

Malocclusion in the deciduous dentition of Caucasian children

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SUMMARY In this study the occlusal characteristics of the deciduous dentition in a sample of young children were investigated to determine whether consensual trends exist, and if the occlusal characteristics in the primary dentition may be considered as acceptable predictors for occlusal relationships in the permanent dentition.

Four hundred and seven boys and three hundred and eighty-two girls aged 4–6 years participated in the epidemiological study. Recording of the occlusal traits was made according to the method described by the Fédération Dentaire Internationale in 1973, adapted to the primary dentition.

Lack of space was frequent (24 per cent in the upper anterior segments), as well as lateral crossbites (16 per cent), excessive overjet of 6 mm or more (6 per cent), Class II relationships (26 per cent) and anterior open bites (37.4 per cent). Obvious similarities could be seen with other investigations on occlusal traits of the primary dentition of Caucasian children. Cross-comparison with available data suggest that the development of the occlusion is a *continuum* for many aspects, with most of the major occlusal trends characterizing the permanent dentition in Europoid populations detectable at early stages. The striking difference in the primary dentition was the much higher prevalence of anterior open bites: this is the only figure expected to decrease dramatically in the permanent dentition. With due reservation inherent to the nature of epidemiological data on malocclusion and their interpretation, it is concluded that, provided the patient's cooperation is satisfactory, early attention may be given to malocclusion, but should mainly be focused on lateral crossbites and sagittal malrelationships.

Introduction

In modern countries today sophisticated attention is given to the development of dentofacial disorders and to the treatment of malocclusions. Treatment usually takes place during the adolescent years when the patient's motivation and cooperation are at their height. Incidentally, epidemiological investigations on occlusion in the permanent dentition have become difficult since a significant part of the population cannot be recorded because of orthodontic treatment. The present study intentionally describes the occlusal characteristics in the primary dentition in a sample of children and investigates whether consensual data can be found on this subject. Cross-comparison with data in the adult dentition

should confirm the validity of occlusal traits in the primary dentition as predictors for occlusal characteristics in the permanent dentition.

Subjects and methods

The survey was conducted in Mulhouse, a city of 110,000 inhabitants in the east of France. The study sample consisted of 407 males and 382 females aged 4–6 years, taken at random from the public nursery schools of the city. Only patients of Europoid extraction were retained in the study group, which represented 18 per cent of the city's population for the same age span (Institut National de la Statistique et des Etudes Economiques, 1992). All recordings were made by the same investigator (P.T.). Registration of

the occlusal characteristics were carried out according to the principles developed by the Fédération Dentaire Internationale (1973) consisting of an objective measurement of the occlusal traits. This method has been adapted to the primary dentition and a brief description is outlined below.

Intra-arch measurements

Crowding and spacing were recorded in the anterior segments which included the four incisors. Measurements were made, by the use of disposable metric rulers, to the closest millimetre.

Inter-arch measurements

For assessment of inter-arch relationships, the dentition was divided into three segments: right lateral, incisal and left lateral. Each lateral segment included the upper and lower canine and the molars. The incisal segment included upper and lower incisors. The assessment was made in the position of habitual maximal intercuspation.

Lateral segments

The major difficulty in investigation of the deciduous dentition is to accurately measure anteroposterior relationships of the lateral segments due to the great variability of the sagittal relationship of the temporary molars, even in ideal conditions. In an extensive study on occlusion in the primary dentition, Ravn (1975) concluded that canine occlusion is a more reliable indicator of inter-arch relationships than molar occlusion. Thus we decided to use the canine as a reference to assess the anteroposterior relationships of the lateral segments. The same criteria as those used by Ravn (1975) and originally described by Foster and Hamilton (1969) were used in this study. The relationship of the canines was considered to be Class I or normal if the tip of the upper primary canine was in the same vertical plane as the distal surface of the lower canine in central occlusion. If the tip of the upper primary canine was anterior to the distal surface of the lower primary canine in central occlusion, it was considered as Class II or distal occlusion, and if the tip of the maxillary primary canine was in posterior relationship to the distal surface of the

mandibular primary canine it was considered to be Class III or mesial occlusion.

Posterior open bite was recorded only if there was no overlap of cusps, i.e. a visible vertical space existed between the teeth when viewed perpendicular to the lateral segment.

The transverse relation of the lateral segments was measured by direct inspection: one of three separate relationships was recorded: (i) normal relationship; (ii) buccal crossbite; and (iii) lingual crossbite. The existence of a buccal or lingual crossbite was registered each time one or several teeth in the lateral segment was involved.

Incisal segments

The anterior overjet at the level of the central incisors was measured by a metric ruler to the closest millimetre.

The amount of vertical overlap of the upper incisors on the lower incisors was marked with a pencil and measured with a metric ruler to the closest millimetre. The amount of open bite was measured directly. Any situation that could not be assessed because of decayed or missing teeth was considered as unrecordable.

Chi-square and *t*-tests were used to compare sex- and age-variations using the SAS package only when sample size was adequate. The level of statistical significance was determined at the 0.05 level of confidence.

Results

The results are given in Tables 1–3 and in Figures 1–3.

The groups were evenly distributed with regard to sex and age (Table 1).

Spacing and crowding of the upper anterior segment (Figure 1)

In 67.5 per cent of the subjects, spacing ranged from 1 to 5 mm. In 8.1 per cent of the population, spacing exceeded 5 mm. There was no spacing or crowding in 24.2 per cent of the individuals. There was no significant difference between males and females, nor with age.

Spacing and crowding of the lower anterior arch (Figure 1)

In 45.5 per cent of the subjects, spacing was between 1 and 5 mm. In 0.4 per cent of the

Table 1 Distribution of the study sample.

Age	Males	Females
4	70	69
5	148	164
6	189	149
Total	407	382

Table 2 Distribution of canine sagittal relationships in males and females.

Right side	Left side		
	Class I	Class II	Class III
Males (<i>n</i> = 406)			
Class I	55.9	5.2	0
Class II	12.6	25.8	0
Class III	0	0	0.5
Females (<i>n</i> = 380)			
Class I	53.4	8.1	0.3
Class II	11.3	26.1	0
Class III	0.3	0	0.5

There was no sex difference. There was no change with age for Class I and Class II prevalence (the Class III sample was too small for statistical evaluation). There was no asymmetrical distribution of Class I and Class II on either side according to Cochran–Mantel–Haenszel statistics.

individuals, spacing exceeded 5 mm. No space or crowding was seen in 54.1 per cent of the cases. There was no sex difference, and no change with age.

Overjet (Figure 2)

An overjet ranging from 1 to 3 mm was seen in 76.1 per cent of the patients, while in 16.7 per cent of the children overjet exceeded 3 mm. Edge-to-edge or negative overjet was characterized in 7.2 per cent. A slight decrease in mean overjet could be seen between ages 5 and 6 ($P < 0.05$). There was no sex difference.

Overbite (Figure 3)

Edge-to-edge or negative overbite existed in 37.6 per cent of the subjects. An overbite between 1 and 3 mm was seen in 60.8 per cent of the children. Overbite exceeded 3 mm in 1.6 per cent

Table 3 Distribution of transverse relationships for the lateral segments in boys and girls.

Right side	Left side		
	Normal	Crossbite	Scissor bite
Males (<i>n</i> = 406)			
Normal	86.9	4.1	0
Crossbite	5.1	2.9	0
Scissors bite	0.2	0	0.4
Females (<i>n</i> = 381)			
Normal	79.7	6.3	0
Crossbite	8.1	5.2	0
Scissors bite	0.2	0.2	0

Crossbites were slightly more prevalent in females ($P < 0.05$). There was no change with age. No asymmetrical distribution for left or right side could be seen according to Cochran–Mantel–Haenszel statistics (scissors bites not tested).

of the cases. Mean overbite was more important in boys ($P < 0.01$). No change could be seen with age between either 4 and 5 or 5 and 6 years.

Sagittal relationships of the lateral segments (Table 2)

A bilateral Class II relationship existed in 25.8 per cent of the males and in 26.1 per cent of the females. Class III was only seen in 0.5 per cent of the group. There was no significant asymmetrical distribution of Class I and Class II on either side according to the Cochran–Mantel–Haenszel statistics (1990). No significant change could be observed with age on either side for Class I or Class II prevalence.

Transverse relationships, lateral segments (Table 3)

Crossbite existed in 16 per cent of the subjects. In 4.1 per cent of the individuals the crossbite was symmetrical. Scissors bite was noted in less than 1 per cent of the children. No change with age could be seen in either group, but crossbites were more prevalent in girls ($P < 0.05$). There was no asymmetrical distribution of crossbite according to the Cochran–Mantel–Haenszel statistics (1990).

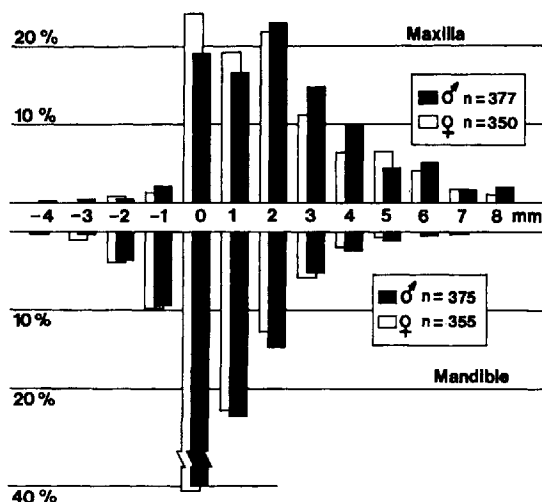


Figure 1 Spacing or crowding of the upper and lower anterior segments. No significant difference existed between males and females, and no change could be seen with age.

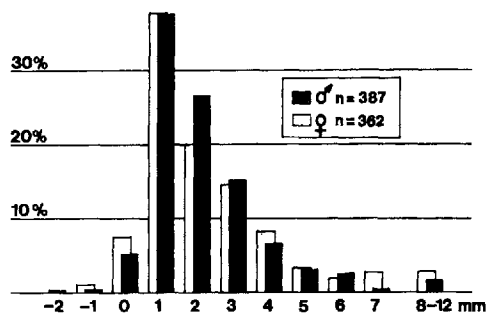


Figure 2 Distribution of the subjects according to overjet. There was no sex difference. No difference was seen in mean overjet between age 4 and 5 years, but a slight decrease could be seen between 5 and 6 years ($P < 0.05$).

Discussion

Epidemiological data on malocclusion show wide variations, depending notably on the population screened and on the recording method: but all epidemiological data on the prevalence of malocclusion should be viewed with some reservations. Nevertheless, some specific common trends do prevail within racial groups and no strong deviations from these tendencies can be expected, unless for specific circumstances.

Tooth-to-jaw discrepancy is certainly the most

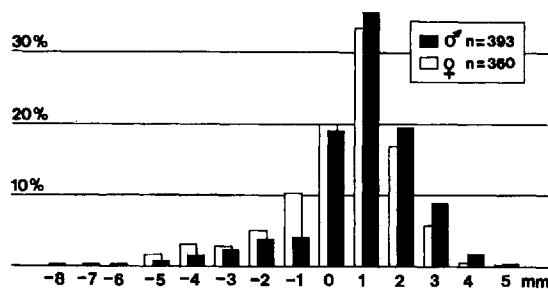


Figure 3 Distribution of overbite in the study group. Mean overbite was greater in boys ($P < 0.01$). No change could be seen with age.

common feature in modern man's dentition. Strong genetic control and increased outbreeding have been considered as significant contributors to the high prevalence of crowding in today's populations. In this study contacts or crowding were observed between the upper anterior teeth in 24 per cent of the individuals. The prevalence of crowding, however, is always higher at later stages in Caucasian populations (Helm, 1968; Ingervall *et al.*, 1972; Thilander and Myrberg, 1973; Lavelle, 1976; Hannuksela, 1977; Infante-Rivard and Payette, 1981; McLain and Proffit, 1985; Kerosuo *et al.*, 1991). Accordingly, individuals with contacts between their upper anterior deciduous teeth can be expected to be the most potential candidates for crowding in the permanent dentition, though improved space conditions to accommodate the permanent incisors may result from surface remodelling accompanying the eruption of the permanent incisors and from leeway space. The fact that extractions are performed in 41–55 per cent of the orthodontic patients in the east of France (Abehsera, 1990; Gessier, 1990; Kuntz *et al.*, 1990; Couratier, 1993; Fiacre *et al.*, 1996) shows agreement with the high prevalence of children with no spacing in the anterior segments seen in this study.

The children with an overjet of 1–3 mm accounted, in this study, for 76 per cent of the population. Excessive overjet greater than 6 mm was found in 3.7 per cent of the present population, while the same conditions existed in 2.1 per cent of a group of 3-year-old Finnish children (Järvinen and Lehtinen, 1977).

Table 4 Sagittal relationships of the dental arches in the primary dentition according to the literature.

Author	Age	n	Ref.	Uni./Bilat.	Class II %		Class III %	
					Males	Females	Males	Females
Humphreys and Leighton (1950)	2-5.5	2711	molars	-	27	23.2	0.6	1.8
Foster and Hamilton (1969)	2.5-3	100	molars	bilat.		31		1.4
Ravn (1975)	3	310	canines	bilat.		36.6		0.6
Infante (1975)	2-5	680	canines	bilat.		19.1		1
Muig (1991)	3.5-7.2	270	-	-		24.1		
Bacon <i>et al.</i> (this study)	4-6	789	canines	bilat.	25.8	26.1	0.5	0.5

Comparable similarity existed for excessive overjet 6 mm or greater, which was reported in 6 per cent of this group and in 6.8 per cent of a group of 3-year-old Danish children (Ravn, 1975). More severe malocclusions are usually seen in homologous populations in the permanent dentition, where the prevalence of overjet 6 mm or greater always exceeds 10 per cent (Helm, 1968; Ingervall *et al.*, 1972; Lavelle, 1976; Magnusson, 1976; Kerosuo *et al.*, 1991). The frequency of excessive overjet in the primary dentition is not an accurate reflection of conditions accompanying the permanent dentition, and an increase in the prevalence of excessive overjet is to be expected with maturation.

A striking figure in this investigation was the high prevalence of open bites: edge-to-edge or negative overbites 0 mm or less existed in 37.4 per cent of the group. A similar figure is given in the study by Ravn (1975), where open bites existed in 34.2 per cent of the cases at 3 years of age. Mean overbite in this study did not change with age to a significant extent. Thus, it is speculated that during this age-span no dramatic changes appear in the expression of the functional constraints controlling the vertical relationships of the anterior teeth. According to Gross *et al.* (1994), at the age of four 54.2 per cent of boys and 41.4 per cent of girls display an open-mouth posture. Important changes appear later with functional maturation and transition to the permanent dentition, where open bites in Europoid populations usually range from 2 to 5 per cent (Lavelle, 1972; Ingervall *et al.*, 1972; Magnusson, 1976; Romette, 1988; Kerosuo *et al.*, 1991). These observations suggest that in most

cases open bites are of dentoalveolar origin and will improve with age, and also that in most cases early orthodontic treatment of open bites is not indicated.

Agreement regarding the prevalence of Class II in the deciduous dentition ranges from 19 to 36 per cent (Humphreys and Leighton, 1950; Foster and Hamilton, 1969; Infante, 1975; Ravn, 1975; Muig, 1991) (Table 4). Wide variation in the prevalence of sagittal malrelationships is also characteristic in the adolescent dentition in Caucasian populations and varies from 18.5 to 33 per cent (Helm, 1968; Magnusson, 1976; Jrvinen and Lehtinen, 1977; Infante-Rivard and Payette, 1981; Romette, 1988). In this study, bilateral Class II existed in 26 per cent of the cases. These figures agree with the prevailing Class II conditions characterizing the Europoid population. Between the ages of 4 and 6 years no change could be seen, suggesting that stable sagittal relationships of the dental arches are already determined in this age-span. This observation also suggests that early concern may be given to this type of discrepancy.

Posterior crossbite was seen in 12 per cent of boys and 19 per cent of girls in this study, with no improvement being seen between 4 and 6 years of age. Other investigators report deciduous posterior crossbites in 7-12 per cent of subjects (Foster and Hamilton, 1969; Infante, 1975; Ravn, 1975). In adolescent and adult dentitions a wide variation in the prevalence of crossbites is also reported, ranging from 9.4 to 24 per cent (Helm, 1968; Ingervall *et al.*, 1972; Magnusson, 1976; Infante-Rivard and Payette, 1981; Kerosuo *et al.*, 1991). Where males and

females were examined separately, a higher prevalence of posterior crossbites in females was the rule. This investigation suggests that transverse discrepancy of the dental arches is already present at an early stage. In the absence of longitudinal data, the common belief that posterior crossbites in the temporary dentition significantly improve with maturation remains questionable.

Prevention and early treatment in orthodontics is still the subject of continuous debate and controversy regarding cost effectiveness analysis and functional and psychosocial benefit. In recent papers Gianelly (1995) favoured treatment in the late mixed dentition for 90 per cent of the children while Viazis (1995) and Varrela and Alanen (1995) concluded that early orthodontic/orthopaedic treatment would be profitable and desirable in younger patients. In this study it was observed that malocclusion is actually commonplace in the temporary dentition. Obvious similarities could be seen with other investigations of occlusal traits in the primary dentition. The available documentation also suggests that development of the occlusion is a continuum for many aspects: most of the major occlusal trends characterizing the adult dentition were detectable at early stages. Lack of space was common, as well as lateral crossbites, excessive overjet or Class II relationships; the striking difference from data concerning the permanent dentition was the high prevalence of open bites which are expected to decrease with maturation. In the absence of longitudinal documentation and with due reservation to the possible biases inherent to cross-comparison of epidemiological data on malocclusion, we are inclined to conclude that, provided the patient's cooperation is established early, consideration may be given to treatment of the malocclusion. This concern should be focused mainly on lateral crossbites and sagittal malrelationships.

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