Esthetic impact of maxillary midline diastema and mandibular crowding in children in the mixed dentition

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Introduction: This study aimed to investigate the esthetic impact of mandibular crowding and maxillary midline diastema in children in the mixed dentition. Methods: The sample for this cross-sectional study comprised 785 children, aged 8-10 years, in the late mixed dentition. Mandibular crowding and maxillary midline diastema were evaluated clinically with the Dental Aesthetic Index. Mandibular crowding and maxillary midline diastema were evaluated to determine tooth size-arch length discrepancies. The sample was stratified as group 1, children without maxillary midline diastema or mandibular crowding (n = 177); group 2, children with maxillary midline diastema (n = 256); group 3, children with mandibular crowding (n = 208); and group 4, children with maxillary midline diastema and mandibular crowding (n = 144). The subjective esthetic impact was evaluated using the Orthodontic Aesthetic Subjective Impact Score. Descriptive and exploratory analyses of the data were performed. A generalized linear model was applied, adjusted for the possible confounding variables (age, gender, and race) with a significance level of 5% because the Orthodontic Aesthetic Subjective Impact Score did not meet the assumptions of analysis of variance. Results: Children in groups 2 and 3 showed greater esthetic concern than group 1 (P < 0.05). Children in groups 2 and 3 did not show a significant difference with children in group 4 (P > 0.05). Conclusions: Children with mixed dentition with mandibular crowding or maxillary median diastema reported significantly more esthetic concern than children without these conditions. (Am J Orthod Dentofacial Orthop 2021;■■■■■)

The mixed dentition stage is characterized by the most significant changes in a child’s occlusal development.1,2 During this stage, the occlusion may improve or worsen.3-6 However, intermaxillary relationships in the anterior and posterior regions in the sagittal, transversal, and vertical planes are important in all stages of development, from primary to mixed to permanent dentition.7 Dental arch dimensions change systematically during intensive growth and development and do not necessarily characterize a malocclusion.3 Management of space problems plays an important role in orthodontic practice. An understanding of the dental development in mixed dentition can help in deciding when and how to intercept malocclusion early.8

Including the patient’s perception of oral health in oral health surveillance is as important as clinical registrations when making decisions regarding treatments.9 Children’s self-perception regarding their dental appearance begins early, around 8 years old, with criteria similar to adults.1,2,10 Mandibular crowding and mandibular midline diastema are among the occlusal conditions with the greatest impact on oral health-related quality of life (OHRQOL),1 reinforcing the hypothesis that the anterior occlusal characteristics are easily perceived by the individual.11 In addition to the psychosocial impact, the assessment of oral health should consider the esthetic impairment of oral conditions perceived by the child.12,13

Unesthetic anterior occlusal characteristics can have a negative impact on a child’s social and emotional well-being, independent of the population and stages of occlusal development.12,13,15,16 However, only OHRQOL has been studied in the mixed dentition stage.1,17 There are no reports in the literature specifically about...
the esthetic impact of anterior occlusal conditions in this stage. To fill this gap in the literature, it is essential to study the esthetic impact related to dental arch dimensions.

Similarly, it is important in this context to compare children with specific problems in the esthetic zone and how these problems impact the esthetic concern in mixed dentition. Therefore, this study aimed was to compare the esthetic impact of mandibular crowding and maxillary midline diastema in children in mixed dentition. The hypothesis was that children with tooth size-arch length discrepancy have a greater esthetic concern because this malocclusion is in the esthetic zone.

**MATERIAL AND METHODS**

A cross-sectional population-based study was conducted with children aged 8 to 10 years. The sample size was calculated using a 95% confidence interval, an effect size of 1.5, and power >90% for the main effects (presence of crowding and diastema) and interaction between them (presence of crowding × presence of diastema), for the significance level of 5%. The analysis was performed in the G*Power (Franz Faul, Christian-Albrechts-Universität, Kiel, Germany). The final sample comprised 785 children (395 girls and 390 boys) aged 8–10 years.

Only children in late mixed dentition were eligible for the study. Mixed dentition was determined about dental age, proposed by Van der Linden, and based exclusively on oral clinical examination. Current orthodontic treatment, deciduous dentition, early mixed dentition, and complete permanent dentition, as well as craniofacial syndromes, were exclusion criteria.

All children and their parents were invited to attend and were asked to give their informed consent before entering the study. Approval from the Research Ethics Committee was granted for the protocol and informed consent process of this study (no. 74393317.7.0000.5385). Data collection was performed between August and November 2017.

The Orthodontic Aesthetic Subjective Impact Score (OASIS) was used to determine the esthetic impact of malocclusion. The OASIS contains 5 items in the first part, each with 3 response choices. The responses are quantified and scored in ascending order according to the Likert scale. The second part includes the esthetic component of the Index of Orthodontic Treatment Need, which assesses psychosocial needs with a dental attractiveness scale illustrated by 10 colored photographs with a descending and continuous level of attractiveness. Image 1 represents the most attractive dental arrangement, and image 10 is the least attractive. After the examiner’s guidance, the children performed their self-assessment, identifying the level of esthetic compromise in the scale images they considered similar to their smile. The final OASIS result was obtained by adding together the responses to the instrument with the value of the image selected in the Index of Orthodontic Treatment Need-esthetic component for a single score. The esthetic impact was dichotomized by the median of responses. Lower values indicate lower esthetic concern, and higher values indicate greater esthetic concern.

The study was designed to evaluate esthetic concerns related to the orthodontic treatment need in groups with tooth size-arch length discrepancy (mandibular crowding and maxillary midline diastema) and those without tooth size discrepancy. The evaluation was performed clinically on the basis of the parameters recommended by the Dental Aesthetic Index (DAI). The DAI is analyzed through the sum of scores of occlusal characteristics evaluated added to a constant value. The sum of the scores classifies the orthodontic treatment need of patients determined by the severity of the occlusal conditions. For analysis purposes, the DAI was not calculated mathematically. The inferior crowding and midline diastema were used separately to verify their relationship with the esthetic concern related to orthodontic treatment needs.

The presence of crowding in anterior segments, including the 4 permanent incisors, was observed in the mandibular arch. Crowding was considered when the space between right and left canines was insufficient to accommodate the 4 incisors in alignment. Crowding in the anterior segment was classified as follows: 0, no crowding in the mandibular segment; and 1, crowding in the mandibular segment. Diastema in the midline between permanent maxillary central incisors was registered in millimeters from the height of the line of adjacent teeth or at the point of greater convexity of the proximal surface. The values considered were ≤ 1 mm, absence of diastema, and ≥ 1 mm presence of diastema.

As shown in Figure 1, the sample was stratified as group 1 children without midline diastema and mandibular crowding (n = 177); group 2 children with midline diastema (n = 256); group 3 with mandibular crowding (n = 208); and group 4 with midline diastema and mandibular crowding at the same time (n = 144).

The examinations were performed under artificial light at the schools by a previously trained examiner. Before the study began, a calibration process was conducted to obtain acceptable consistency for all the clinical conditions. The training stage consisted of a
theoretical discussion followed by a practical stage. During training and calibration, interexaminer and intraexaminer agreement were estimated by the intraclass correlation coefficient for mandibular crowding and maxillary midline diastema, with an acceptable limit value (kappa = 0.92).

Statistical analysis

Initially, descriptive and exploratory analyses of the data were performed. A generalized linear model was applied, adjusted for the possible confounding variables (age, sex, and race), with a significance level of 5%, because the OASIS total score did not meet the assumptions of analysis of variance. The analyses were performed in the R program (R Foundation for Statistical Computing, Vienna, Austria), with a significance level of 5%.

RESULTS

Table I shows the descriptive analysis of the 4 groups regarding the variables age, sex, and race. In group 1, there were 177 (22.5%) children, 87 boys and 90 girls, with a mean age of 9.4 years (standard deviation [SD], 0.8), whereas, in group 2, there were 256 (32.6%)
children, 127 boys and 129 girls, with a mean age of 9.0 years (SD, 0.7) participated. Group 3 consisted of 208 (26.5%) children, 110 boys and 98 girls, with a mean age of 9.2 years (SD, 0.8), and in group 4, there were 144 (18.4%) children, 66 boys and 78 girls, with a mean age of 8.9 years (SD, 0.8). Thus, gender, race, and age distribution between the groups were similar, and the sample was considered homogeneous.

Table II shows the esthetic impact analysis (total OASIS score) according to the groups, adjusted for gender, race, and age. Children in groups 2 and 3 showed greater esthetic concern than children in group 1 (P < 0.05). In contrast, children in groups 2 and 3 did not differ significantly from the children in group 4 regarding esthetic concern (P > 0.05) (Fig 2).

DISCUSSION

This study analyzed esthetic concerns related to tooth size-arch length discrepancies in the mixed dentition stage. The main finding was that children with mandibular crowding or maxillary midline diastema showed greater esthetic concern than children without these conditions. These findings support our hypothesis and are following previous studies performed on the permanent dentition stage, highlighting that malocclusions in the esthetic zone have a negative influence on the esthetic concern.13,16,24,25 The probable explanation may be that children’s esthetic perception shows criteria similar to adults.1,2,10

In general, the greater the severity of malocclusion, the greater the negative effect on the individual’s life because the malocclusion has been shown to predict a negative OHRQOL.14,16,26

As children begin to develop early self-perception ability with their appearance, it is easy to understand why esthetic conditions play an important role in the social interactions and psychological well-being of children.2,16,18,27 In this sense, according to the literature, the conditions most easily perceived and that influence children’s daily lives are crowding, spacing, and midline diastema.13,15,16,25,26,28 Thus, we choose the specific types of malocclusion, mandibular crowding, and maxillary midline diastema because they represent the esthetic changes that characterize the physiological transition of the occlusion, from primary to permanent dentition. In addition, mandibular crowding and the midline diastema are conditions that could influence arch length discrepancy in permanent dentition and have a direct impact on future orthodontic treatment.

Previous studies highlighted that malocclusion has a significantly greater negative impact on the OHRQOL of those with malocclusion than those without malocclusion in mixed dentition.11,14,26,29,30 As in permanent dentition, the children showed concern about the occlusal characteristics in the esthetic zone.6,25,26 However, this is the first study to evaluate the impact of malocclusion in the esthetic perception of children in mixed dentition, and therefore, this study will be a
contribution to the literature. Our findings showed a significant esthetic concern in the children presenting mandibular crowding and maxillary midline diastema. However, we did not find any statistical relationship in children with both occlusal conditions. Therefore, the study suggests that children with alterations in the esthetic zone worry more, regardless of the observed conditions.

To evaluate the occlusal conditions in the mixed dentition, considering the physiological changes of this stage of development and not the malocclusion in isolation, was the strength of the study. Furthermore, considering the wide range of occlusal variations in mixed dentition, the evaluated sample groups were quite homogeneous. As a limitation of the study, the subjective esthetic impact of these conditions was evaluated only over a specific period. The study would be strengthened if a longitudinal design had been performed during all the mixed dentition stages.

Finally, the effect of malocclusions on OHRQOL is modified by the age of the children and their cultural environment. However, the OHRQOL assessment instruments are not always able to identify the impact of malocclusion. The socioeconomic condition is still a determining factor in the daily life of an individual and a preponderant factor in the evaluation of OHRQOL. In contrast, esthetic concern seems to affect the individual, independent of age. This fact suggests that children detect malocclusions, and their self-perception is affected by them. In general, children might have problems relating malocclusion with oral health as most orthodontic conditions are asymptomatic, but the esthetic perception of malocclusion is easily perceived.

CONCLUSIONS

Children with mandibular crowding or maxillary midline diastema reported significantly more esthetic concern than children without these conditions in the mixed dentition stage.

AUTHOR CREDIT STATEMENT

Diego Patrik Alves Carneiro contributed to conceptualization, methodology, investigation, data curation, original draft preparation, and manuscript review and editing; Giovana Cherubi Venezian contributed to methodology, formal analysis, and manuscript review and editing; Heloísa Cristina Valdrighi contributed to manuscript review and editing; Marcelo de Castro Meneghim contributed to conceptualization, methodology, and manuscript review and editing; Silvia A.S. Vedovello contributed to conceptualization, methodology, data curation, original draft preparation, manuscript review and editing, supervision, and project administration.

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