors and primary canines), subsequently causing a horizontal overlap leading to dental crowding.[2]

The present study revealed a statically significant (p <0.030) crowding in the lower incisor region in the girls' group compared to boys, which can be appropriated to an early growth spurt in girls. This can cause significant orofacial growth and lead to the early mandibular rotation, which is considered an element in incisors crowding.[22] This was in agreement with the study of Melo et al.[6] and AlShahrani,[21] conversely, crowding in the upper incisor segment was insignificant (p = 0.536) when boys and girls data were analyzed, and this was in contrast to the studies by Melo et al.,[6] and AlShahrani.[21]

The present study showed significant differences in the incisor crowding between the maxillary and mandibular arch in the boy group, and this is in agreement with the findings of Moorrees and Chadha;[7] however, no significant difference was found between upper and lower arches in girls which is in contrast to Moore's and Chadha study.[7]

Conclusion

Nearly five out of ten schoolchildren in Erbil city had crowding of the maxillary incisors, and six out of ten had crowding in the mandibular incisors. Three out of ten schoolchildren had crowding of the maxillary and mandibular incisors. The prevalence of crowding in mandibular incisors is higher than maxillary incisors in girls, while in boys, the prevalence was equal.

Conflicts of interest

The author reports no conflicts of interest.

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