Evaluation of Crossbites in Relation with Dental Arch Widths, Occlusion Type, Nutritive and Non-nutritive Sucking Habits and Respiratory Factors in the Early Mixed Dentition

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Purpose: The purpose of this study was to analyse the connection between dental arch widths, malocclusion type, nutritive sucking habits and non-nutritive sucking habits, and respiratory factors with the presence of crossbites (CB) in the early mixed dentition.

Materials and Methods: Data were collected from 72 children with and without CB. A questionnaire was applied to parents/carers to obtain information about nutritive and non-nutritive sucking habits. The posterior and anterior crossbites were diagnosed in a centric relationship. Dental arch widths were measured directly from the models by two calibrated examiners. The data were analysed statistically using chi-square and Fisher's exact tests.

Results: The incidence of Class III malocclusion and the presence of ear, nose and throat problems in the study group were significantly higher than in the control subjects ($p = 0.01$, $p = 0.047$). The mean breastfeeding duration for children in the CB group was found significantly shorter than in the control subjects ($p = 0.043$). The number of children with mouth breathing in sleep was significantly higher in the CB group than the control subjects ($p = 0.046$). The children with CB demonstrated a statistically significant increase in mandibular intercanine width (ICW) than the control group ($p = 0.044$).

Conclusion: The results demonstrated that an insufficient duration of breastfeeding, mouth breathing, ear-nose-throat problems and Class III malocclusion were associated with the presence of CB in the early mixed dentition.

Key words: arch widths, crossbite, mixed dentition, oral habits

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Researchers' attention on preventive orthodontic care requires rational planning of orthodontic preventive evaluations among children in the early stages of dental maturation.[29] Malocclusions are under consideration as a public health problem owing to their high prevalence, which takes third place following dental caries and periodontal diseases.[2,59] Aetiology of malocclusions are multifactorial and several studies have demonstrated the influence of malocclusions on quality of life with disturbances of oral health, oral function and dentofacial aesthetics.[9] The aetiologic factors include socioeconomic determinants, breastfeeding and feeding practices, nutritive sucking habits (NSH) and non-nutritive sucking habits (NNSH), respiratory and functional factors such as environmental, behavioural and biological-genetic intrinsic factors.[45] Occlusal relations in the deciduous dentition play a key role as a guide for the development of permanent dentition and the malocclusions in the deciduous dentition can be transferred into the permanent dentition.[7] Several studies have included the identification of alterations in the normality pattern among the possible aetiologic factors. Sucking behaviour has been reported as affecting occlusion and dental arch characteristics.[38,56] Breastfeeding activates normal craniofacial growth and development and prevents NNSH and modifications of the occlusion in the deciduous dentition.[23] Breastfeeding

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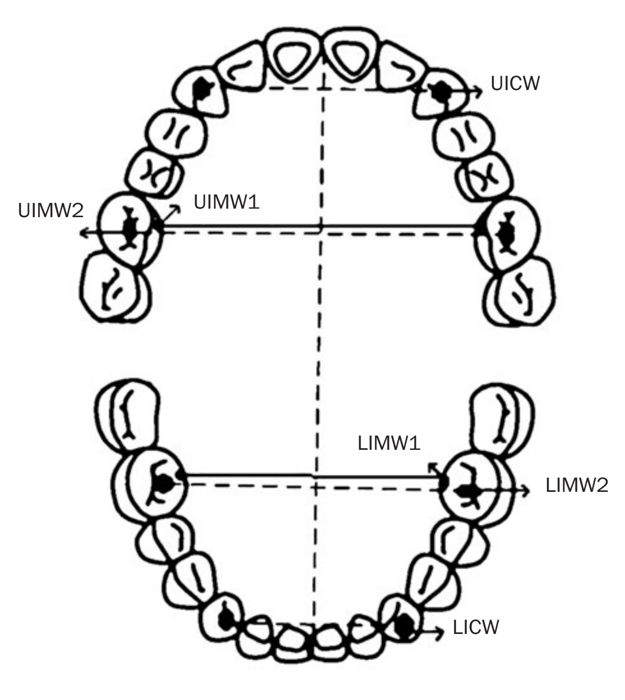

Fig 1 The maxillary and mandibular reference points for dental arch measurements. UICW: maxillary intercanine width, UIMW1: maxillary intermolar width 1, UIMW2: maxillary intermolar width 2, LICW: mandibular intercanine width, LIMW1: mandibular intermolar width 1, LIMW2: mandibular intermolar width 2.

and bottlefeeding involve different orofacial muscles, possibly leading to different effects on harmonic growth of maxilla and dental arches.[41,55] The sucking mechanism is different in the two instances.[58] The movement of lips and tongue contribute more to squeezing than to sucking and the tongue compresses the soft breast nipple against the palate using a peristaltic-like motion in breastfeeding. The bottlefeeding child uses the tongue with piston-like motion with a more powerful sucking activity of lips and cheeks. Bottlefeeding compared to breastfeeding causes a greater upward force on the palate.[36,41,58] Several oral habits can contribute to developmental failure of occlusions in the deciduous dentition depending on the duration, intensity and frequency of the habit.[21] Several reports have suggested that NNSH (usually in the form of thumb-sucking or pacifiers) may be responsible for some forms of malocclusion in children (especially open bite and posterior crossbite).[15,21]

The breathing pattern depends on the interaction between genetic and environmental factors and may influence the development of the transverse relationship, resulting in the development of crossbite.[16] Previous studies reported a correlation between posterior crossbites (CB) and mouth-breathing pattern, showing that posterior CB is more frequently seen in mouth-breathing subjects.[17,30]

The presence of obstruction of the airways, especially at the level of the nose and pharynx, forces the patient to breathe through the mouth.[53] Allergic rhinitis and adenotonsillar hypertrophy are the main cause of airway obstruction. They are usually associated with various symptoms: lack of nasal airflow, sneezing, itching, runny nose, but also snoring, possible obstructive sleep apnoea syndrome and increased respiratory infections such as ear infections, sinusitis and tonsillitis.[17,47]

Mouth breathing due to airway obstruction leads postural changes such as lip incompetence, low position of the tongue in the mouth floor and increased vertical facial height.[48]

The size of the deciduous dental arches allows us to determine the proper eruption of permanent teeth.[7] The maxillary and mandibular intercanine (ICW) and intermolar widths (IMW) are largely formed throughout the deciduous dentition and do not increment during growth and development.[3] The early mixed dentition is an important period to assist various preventive and interceptive assessments.[49] The treatment in mixed dentition needs the judgment and experience of both an orthodontist and a pedodontist. Proper diagnosis and treatment planning can produce the most satisfying results during the mixed dentition stage.[28]

The purpose of this study was to analyse the connection between dental arch widths, malocclusion type, NSH and NNSH, respiratory factors with the presence of crossbites (CB) in the early mixed dentition.

MATERIALS AND METHODS

Thirty-six (36) children (21 boys, 15 girls; mean age, 91.3 ± 8.7 months) with posterior (PCB, n = 7) and anterior crossbite (ACB, n = 29) and 36 children without CB (17 boys, 19 girls; mean age, 92.8 ± 7 months) were randomly selected from patients who were scheduled for dental treatments at Istanbul University, Faculty of Dentistry, Pediatric Dentistry Clinics. The Ethics Committee of Istanbul University, Faculty of Dentistry approved the study (2015/75). The procedures were explained in detail to the parents of the children involved in the study and their written consent received prior to the investigations.

At the start of the study the parents of all the children received a questionnaire, which was described previously by Melink et al.[29] The questionnaire included questions on previous or persisting habits, breathing pattern, allergies and ear, nose and throat (ENT) diseases. Information about a subject's nutritive (breast and bottlefeeding) and non-nutritive sucking behaviours (digit- or pacifier-sucking) was recorded in the questionnaire. The parents were also asked whether their child had a history or presence of ENT-related disease, such as allergic rhinitis, septum deviation, nasal congestion, rhinorrhoea, sinusitis, otitis media, tonsillitis, pharyngitis and adenoid disorders.

For each patient dft/DMFT values were recorded according to criteria of WHO,[59] and patient's tooth decays, fillings, missing teeth, space maintainers and prosthesis, if present, were recorded on the examination form. Angle's classification[6] was used as the diagnostic criterion for malocclusion. All the clinical measurements were performed by one of the authors. All occlusal relationships were evaluated with the child in centric occlusion. The types of malocclusion were determined by the evaluation of the vertical, anteroposterior and transverse planes.

Types of CB were recorded as either anterior crossbite (ACB) or posterior crossbite (PCB). Patients with anterior open bite weren't included to the study.

For the model measurements, alginate impressions were taken from each patient, then lower and upper jaw plaster models were obtained using hard plaster. Dental arch evaluations were recorded using these plaster models for studying transverse dimensions. Maxillary and mandibular ICW and IMWs were measured with a digital vernier calliper. Arch width measurements on dental casts were performed independently by two investigators. The internal consistency was above the acceptable level of Cronbach's $\alpha > 0.70$ ($\alpha = 0.947$).

The maxillary and mandibular reference points were determined for dental arch measurements (Fig 1). Those reference points were: distance between left and right primary canine's cusp tip, transverse distance between left and right first molars central fossa and distance between the points where left and right first molars palatinal groove and palatinal mucosa meet at the upper jaw; distance between left and right primary canine's cusp tip, transverse distance between left and right first molars central fossa and distance between the points where left and right first molars lingual groove and oral mucosa meet at the lower jaw, as described by Akkaya et al.[4] Two reference points were used for the measurement of intermolar width, in order to exterminate the influence of buccally erupted first molars.

Data Management and Statistical Analysis

The Power analysis performed using Power and Sample Size program and the number of samples detected for Power: 0.80 and α:0.05 was found to be a minimum of n: 12 for each group when Δ: 2.5 SD: 2.1 was taken. For the statistical analysis, the IBM SPSS Statistics 22 (IBM SPSS, Turkey) program was used. The normality of the data was checked by Shapiro–Wilks test. Student's t test was used for comparison of two groups for normal distribution parameters, and Mann Whitney U test was used for comparisons of non-normal distributed variables. Fisher's exact chi-square test, continuity (Yates) corrected chi-square test and Fisher Freeman Halton test were used for comparison of qualitative data. Statistical significance was assessed at $p < 0.05$.

RESULTS

The study sample involved 72 children between 6 and 8 years of age with complete eruption of permanent first molars. Patient baseline characteristics and demonstrative results for the subjects are given in Table 1.

There were no statistically significant differences in birth weight, prematurity, breastfeeding, bottlefeeding, pacifier-sucking, digit-sucking and nail-biting incidences between the two groups ($p > 0.05$). The occurrence of Class III malocclusion type and the presence of ENT problems in the study group were significantly higher than in the control subjects ($p = 0.01$, $p = 0.047$). The mean dft/DMFT scores were not significantly different between the two groups. Out of the 36 patients, 29 (80.6%) had ACB and 7 (19.4%) had unilateral PCB.

Duration of NSH and NNSHs for the subjects is presented in Table 2. The mean breastfeeding duration for children in the CB group was found significantly shorter than in the control subjects ($p = 0.043$). The duration of other NSH and NNSHs (bottlefeeding, pacifier-sucking, digit-sucking and nail-biting) did not depart significantly between the two groups ($p < 0.05$).

The incidence of mouth breathing, snoring, bruxism, bottlefeeding, pacifier- and digit-sucking in sleep is presented in Table 3. The issue of children with mouth breathing in sleep was significantly higher in the CB group than the control subjects ($p = 0.046$).

The measurements (mm) of maxillary and mandibular ICW and IMWs in the study and control groups are presented in Table 4. The children with PCB and ACB demonstrated statistically significant increase in mandibular ICW than the control group ($p = 0.044$). The maxillary ICW and IMWs of both groups did not differ statistically.

The measurements (mm) of dental arch widths in children with ACB are presented in Table 5. The children with ACB showed a statistically significant increase in mandibular ICW than the control group ($p = 0.002$).

The children with PCB were not analysed due to their small sample size.

DISCUSSION

Malocclusion may have an impact on subjects' oral health-related quality of life.[52] Patients with severe malocclusion may report various oral health impacts due to malocclusion that can affect their quality of life in many ways. Severe malocclusion is significantly associated with functional limitation, physical pain and social disability in young adults.[14,52].

Many young people with a malocclusion also have dental caries, missing teeth, periodontitis, temporomandibular disorder or stomatitis, which can seriously affect the patient's quality of life.[14,51] Functional limitation is reported to be one of the biggest problems in patients with severe malocclusion, because improper occlusion causes difficulties in eating, speaking and smiling.[14,51,52]

There are so many factors that can affect the development of occlusion in a negative way. The detection of these factors, especially during the period of deciduous and mixed dentition, is beneficial in preventing malocclusions because it provides early intervention opportunities.[35]

Transverse discrepancies during the period of deciduous and mixed dentition can occur due to occlusal interferences, which causes the mandibular to slide anterior or laterally.[28,35] It is reported that presence of cleft lip-palate,

Table 1 Characteristics of the study and control groups

Variable	Study group (Mean ± SD)		Control group (Mean ± SD)		p
Age (months)	91.3 ± 8.7		92.8 ± 7		0.423
Birth weight (gr)	3269.4 ± 702.8		3240 ± 587.1		0.848
dft	0.43 ± 0.25		0.38 ± 0.23		0.292
DMFT	0.07 ± 0.11		0.05 ± 0.09		0.530
Variable	Number	%	Number	%	
Sex					
Female	15	47.1	19	52.8	0.479
Male	21	58.3	17	47.2	
Prematurity					
Yes	3	8.3	4	11.1	0.788
No	33	91.7	32	88.9	
Occlusion type					
Class I	25	69.4	35	97.2	
Class II	0	0	1	2.8	
Class III	11	30.6	0	0	0.001**
Crossbite type					
Anterior crossbite	29	80.6			
Posterior crossbite	7	19.4			
Presence of					
Ear, nose, throat problems	12	33.3	4	11.1	0.047*
Asthma and allergies	11	30.6	6	16.7	0.267
Sucking habits					
Breastfeeding	35	97.2	33	91.7	0.614
Bottlefeeding	23	63.9	19	52.8	0.473
Pacifier-sucking	11	30.6	11	30.6	1.000
Digit-sucking	3	8.3	5	13.9	0.710
Nail-biting	11	30.6	11	30.6	1.000

*x2, **Fisher's exact test.

malformations in the head and neck region, bilateral condyle hypoplasia or hyperplasia, juvenile rheumatoid arthritis, neonatal intubation or long-term pressure to the palatal area, long durations of pacifier use or bottlefeeding, abnormal sucking habits, mouth breathing, reduction in tonic muscle activity and scar tissue due to trauma can cause CB malocclusion.[12,13,29,39,43]

It has been documented that children born at an inadequate birth weight may be more susceptible to predisposing factors leading to the formation of malocclusions.[18] Seow et al[46] has reported that development and eruption of teeth can be delayed and occlusion may be affected in children born at an inadequate birth weight. In this study, it is identified that 8.3% of the study group and 11.1% of the control group have low birth weight. There was no statistically significant difference in birth weight between two groups and there was no correlation between inadequate birth weight and CB malocclusion.

The aetiologic causes of malocclusions seen during primary dentition can vary widely from genetic or environmental.[3,13,22,29,33,39] Concerning the development of occlusion, NSH and NNSH of the children are considered as predisposing factors that constitute malocclusion. Sucking function is needed in oral muscle development.[55] Continuous and repetitive movements by breastfeeding regulate the proper development of oral muscles, increase muscle tone and enable development of the mouth functions.[20] Therefore, adequate nutrition with breastfeeding in the period of

Table 2 Duration of nutritive and non-nutritive sucking habits of the subjects

Variable (months)	Study group (Mean ± SD)	Control group (Mean ± SD)	p
Breastfeeding	13.87 ± 9.92	17.82 ± 7.89	0.043*
Bottlefeeding	25.26 ± 15.3	33.21 ± 24.75	0.371
Pacifier-sucking	21 ± 16.5	27.36 ± 18.52	0.374
Digit-sucking	6.67 ± 5.03	30 ± 23.24	0.097
Nail-biting	26.09 ± 19.98	29.27 ± 19.41	0.921

*Mann Whitney U test.

Table 3 The incidence of mouth breathing, snoring, bruxism, bottlefeeding, pacifier- and digit-sucking in sleep

	Study group		Control group		
Variable	Number	%	Number	%	p
Mouth breathing	23	63.8	11	30.5	0.046*
Snoring	9	25	3	8.3	0.114
Bruxism	5	13.9	4	11.1	1.000
Bottlefeeding	1	2.8	0	0	1.000
Pacifier-sucking	3	8.3	3	8.3	1.000
Digit-sucking	0	0	3	8.3	1.000

* Fisher's exact test.

Table 4 The measurements (mm) of maxillary intercanine (UICW), mandibular intercanine (LICW), maxillary intermolar (UIMW) and mandibular intermolar widths (LIMW) in the study and control groups

Measurements	Study group (Mean ± SD)	Control group (Mean ± SD)	p
UICW	30.0 ± 3.03	30.9 ± 2.42	0.167
UIMW 1	33.6 ± 3.21	33.46 ± 2.28	0.833
UIMW 2	44.03 ± 3.12	44.24 ± 2.81	0.767
LICW	25.07 ± 2.36	23.89 ± 2.52	0.044*
L IMW 1	31.81 ± 1.86	32.04 ± 2.19	0.623
LIMW 2	40.35 ± 2.05	40.4 ± 2.93	0.926

*Student's t test.

Table 5 The measurements (mm) of maxillary intercanine (UICW), mandibular intercanine (LICW), maxillary intermolar (UIMW) and mandibular intermolar widths (LIMW) in children with anterior crossbite and the control group

	Study group		Control group		
Measurements	Boys	Girls	Boys	Girls	p
UICW	32.3	32.8	29.0	31.2	0.579
LICW	27.8	26.1	25.7	24.4	0.002*
UIMW	46.0	45.8	46.6	42.7	0.434
LIMW	42.4	41.8	42.6	39.6	0.199

* Fisher's exact test.

development of orofacial structures is thought to have a positive effect.[32] Viggiano et al[55] and Karjalainen et al[20] described that breastfeeding for a sufficient period of time was a factor reducing the prevalence of CB. Other studies reported that the frequency of PCB is increased in children that were breastfed for less than 12 months.[2,3,13,25,42]

Published systematic reviews show some evidence of a protective effect of breastfeeding against primary dentition malocclusion but no supportive evidence for mixed dentition and permanent dentition malocclusions.[2,43] Peres et al[44] stated the importance of future studies associated with sucking movements rather than using general malocclusion indices on this subject.

In this study, increasing values of intercanine arch width in the mandibula with shorter durations of breastfeeding were observed in the study group. Thus, it may be concluded that adequate nutrition with breastfeeding seems to have a positive effect on development of orofacial structures, but in order to present a strong evidence of the protective effect of breastfeeding against mixed dentition malocclusions, the breastfeeding pattern of children must be evaluated in detail with other factors that can affect the development of occlusion.

Bottlefeeding is observed more often in children when breastfeeding is not sufficient or when it is short term.[2,34,40] The sucking function applied by the baby when bottlefed is very different from the sucking function applied when the baby is breastfed. There are some mechanisms suggesting that bottlefeeding habits are the cause of malocclusion: there is less need for muscle activation when milk is sucked out of bottle; therefore the development of muscles that provide the sucking function is affected negatively, and infantile swallowing can settle in the child as the tongue only controls the milk output during the bottle feeding.[58] It is reported that more than 60% of children who have been bottlefed show mouth breathing.[10] Narbutyte et al[34] stated that there was not enough evidence to explain the relation between bottlefeeding and skeletal malocclusions. In this study, it was found that 63.9% of the children in the study group were fed by bottle, but there was no statistically significant result to support the formation of malocclusion when compared with the control group.

Children who were breastfed naturally do not tend to any other objects such as pacifier and finger. NNSH are developed with the instinct to supply the child's sucking needs.[2,10,13] Different studies have reported different results regarding the frequency of pacifier and finger sucking habits. According to research in Australia and Sweden, the frequency of the pacifier-sucking habit was 18.2% and 61.5%, and for the finger sucking habit 70.3% and 10%, respectively.[12,24] The diversity in results show that NNSH may be affected by interpopulation cultural changes.[13] In this study, the frequency of the pacifier-sucking habit was found to be 30.6% and the frequency of the finger sucking habit at 11.1%.

Ozawa et al[40] have reported that children breastfed for shorter terms are more likely to have pacifier-sucking habits. Also, Melink et al[29] stated that there is a high correlation between PCB malocclusion and long-term use of a pacifier. Montaldo et al[31] reported that bottlefed children exhibited more oral habits and higher CB malocclusion, anterior open bite and distal molar involvement in comparison with breastfed children. In this study, the incidence of other oral habits in children using bottlefeeding was not evaluated in detail, and no statistically significant difference was found between the two groups when evaluated in terms of pacifier use and finger sucking habits.

Tooth grinding (bruxism) is described as the involuntary habitual grinding of the teeth.[11] It has been reported that this parafunctional activity is carried out completely at the subconscious level, causing no temporal neuromuscular protection mechanisms during parafunctional activity and causing a change of the masticatory system leading to temporomandibular disorders.[1,11,54] It has been stated in bruxism that increased forces applied to the teeth may cause tooth movement and thus may lead to malocclusions.[1] In this study, the frequency of bruxism was 12.5% of the total and it was found 55.5% in the control group.

Breathing patterns have a noteworthy function in the maturation of the face and teeth. Any condition that disrupts normal breathing physiology may affect facial development.[19] It has been reported that due to mouth breathing, the mandible will be rotated backwards, the head will be positioned in posteriorly and the tongue position will be inferior.[26,27] Melsen et al[30] and Melink et al[29] reported a correlation between PCB and mouth breathing, and that PCB was more frequent in children with mouth breathing. Behlfelt et al[8] reported that narrowing of the palate caused by hypertrophic tonsils would constrict the airway, the tongue position would be projected forwards, mandibular incisors would be inclined lingually and mouth breathing would occur. In this study, 63.8% of children with CB were found to have mouth breathing, which was significantly higher when compared to children in the control group.

Studies have reported that the narrowing of the oropharynx due to hypertrophic tonsils may lead to the opening of the mouth and causing the tongue to be positioned more anteriorly.[8,16,53] Behlfelt et al[8] reported a higher PCB incidence in children with hypertrophic tonsils compared to the control group. In this study, CB detection in 75% of children with ear-nose-throat problems supports the results of other investigations.[8,26,27] In addition; CB malocclusion was found in 80% of children in need of ear-nose-throat surgery. This result indicates that ear-nose-throat problems may increase the risk of malocclusions and it is important to evaluate patients with CB in terms of possible ear-nose-throat problems.

How dental caries causes malocclusion in the primary dentition is explained as follows. Following caries, the primary teeth lose mesiodistal tissue width and move forwards (physiological movement); as a result, the available space for permanent teeth is reduced. Malocclusion can occur due to the early loss of primary teeth.[50] In this study, there was no significantly difference in dft/DMFT values between two groups. This result was thought to be misleading because all the children in the study were patients who applied to Istanbul University Faculty of Dentistry, Department of Pedodontics. In the assignation of tooth decay and CB relationship, it is predicted that if the constituents of the dft/DMFT indices will be examined separately, results would be more accurate.

It is known that the aetiology of transverse discrepancies during deciduous and mixed dentition may be multifactorial.[35] Malocclusion type is very important to achieve right treatment of ACB and PCB. In a study consisting of 33 patients with bilateral PCB, it is reported that on the CB side the mandibular condyle moves to posterior, superior and lateral while mouth is closing, on the other side the condyle moves anterior, inferior and medial. Therefore, even if a patient has Class I occlusion type skeletally, while the mouth is closing there would be Class II type occlusion on the CB side and Class III type occlusion on the other side.[37] In this study, 69.4% of the patients with CB have Class I type occlusion and 30.6% of the patients with CB have Class III type occlusion as significantly higher than the control group. In the study group, 80.6% of the children had ACB and 19.4% had unilateral PCB. In patients with unilateral PCB, clinical examinations and measurements performed on the patients in order to determine whether the anomaly was dental or skeletal. In this study, pseudo Class III type occlusion was detected in 5.5% of children with CB. Non-skeletal CB malocclusions should be treated as early as possible and treatment planning should be targeted to stop oral habits if they still persist. It has been reported in many studies that jaw maturation and tooth alignment are affected by soft tissues and oral habits; the frequency and duration of sucking habits were reported to take role on the narrowing of maxillary arch.[29,31,40]

The size and shape of the dental arches is first ascertained by the cartilaginous skeletal structure in the foetal period. As growth and development continue, the growth of jaws begins to be affected by tooth germs. Dental arch widths are affected by dental development rather than endocrine development.[32] The alveolar width between the canine teeth increases between 6 and 8 years of age in the mandible, and 8 and 14 years of age in the maxilla. This increase is generally achieved by the tipping of the primary canines to the distal primate spaces.[32,56] Warren et al[57] reported which NNSH were investigated about their effect on dental arch development, and that the mandibular ICW would be shortened by a long-term pacifier-sucking habit. Aznar et al[7] reported that the pacifier-sucking habit would cause a noticeable decrease in ICW and IMW. Melink et al[29] stated that in the model measurements of children with CB, regardless of pacifier-sucking habits, the expected values of ICW were lower in the maxilla and higher in the mandibular. In a study by Ögaard et al,[38] 445 children with PCB were examined and it was reported that the mandibular ICW was higher in children who used pacifiers rather than the other children. In this study, we recorded that the mandibular ICW in the study group was higher than the control group. The increase in ICW can be explained by the functional and dental discrepancies instead of skeletal abnormalities.

One of the major advantages of the dental models used for the verification of clinically recorded relationships is the provision of the appearance of the occlusion in lingual terms. Consequently, the best way to understand the interdigital relationships are the model measurements. In this study, ICW and IMW of the maxilla and mandible were measured for transversal width measurements on the model.

For measurement of intermolar distance, the transverse distance between the left and right first molars' central fossa and between the points where left and right first molars palatal groove and palatal mucosa meet at the maxilla were noted (as two different measurements). This was to avoid the effect of buccal eruption of the first molars. Marking the reference points and then making measurements enabled better coherence of the measurements. When the models are examined, if the palatum durum is wide and the dentoalveolar processes leaning inward, it was accepted that the CB is of dental origin and caused by dental arch distortion. When the palatum durum is narrow and the maxillary teeth are inclined outward, it was accepted that the CB is skeletal and is caused by a narrow maxilla.[5] As a result of measurement of transversal distances in this study, only an increase in mandibular ICW was observed in cases of CB. This result suggests, considering that more of the patients in the study group had ACB, it was due to functional and dental alignment problems much more than skeletal malocclusions. The increase in mandibular ICW in subjects with ACB can be explained by exceptional axial inclination of the maxillary anterior teeth and functional forwards positioning/shift of the mandible on closure.

In the instances of CB malocclusion, it should be understood that when the mandibular width values are higher and the maxillary values are normal, there is a skeletal incompatibility, and further analysis of the patient should be performed. Early treatment of ACB and functional PCB cases is crucial to prevent future problems. At the same time, identifying and eliminating the aetiologic factors in treatment planning is the most important aspect that directs the treatment positively and increases its success.

CONCLUSION

The results demonstrated that insufficient duration of breastfeeding, mouth breathing, ear-nose-throat problems and Class III malocclusion were associated with the presence of crossbite in the early mixed dentition.

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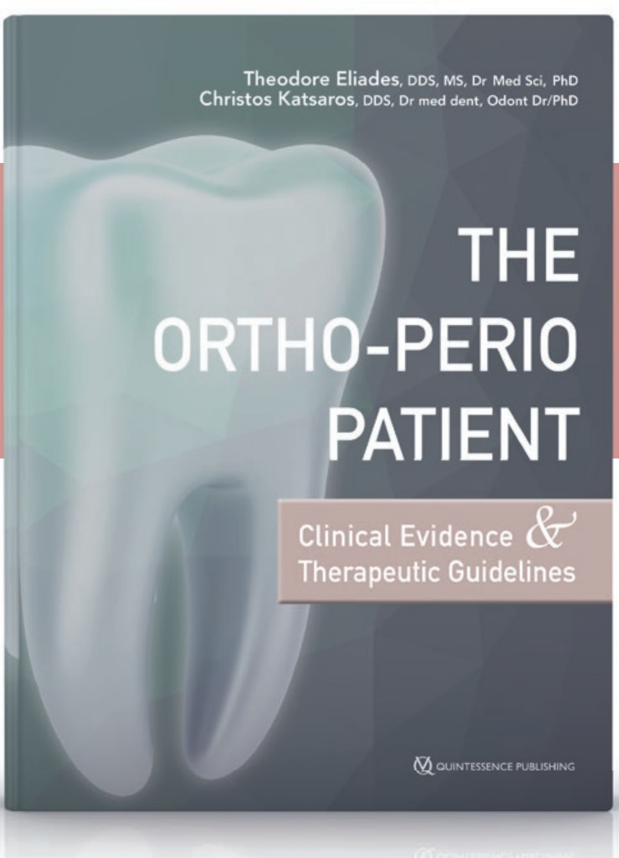

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