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Occlusal Standards in Temporary Dentition: A Survey of an Infantile Population in Fez, Morocco

Achabi Najoua*

Department of Dental Medicine, Mohammed V University, Rabat, Morocco

ABSTRACT

Objective: Until these days, the occlusal standards characterizing the Moroccan child population have not been evaluated. Only international references are used. The objective of this work is to place the occlusal standards of our population in relation to international references, by comparing the intra and inter arch parameters found in our study (arch perimeter, inter canine distance, inter molar distance) with those found in other similar studies.

Methodology: A sample of 30 children (17 girls, 13 boys), aged from 3 to 5 years, was selected from the nurseries of the city of Fez. Study casts were made. Measurable data were collected and analyzed by SPSS 13.0 software (Chicago, IL, USA).

Results: The majority of the children examined had different types of diastema. Their prevalence was (96.7%) in the maxilla and (66.66%) in the mandible, with a predominance in males. The length, perimeter, and width of the arch in the children of our sample are of an average value that is close to the other populations, but it was difficult to compare all the results; due to the use of different measurement techniques by the investigators. A similar terminal plane and canine ratio were found in most children in our survey. Incisal overlap and overhang had successive average values of 1.10 mm and 1.20 mm.

Conclusion: Our study will be a key for Moroccan investigators in different regions of the country to be able to determine the characteristic occlusal standards of our country and to be able to compare them with those of similar studies.

Keywords: Diastema; Maxilla; Inter canine distance; Inter molar distance; Infant

INTRODUCTION

Childhood is the mirror in which adult proportions are reflected. Similarly, the type of occlusion in the temporary dentition predicts the occlusion in the permanent dentition [1]. The temporary dentition also contributes to the harmonious development of the maxilla-facial complex [2].

Knowledge of the occlusal ratios in the temporary dentition is an essential tool in the oral health care of the child. Indeed, distinguishing between (the physiological) and (the

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Corresponding author: Achabi Najoua, Department of Dental Medicine, Mohammed V University, Rabat, Morocco; E-mail: najoua.achabi@gmail.com

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pathological) allow the practitioner to make early diagnoses and thus intercept or prevent malocclusions, dysfunctions, or dysmorphias [3].

Numerous observational studies of occlusion in temporary dentition have confirmed that occlusal characteristics vary among populations and ethnic groups [4]. Studies of temporary dentition occlusion have been widely conducted in children of different ages in various parts of the world [5]. However, very few studies have been done on African populations. Until today, the occlusal standards of the Moroccan child population have not been evaluated. The objective of this work is to report the dimensions and observations of occlusal ratios in temporary dentition in a Moroccan child population to situate them in relation to international references.

MATERIALS AND METHODS

Population of the Study

The selection was made on a Moroccan child population, made up of 30 subjects, including 17 girls and 13 boys, with an age range between 3 and 5 years. This age group was selected because of the presence of a complete and stable temporary dentition. From this sample, casts were made [6].

Technical Material

For our study, we used the material described in the table below. The data collected were recorded on a survey form (**Table 1**).

Table 1: Material used in the study.

Impression material	Impression casting material	Study material
Tongue depressors	Hard plaster	Vernier caliper
Gloves	Mixing bowl and spatula	Graduated ruler
Fingerprint holders	Vibrator	Orthodontic caliper
Type A alginate	Plastic bases	Thickness caliper for measuring diastemas
Bowl	Boxes for the conservation and protection of the plaster models	Graduated periodontal probe
Mixing spatula	Felt pen for numbering the models	Brass wire of 0.12 mm
		Pink wax to fix the brass wire on the models
		Orthodontic wire of 0.19 mm

Selection Criteria

The selection included subjects with a stable temporary dentition, free of caries, or with carious lesions not disturbing the interdental relationships (e.g. lesions on the vestibular, palatal or lingual surface).

We excluded from our study:

- Any child with a carious lesion with loss of substance, or a structural abnormality, likely to modify the interdental relationships.
- Subjects with missing teeth.
- Wearers of orthopedic or other appliances.
- Children with clinically detectable oro-facial or para-functional dysfunction.
- Uncooperative children or children with nausea reflux, or a known allergy to alginate.

Study Setting

The study was conducted in preschools in the city of Fez and some cases were detected in a dental office. The dental examinations and the taking of impressions were carried out in the nurseries for some children and also in dental surgery for others [7-11].

Course of the Survey

The study consisted of three stages:

- **Oral examination:** It allowed identifying a stable and healthy temporary dentition with occlusal variables in the three directions of space.
- **Impression taking:** The casts obtained are numbered and kept in boxes.
- Recording of measurements and occlusal parameters between and within arches.

Observations and measurements are taken in the three directions of space in both the maxilla and the mandible. All the data collected are noted on the survey form.

For the intra-arch arrangement: Diastemas, their numbers, their multiple situations, and also their measurements were identified using the caliper.

The interincisal diastema was measured between the most mesial point of the mesial surface of the right temporary central incisor and the most mesial point of the mesial surface of the left temporary central incisor (**Figure 1**).

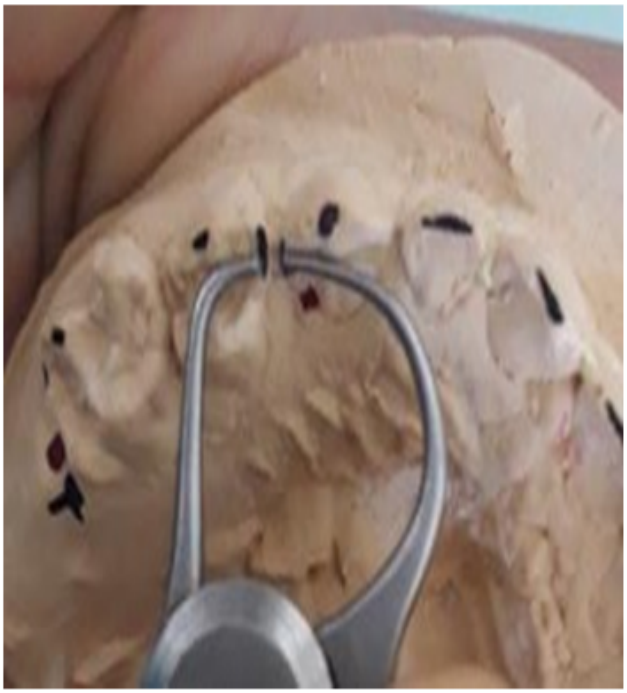

Figure 1: Measuring diastemas with a caliper.

The percaline diastema measurement was taken between the most distal point on the distal surface of the temporary lateral incisor and the most mesial point on the mesial surface of the temporary canine.

The post canine diastema was determined between the most distal point on the distal surface of the temporary canine and the most mesial point on the mesial surface of the temporary first molar.

- The inter-canine distance is measured with an orthodontic caliper between the most distal points of the distal surfaces of the right and left canines.
- The inter-molar distance was measured by an orthodontic caliper between the most distal points of the distal surfaces of the temporary second molars.
- The arch perimeter was measured using brass wire and wax to fix it on the curve passing through the vestibular cusp tips, from the most distal of the second temporary molars, the cusp tips of the first temporary molars, the tips of the canines and the free edges of the incisors, and then the curve was measured using a ruler graduated in (mm).
- The arch length is the perpendicular of the line between the distal surfaces of the temporary second molars, marked by the orthodontic wire, and the free edge of the temporary central incisors (**Figure 2**).

Figure 2: (a) Inter-canine distance (b) Inter-molar distance (c) Arch length (d) Arch perimeter.

For the inter-arch ratio, the following parameters were determined:

- In the vertical direction, we examined and measured the incisal overlap.
- In the transverse direction, we specified the coincidence or not of the inter-incisal points (**Figure 3**).

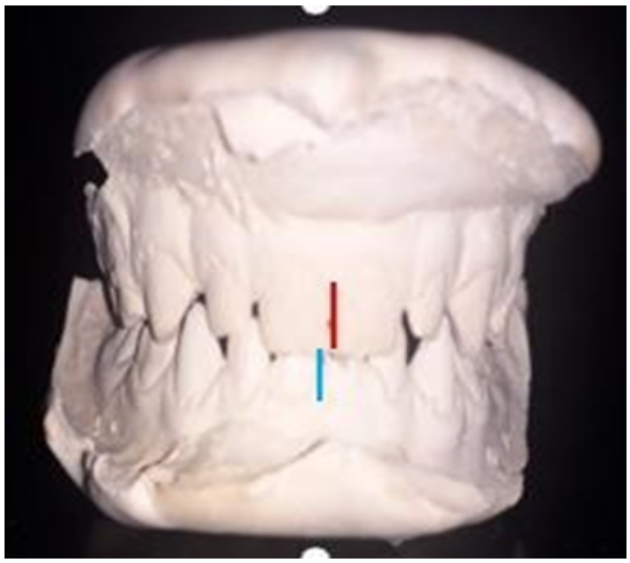

Figure 3: Plaster model showing the non-coincidence of the inter-incisal point.

In the Anteroposterior Direction

Chapman's terminal planes: Defined by the distal surfaces of the lower and upper temporary second molars. There are 3 types of terminal planes: straight, mesial, and distal.

The inter-canine relationships are noted, referring to Angle's classification: Class I correspond to the projection of the maxillary canine tip at the canine/lower 1st molar line. In front of this line is class II and behind it is class III.

At the incisal level, the incisal overhang (over-jet) is determined by a graduated periodontal probe. Statistical analysis was performed with the "Statistical Package for Social Science (SPSS)" software, and for data entry, the software Excel of Windows 2010 was used. These statistics allowed making a descriptive analysis of each occlusal variable in the sample. They are composed of the average, minima, maxima, standard deviations, and percentages. Values were taken from girls and boys, maxilla and mandible [12-17].

RESULTS

Intra-Arch Arrangement

Diastemas

The highest frequency of diastemas was observed in the maxilla. The inter incisal diastema was more present in the maxilla. The pre-canine diastema was also dominant in the maxilla with a value of (93.3%). In the mandible, the post-canine diastema was present in (56.7%) of the children (Table 2).

Table 2: Distribution of inter-incisor, pre-and post-canine diastemas in the maxilla and mandible.

Diastemas	Inter-incisor diastemas	Simian diastemas	
		Pre-canine	Post-canine
Max.: 96.7% of children Mand.: 66.7% of children	Max.: 53.3% of children Mand.: 50% of children	Max.: 93.3% of children	Mand.: 56.7% of children

Other Intra-Arch Parameters

The inter-canine distance, the inter-molar distance, the perimeter, perimeter, and arch length, show greater values in the maxilla maxilla than in the mandible (Table 3).

Table 3: Average values of inter-canine distance, inter-molar distance, perimeter and arch length.

Intra-arch parameters (in mm)	Maxillary (SD)	Mandible (SD)
Inter-canine distance	30,17 (+/-2,57)	24,57 (+/-1,69)
Inter-molar distance	35,70 (+/-1,29)	33,57 (+/-1,54)
Arch perimeter	72,70 (+/-3,019)	68,63 (+/-2,22)
Arch length	28,37 (+/-1,45)	24,60 (+/-1,522)

Note: SD: Standard Deviation.

Inter-Arch Ratio

Anteroposterior direction: The terminal plane of the right side is straight in (56.7%) of children, mesial in (30%), and distal in (13.3%) of children. In the left hemi-arch, the three types of terminal planes are equally distributed in our population (Figure 4).

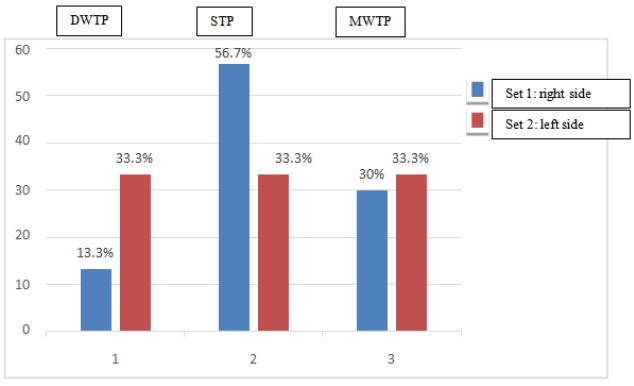

Figure 4: Distribution of the different types of Terminal Plane (TP) on the right and left sides.

Note: DWTP: The Distal Walking Terminal Plane; STP: The Straight Terminal Plane; MWTP: The Mesial Walking Terminal Plane. Set 1: The right sided terminal plane; Set 2: The left sided terminal plane.

56.7% of the children had similar terminal planes between the right and left sides (Figure 5).

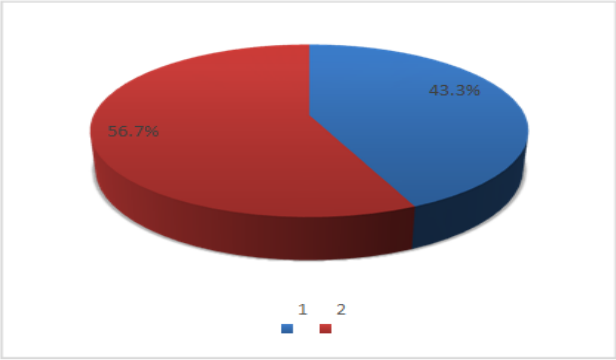

Figure 5: Comparison of the similarity of the terminal plane between the two sides.

Note: 1: Not similar; 2: Similar.

The canine ratio is characterized by the predominance of class I on both the right and left sides (Figure 6).

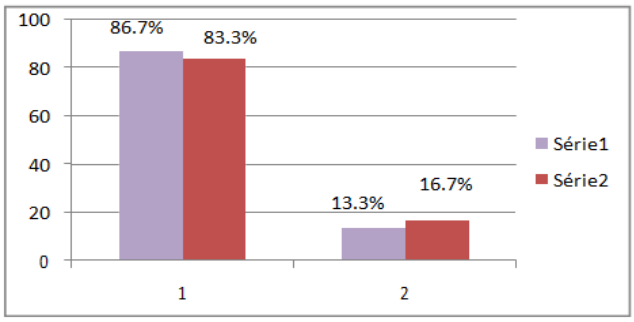

Figure 6: Distribution of the right and left canine ratio.

Note: 1: Class I, 2: Class II, Series 1: The right side canine ratio, Series 2: The left side canine ratio.

The incisal overhang is characterized in our sample by an average value of 1.20 mm (Table 4).

Table 4: Average value of the incisal overjet.

Parameter	Over-jet
Average variable in (mm)	1,20
Standard deviation	0,794

The vertical direction: The infant population in our sample is characterized by an incisal overlap with an average value of 1.20 mm (Table 5).

Table 5: Average value of the incisal overbite.

Parameter	Over-bite
Average variable in (mm)	1,20
Standard deviation	0,794

The transverse direction: Half of our population (50%) presents a median inter-incisal contact. In the other half, 16.7% of the children did not show inter-incisal contact due to the presence of diastemas (Figure 7).

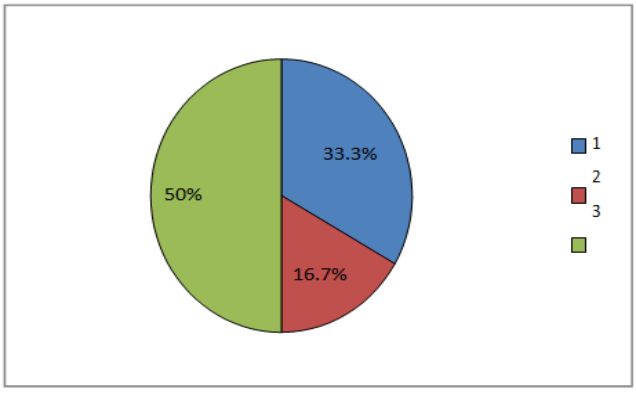

Figure 7: Distribution of the coincidence of inter-incisive points.

Note: 1: Coincidence of inter-incisal points, 2: Absence of coincidence, 3: Presence of median inter-incisal diastemas.

Comparative Results between Girls and Boys (Intra-Arch Ratio)

In the maxilla, all the girls in our sample have diastemas. For the boys, only one is an exception. In the mandible, the boys have a high prevalence of diastemas. The average value of the arch length of the girls is slightly higher than the boys' arch length in both the maxilla and mandible. While the inter-canine and inter-molar distances are higher in the boys of our population (Table 6).

Table 6: Comparative results of intra-arch ratios between girls and boys.

Parameters	Maxillary			Mandible		
Sex	Girl	Boy	p	Girl	Boy	p

Diastemas	100% (17)	92.30% (12)	0,011	58.182%	76.92%	0,348
Perimeter	72,24 mm	73,31 mm	G: 0,683 B: 0,909	68,71 mm	68,54 mm	G : 0,58 B: 0,57
Length	28,41 mm	28,31 mm	G: 0,41 B: 0,30	24,71 mm	24,46 mm	G: 0,28 B: 0,53
Inter-canine distance	29,65 mm	30,85 mm	G: 0,568 B: 0,775	24,18 mm	25,08 mm	G : 0,27 B: 0,60
Inter-molar distance	35,41 mm	36,08 mm	G: 0,243 B: 0,431	33,00 mm	34,31 mm	G: 0,36 B: 0,36

Comparative Results between Girls and Boys (Inter-Arch Ratio)

Our sample is characterized on the right side by the predominance of the straight terminal plane in girls and the mesial plane in boys. On the left side, the terminal plane is straight in 50% of cases for both girls and boys. A canine ratio of class 1 on both sides is observed especially in girls. The average value of overlap and overhang was higher in the 13 boys in our study. The absence of contact of the inter-incisive points was also observed in 60% of the boys (Table 7).

Table 7: Comparative results of inter-arch ratios between girls and boys.

Parameters	Girls (N=17)	Boys (N=13)
Terminal plane		
Right side	Straight: 52.9%	Mesial: 75%
Left side	Straight: 50%	Straight: 50%
Similarity	47.1%	52.9%
Canine ratio	Class 1	
Right side	53.8%	46.2%
Left side	56%	44%
Similarity	47.8%	52.2%
Over-jet	1,12 mm	1,31 mm
Over-bite	0,76 mm	1,54 mm
No coincidence of inter-incisal points	40%	60%

DISCUSSION

We describe the occlusal parameters in the stable temporary dentition of our sample in the three directions of space, noting the intra and inter arch ratios.

Surveys dealing with the same subject have been carried out in many parts of the world, for example: In Sweden by Seipel, in North America by Moorrees, et al., in Great Britain by Clinch. Few have concerned African populations. We will compare our results with the literature on the same subject, highlighting the differences between the two sexes.

The results of the present study indicate that the presence of diastemas seems to be a common feature concerning the temporary dentition of our population, although there are some exceptions. Diastemas are present mainly in the maxilla (96.66%) and are observed in all girls in our study. The mandibular arches of our sample present (66.66%) diastemas and are mostly present in boys. The table below gives a summary of the comparative results of the prevalence of diastemas with other studies performed by Taiwanese, Polish, Jordanian, and Brazilian (Table 8).

Table 8: Comparative results of diastema prevalence with other studies performed by Taiwanese, Polish, Jordanian, and Brazilian.

Studied population	Sample size	Age range	Prevalence of diastemas in the maxilla	Prevalence of diastemas in the mandible	Difference between girls and boys
Morocco	30 children	3 to 5 years	96.7%	66.7%	Girls have more diastemas in the maxilla and less diastema in the mandible.
Taiwan	147 children	3 to 6 years	85%	72.1%	Higher frequency in boys.
Poland	50 children	5 years	90%	80%	-
Jordan	Group 1: 456 children	2.5 to 4 years	61.4%	62.9%	Diastemas are more frequent and larger in boys than in girls.
	Group 2: 592 children	5 to 6 years	62.2%	59.6%	
Brazil	356 children	3 to 5 ½ years	89.9 %	67.1%	There is a significant difference in the prevalence of diastemas between girls and boys, without naming the sex with the highest frequency.

We also compared the maxillary and mandibular arch dimensions of our study population with those obtained in other similar studies, and we have gathered the results in the table below (**Table 9**).

Table 9: Comparative results of the dimensions of the maxillary and mandibular arches found in our study with others performed in England, Peru, Pakistan, Saudi Arabia, Turkey, and also with the one performed by Mr. Baume.

Parameters	Studied populations	Maxillary (mm)	Mandible (mm)	Differentiation between girls and boys
Arch Perimeter (AP)	Morocco	72,70 mm	68,63 mm	Max: (AP) more important for male gender
	England	79,07 mm	72,21 mm	Bigger for boys
	Peru	74.47 mm	68.56 mm	
	Pakistan	73.066 mm	63.052 mm	
Arch width CD: Inter-canine distance MD: Molar Distance	Morocco	CD:30,17 mm MD: 35,70 mm	CD: 24,57 mm MD: 33,57 mm	Larger for boys
	Saudi Arabia	CD:31.09 mm MD: 33.31 mm	CD: 28.55 mm MD: 28.63 mm	Larger for boys
	Turkish	CD: 33.5 mm MD:56 mm	CD: 22.75 mm MD: 41.5 mm	
	Pakistan	CD:33.171 mm MD: 46.100 mm	CD: 26.182 mm MD: 48.694 mm	
Arch length	Morocco	28,37 mm	24,60 mm	Greater for girls
	Pakistan	27.680 mm	22.667 mm	Greater for boys
	Mr. Baume	27,5 mm	23,5 mm	

Concerning the vertical direction, we obtained an average value of the incisal overbite of 1.20 mm. This value is higher in boys, which is not the case in the Danish who observed dominance of the anterior gap in their boys.

The Nigerians in their study of 525 children aged from 3 to 4 years reported an average value of the incisal overbite described as "ideal" without any precision of the normality references used, which made the comparison with our results impossible.

In the transverse direction, the inter-incisal point is the criterion studied in our survey. It was compared with the Ivorians whose 66.6% of their children present a coincidence of inter-incisal points, which is not the case with our children, among whom only 33.3% present coincidences.

In the anteroposterior direction, 56.7% of the children in our population had similar terminal planes on both sides. The 2 Nigerian and British studies have the same results as ours. This similarity characterizes mainly the boys of our sample which is not the case for the Nigerian children where there is no difference between the two sexes.

Concerning the canine ratio, it is characterized by the dominance of class 1 and its similarity in 67.6% of the children in our sample, which is close to the results found by the Danish and Nigerians. The average value of the incisal overhang in the boys of our sample was 1.31 mm. However, girls were characterized by an average overhang value of 1.12 mm. A study looked at incisal overhang measurements for a population of different ethnicities. In this study, they found that the incisal overhang (over-jet) had a higher average value in black children than in white children. In general, our results are close to the results found by some populations and differ from those found by others. This may be explained by the variability in measurement techniques used by investigators. It was also concluded that there are no ideal occlusal standards but each population has its own standards, hence the interest for each population to know the occlusal standards that characterize them in order to adapt to them.

CONCLUSION

It is evident from the results of our study that there are variations in arch dimensions and occlusal characteristics compared to other racial and ethnic groups. These variations are certainly at the origin of the difficulties of clinical adaptation of dental material manufactured in Europe. These standards could eventually be used for the production of dental materials (impression trays) adapted to the arches of Moroccans in the temporary dentition. Our perspectives are then oriented towards a large scale study to give scientifically exploitable statistics.

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