

# Occlusal assessment of a 3–5 year population

Ronald S. Penido, D.D.S., Robert Carrel, D.D.S., M.Ed., and A. J. Chialastri, D.D.S.

## Abstract

*One hundred children consisting of 53 blacks and 47 white children ages of 3 and 5 were selected from a random sample. All children had occlusions of the primary teeth only with no permanent teeth erupted. The occlusions of the primary dentition were characterized by the following observations. The mesial step type relationship was more frequent than the flush terminal plane type pattern. The incidences of posterior crossbite were about the same in both the black and white children. Between ages 3 and 5 the intracanine and intermolar width, overjet, and overbite progressed with age in both races. The presence of spaces between incisors was much lower than those reported by other investigators.*

## Introduction

In order to practice preventive orthodontics, a clinician must be able to identify normal occlusion and detect potential malocclusion problems in the primary dentition. Children differ considerably from each other, even within the same family, with regard to growth factors, skeletofacial patterns, and spacing of teeth. Studies have been carried out internationally in an attempt to secure statistics which might serve as guidelines for normal occlusion in the primary dentition.

In the early 1900's, Mershon<sup>1</sup> stated that "normal" was not confined to form alone, and that there was a "normal" to be seen in function. According to Ramford and Ash's<sup>2</sup> definition, "normal" implies a situation commonly found in the absence of disease and the normal value is a biologic system within a physiologic adaptive range. Such a concept of normal occlusion emphasizes the functional aspect of occlusion and the capability of the masticatory system.

Baume<sup>3</sup> stated that any attempt to develop preventive methods in the field of orthodontics must be based on adequate knowledge of normal growth and development of the dentitions and the many modifying factors. According to the work done by Carlsen and Meredith,<sup>4</sup> it is possible to predict into which category of malocclusion the permanent dentition will fall. Stillman<sup>5</sup> and Bogue<sup>6</sup> in their studies noted that if malocclusion was observed in the primary dentition, it was

to be expected that some irregularities would occur in the corresponding permanent dentition.

An interesting factor to consider is that investigators such as Chiavaro,<sup>7</sup> Moller,<sup>8</sup> Pedersen,<sup>9</sup> Miller and Hobson<sup>10</sup> found a prevalence of about 20% of malocclusion in their studies, while others such as Plaetschke,<sup>12</sup> Popovich and Grainger<sup>13</sup> reached results of 50 to 70% of cases presenting malocclusion. These discrepancies in results are also found in other studies dealing with terminal plane patterns, primate spaces, spacing among incisors, overbite, and overjet.<sup>14-28</sup>

Several authors have described features of "normal" occlusion of the primary dentition among them Chapman,<sup>29</sup> Friel,<sup>30</sup> Graber,<sup>31</sup> Walter,<sup>32</sup> and Moyer.<sup>33</sup> Four features are usually described when considering a normal occlusion. They are: spacing of the incisors, a deep incisor overbite, the relationship of the distal surface of the upper and lower second primary molars, and the "primate spaces." Foster, in his study with 100 British children, found that none of the patients matched these four standards in every respect.<sup>34</sup> The purpose of this study is to provide additional information on the development of children's dentition and occlusion.

## Methods and materials

The population selected for this study was a random sample of 100 children of low socioeconomic status but with good dental health who attended the Temple University Dental Clinic and the Dental Clinic of St. Christopher's Hospital for Children. The children ranged from 3–5 years of age. The group consisted of 53 black children and 47 white children. All patients had a complete hospital record that included a full set of roentgenograms (panoramic, periapical, and bite-wing films) along with a medical and dental history.

The criteria for selecting the children consisted of choosing those having all of their primary teeth with no eruptions of permanent teeth. No stainless steel crowns or proximal amalgam restorations were permitted on any teeth if the patient was to be included in this study. Alginate impressions were taken of both dental arches and were poured in stone.

All of the information in this study was obtained from the dental stone models. The data recorded on a specially prepared form was as follows:

1. The type of terminal plane pattern of the dental arches in centric occlusion (straight, distal, or mesial steps).
2. The presence or absence of any posterior crossbite.
3. The presence or absence of primate spaces in the upper and lower arches.
4. The presence or absence of spacing among the anterior teeth in both arches.
5. The cuspid to cuspid width of both mandible and maxillary dentitions. This measurement was taken from a straight line drawn between the middle of the lingual surface of the cuspid on one side of the arch to its antimere tooth and surface.
6. The molar to molar width from both mandible and maxillary dentitions. This was also measured in the same way as the cuspid width.
7. The circumference, or arch length, from both mandible and maxillary dentition was measured by means of a piece of soft copper wire contoured to form a smooth curve over the buccal cusps of the

**Table 1. Dental relationships in 53 black children**

Dental relationships	Age (no. of children)					
	3 yr	(11)	4 yr	(25)	5 yr	(19)
Terminal molar relationship (%)						
Mesial	82	(9)	96	(22)	74	(14)
Flush (straight)	18	(2)	4	(1)	26	(5)
Presence of posterior crossbite (%)	0	—	4	(1)	22	(4)
Presence of anterior spacing (%)						
Maxilla	64	(7)	66	(15)	85	(16)
Mandible	55	(6)	48	(11)	69	(13)
Presence of primate spacing (%)						
Maxilla	91	(10)	96	(22)	100	(19)
Mandible	64	(7)	52	(12)	85	(16)
Cuspid width (mean) (mm)						
Maxilla	21.80		23.30		23.05	
Mandible	16.90		17.91		18.15	
Molar width (mean) (mm)						
Maxilla	27.27		28.65		28.47	
Mandible	26.36		27.21		28.00	
Arch circumference (mean) (mm)						
Maxilla	76.81		79.69		80.00	
Mandible	69.45		71.00		72.26	
Overjet (mean) (mm)	1.41		1.76		1.86	
Overbite (mean) (mm)	0.70		1.23		1.26	
Openbite (mean) (mm)	1.50		2.00		3.50	

**Table 2. Dental relationships in 47 white children**

Dental relationships	Age (no. of children)					
	3 yr	(14)	4 yr	(16)	5 yr	(17)
Terminal molar relationship (%)						
Mesial	79	(11)	94	(15)	77	(13)
Flush (straight)	21	(3)	6	(1)	23	(4)
Presence of posterior crossbite (%)	7	(1)	6	(1)	6	(1)
Presence of anterior spacing (%)						
Maxilla	50	(7)	88	(14)	100	(17)
Mandible	29	(4)	50	(8)	77	(13)
Presence of primate spacing						
Maxilla	93	(13)	94	(15)	100	(17)
Mandible	43	(6)	69	(9)	77	(13)
Cuspid width (mean) (mm)						
Maxilla	21.78		22.75		23.23	
Mandible	16.42		17.75		18.47	
Molar width (mean) (mm)						
Maxilla	27.78		28.25		29.58	
Mandible	16.42		17.75		18.47	
Arch circumference (mean) (mm)						
Maxilla	75.85		75.62		80.11	
Mandible	68.07		67.50		71.70	
Overjet (mean) (mm)	1.32		1.31		2.11	
Overbite (mean) (mm)	1.00		1.06		1.31	
Openbite (mean) (mm)	3.5				3.00	

molars and incisal edges of the anterior teeth. The wire was placed from distal surface of the primary right second molar to the same point on the contralateral tooth. The wire was then marked with a hydrographic pen after which it was straightened and measured with a standard Boley millimeter gauge. The measurements were read to the nearest 0.5 mm.

8. The presence or absence of any overjet (measured from the lingual surface of maxillary incisors to the labial surface of mandibular anterior incisors at the maxillary incisor incisal edge).
9. The presence or absence of any overbite (measured from the incisor edge of the mandibular anterior incisors to the most inferior point reached by the edges of the maxillary incisors).
10. The presence of any open bite cases.

## Results

The specific data in this study are summarized in Tables 1 and 2.

1. When the data relative to molar relationships were

analyzed, it was found that both races and ages presented similar characteristics and that the mesial step type of molar relationship was much higher than the flush (straight) terminal plane pattern. Based on this finding the data processing of all groups together presented a figure of 85% of cases presenting a mesial step type of molar relationship, compared to 15% of cases presenting a flush terminal plane pattern.

2. The presence of posterior crossbite was about the same in both races and ages, except for the group of 5-year-old black children, who presented a higher percentage (22%) when compared to the other groups.
3. The increase in the intercanine and intermolar widths in both arches, in both races and all age groups, is progressive from age to age, and it does not appear to present great discrepancies in the mean values when comparing races. The same results were obtained when analyzing arch circumference.
4. Overjet presented a progressive mean value with an increase in age. Black children in the age range of 3-4 presented a higher figure when compared with the same age group of the white race.
5. The mean value for overbite was also progressive with an increase of age in both races, with the black children presenting a higher value for the ages of 4 and 5.
6. The bite tended to open progressively with age in the black children, but this facet was inconsistent when the white group was analyzed.

## Discussion

In this study, the sample was a random one but at the same time, all participants met specific criteria. The population was not confined to a state hospital or similar environment because of convenience of numbers. There were no growth syndromes or medical problems associated with any of the patients included in this evaluation.

Throughout the literature, one finds extensive references to the fact that proximal carious lesions can alter the original pattern of occlusion. However, it is not always stated whether this type of pathology was completely excluded when statistical observations were recorded. It is further important to consider the number of restorations that were performed on the sampled population. The addition of stainless steel crowns unilaterally could have a very profound effect on the shifting of proximal contact points and the changing of occlusal patterns.

Ravn,<sup>17, 18</sup> Bujwidona,<sup>21</sup> Nanda *et al.*,<sup>22</sup> Humphreys and Leighton<sup>23</sup> and Kaufman and Koyoumdjisky<sup>27</sup> ob-

served a higher percentage of patients with the straight terminal type molar relationship. This finding was in contrast with the results of this paper in which there was a prevalence of the mesial step molar relationship.

Other investigators such as Kim,<sup>14</sup> Bonnar,<sup>15</sup> Baume,<sup>24</sup> Provost,<sup>25</sup> and Infant<sup>28</sup> seem to support our findings. With the data of developmental occlusion following such diversified pathways, it is difficult to speculate on the exact reasons for such differences. However, the best explanation will probably be found in studies that demonstrate the tooth changes as compared to growth pattern differences. The influence of environment has a profound effect on the overall growth potential. There is no reason to expect that arch relationships should be excluded from this influence.

It was interesting to note that the percentage of posterior crossbite in both races (4.6%) obtained by Infant<sup>28</sup> paralleled our results very closely. The population sampling for age and race distribution seems to be very similar.

On the other hand, Ravn<sup>18</sup> in his study found the low figure of 45.5% for cases presenting a class I type of canine relationship. This differs substantially from our study in which "all" of the subjects had the tip of the maxillary canine occluding in the embrasure formed by the primary mandibular first molar and the mandibular canine.

The latter results coincide very closely with the data recorded by Nanda *et al.*<sup>22</sup> This wide range of difference between the study of Ravn and ours is an important point in occlusal development. There is a possibility that the observations made in the Ravn<sup>18</sup> study were more in line with assumptions rather than actual observations.

When the presence of spacing among the incisors was analyzed, White *et al.*,<sup>20</sup> Richardson<sup>26</sup> and Kaufman and Koyoumdjisky<sup>27</sup> reached results of 80-90% which are higher than those in our study. On the assessment of primate spaces we do find that our figures are more in line with those obtained by Kaufman and Koyoumdjisky.<sup>27</sup>

Our results relative to the molar and canine widths should not be compared with other studies, in which distance between cusps was measured. This method, in our opinion, is unsuitable since any inclination or rotation of a particular tooth may alter the results. Also the possibility of abrasion cannot be excluded. The results obtained from this study on the measurements of the arch circumference are the same as those found by Moorrees,<sup>40</sup> and Richardson.<sup>26</sup> Nanda *et al.*<sup>22</sup> observed in their study that the overjet and overbite decreased from the younger to the older child. In our study the opposite was noted. An interesting obser-

vation made during the process of data selection was that a great number of children in the age group of 5 were not deemed suitable for the study since they had one or more permanent teeth in the process of eruption.

## Conclusions

The main conclusions are as follows:

1. the mesial step type of molar relationship was more frequent than the flush terminal plane type pattern;
2. the incidence of posterior crossbites was about the same in both races;
3. the increase in intercanine and intermolar width is progressive with age;
4. overjet presented a progressive mean value with an increase in age;
5. the mean value for overbite was progressive with age in both races;
6. this study presented a class I type canine relationship in all cases;
7. the presence of spacing among incisors was much lower than the results reported by many other investigators.

The results of this study must be regarded as being a summary of specific measurements of a special group of children where comparisons were made to our concept of "normal."

No attempt has been made in the present study to arrive at an overall assessment of malocclusion but rather to present additional information concerning the development of occlusion in the primary dentition.

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**Robert Carrel, D.D.S., M.Ed.** is Professor of Oral Pediatrics and Director of Post Graduate Oral Pediatrics at the Temple University. Requests for reprints should be addressed to Dr. R. Carrel, Temple University Health Sciences Center, School of Dentistry, 3223 North Broad Street, Philadelphia, Pennsylvania 19140.



**Ronald S. Penido, D.D.S.** is a Resident at St. Christopher's Hospital for Children in Philadelphia, Pennsylvania.



**A. J. Chialastri, D.D.S.** is Assistant Professor of Oral Pediatrics and Director of Dental Services at St. Christopher's Hospital for Children in Philadelphia, Pennsylvania.