International Dental & Medical Journal of Advanced Research (2018), 4, 1–6

ORIGINAL ARTICLE

Coronal morphometry of deciduous molars of melano-Ivorian children, West Africa

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Keywords:
African melanoderm, coronal diameter cote, D'Ivoire, deciduous molar, morphometry

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Received 26 June 18;
Accepted 30 October 18

doi: 10.15713/ins.idmjar.95

Abstract

Background: Dental identification is based on the comparison of anterior and postmortem documents, in the absence of fingerprints or other details.

Aim: The aim of this study was to determine coronal measurements of the deciduous molars of the melano-African children of Cote d'Ivoire to contribute to the establishment of dimensional indicators in deciduous teeth.

Materials and Methods: It is a retrospective survey which concerned 1411 deciduous maxillary and mandibular molars resulting from 366 casts of melano-African children of Cote d'Ivoire, aged from 2½ to 8½ years, in stable deciduous and mixed teeth. Measurements of coronal diameters at the vestibular, palatal or lingual, proximal, and occlusal surfaces in both the sexes were performed using a drypoint compass and a graduated ruler. From a statistical analysis, with Microsoft Office Excel® and Access® software, mean values and their standard deviations were calculated. A comparative analysis based on the reduced deviation test formula compared the coronal diameters of the right and left hemi-arches; and those of girls and boys, with a statistical significance test, equal to "t" >1.96 at the 0.05 threshold.

Results: These results show that there is no significant difference between the diameters on the right and left sides. The first and second maxillary deciduous molars have identical coronary diameters; however, at the mandible, the second molar has coronal diameters statistically greater than those of the first deciduous molar with a significance test >1.96. The coronal diameters of the molars are statistically identical for both the sexes at the maxilla and mandible.

Conclusion: Molars are identical to their contralateral. The mandibular molars are in ascending series. There is no sexual dimorphism. This study needs to be extended to the temporary anterior teeth in order to obtain complete morphometric data in temporary teeth in the Melano-Ivorian subject.

Clinical Significance: The practical application of European coronal measures on the deciduous molars of the melano-Ivorian subject poses enormous difficulties; linked to the non-compliance of standards during treatment. To overcome the challenges, it seems useful to make our contribution to the morphometry of the dental identification which is based on the comparison of anterior and postmortem documents, in the absence of fingerprints or other details of the molars of the melano-Ivorian children.

Introduction

The literature review abounds in the study on the morphometry of deciduous and permanent human teeth.[1-12] Thus, the problem of the dimensions of contemporary human teeth has already been the subject of several publications according to Lavergne.[13] For the latter, it is always interesting to repeat the problem because old studies can be the subject of criticism.[13] However, they have made it possible to establish dimensional standards for the permanent and dental identification which is based on the comparison of anterior and postmortem documents, in the absence of fingerprints or other deciduous teeth of leuco-

European patients. Their interest is in paleoanthropology, identification, and dental practice.[14] The distinctive and resistant characteristics of dental structures make them the fossils most frequently discovered in paleoanthropological and archaeological excavations.[14,15] Thus, the teeth found intact in these excavations make it possible to go back to the origins of the human being and consequently to follow his evolution and to identify him.[14,15] Indeed, the identification of victims of natural and accidental disasters and increasingly criminal cases, with victims that are difficult to identify using conventional techniques, relies on dental identification, which is on the rise. For Sonan *et al.*[14] and Ebrottié,[15] "the chances of identifying an individual by dental means increase as the chances of identifying him by other means decrease." For the forensic dentist, the morphometric data of the teeth are of interest by also giving indications for racial orientation. They can make it possible to know if the victim is of leuco-European or melano-African origin.

The morphometry of human teeth, especially deciduous molars, is of interest to pediatric dentists and orthodontists in daily practice. Like other groups of teeth, deciduous molars play a very important role in orofacial function and maxillofacial and dental growth in children. Their measurements are useful to know because they describe in part, their anatomy,[16] which must be considered during different therapies. Indeed, in most African countries, leuco-European standards are taught and used in dental clinics.[15] The material designed according to the leuco-European standards poses enormous difficulties of the unsuitability of dental material in general and in particular of pedodontic caps, orthodontic braces, and deciduous teeth during their use in melanoderm, due to morphological variability between the two ethnic groups. In addition, in Africa, particularly in Côte d'Ivoire, the measurement of teeth concerned only permanent teeth.[14,15] Few studies have been carried out on deciduous teeth, particularly the deciduous molars of the melano-Ivorian child.[17] Therefore, the research question is this: What are the morphometric values of the deciduous molars of melano-Ivorian children?

The different hypotheses were the comparison between:

- The right deciduous molars and their left counterparts,
- The first deciduous molar and the second deciduous molar of the same hemi-arch,
- The average coronal dimensions of the deciduous molars of girls and boys.

The objective of this study was to determine the coronal diameters of the deciduous molars of melanoderm children in Côte d'Ivoire to provide for the future fundamental biometric data necessary for teaching (atlases and plates), clinical cases (indication for victim identification, diagnosis, and treatment in pediatric dentistry and orthodontics), and research (industrialization of dental equipment adapted to our realities).

Materials and Methods

This work was a preliminary study carried out as part of a vast research program on craniofacial growth in melanoderm children in Côte d'Ivoire. This was a retrospective survey of children's casts that gathered information. The choice of our study population was deliberately based on children from nursery and primary school resident in the city of Yopougon, a suburb of the Abidjan district, made up of a cosmopolitan population of about 1 million inhabitants. It included 183 children of sexes, African melanoderms without any racial mixing, aged from 2½ to 8½ years.

The inclusion criteria of this study were as follows:

- Children without a parental history of dental malformation;
- Children in the age group of 2–8½ years without gender distinction;
- Ivory Coast melanoderms with stable teeth;
- Children having deciduous teeth whose clinical emergence is complete;
- Children having deciduous teeth with no severe malpositions or carious cavities.

As for the criteria for non-inclusion, the following were excluded from the study:

- Melanoderms without being mixed;
- Children having inoperable dental casts;
- Children with coronary destruction of the deciduous molars;
- Children having an absence of deciduous molars.

A survey sheet was prepared and used to record each subject. It consisted of two parts, the first reserved for identification and the second for metric parameters. Thus, the metric information obtained on the maxillary and mandibular casts were reported on this survey sheet.

These casts were made from impressions taken with fast setting class B AROMA® alginate type 2 and immediately cast with FUJI® or VEL MIX STONE® brand β (hard plaster) hemihydrate. A well-trained and knowledgeable operator had measured the coronal diameters using a dry-tip compass and a millimeter scale. For each measurement, benchmarks were considered. This was the larger contour area and the occlusal surface. Measurements were made on vestibulopalatal and lingual, mesiodistal palatal or lingual, mesiodistal occlusal, and vestibulopalatal and lingual occlusal diameters [Figures 1 and 2].

a. ØMDV: Mesiodistal diameter of the vestibular view at the level of the largest contour
b. ØMDP/L: Mesiodistal diameter of the palatal or lingual view at the largest contour
c. ØMDo = Mesiodistal occlusal diameter represented by the distance between the mesial marginal edge and the distal marginal edge.
d. ØVPo/Lo: Vestibulopalatine or lingual diameter at occlusal view represented by:
    - The distance between the vestibular intercuspid point and the tip of the palatal cusp for the upper molars.
    - The distance between the vestibular and lingual intercuspid points for the mandibular molars.
e. ØVP/L: Vestibulopalatine or lingual diameter at the largest contour

The statistical analysis was performed using MICROSOFT®, ACCESS®, and EXCEL® software to process the data. Mean values, variance, and standard deviation were calculated. The "t" test comparing the two observed means was applied to the mean

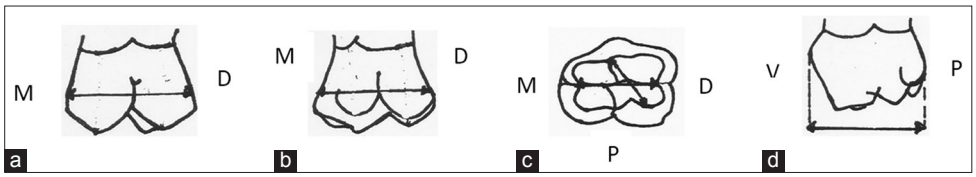

Figure 1: Diameters of the different faces of the upper deciduous molars. (a) Vestibular face, (b) palatal face, (c) occlusal face, (d) proximal face

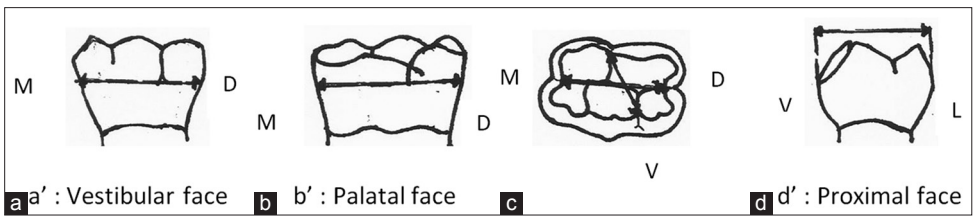

Figure 2: Diameters of different faces of the lower deciduous molars. (a) Vestibular face, (b) palatal face, (c) occlusal face, (d) proximal face

values of the two sexes and the left and right hemi-arches. This test is defined as follows: The comparison between two means is based on the reduced deviation. Thus, if the number n_1 is <30 and the number n_2 <30, the test formula "t" is as follows:

$$t = \frac{m_1 - m_2}{\sqrt{\frac{V_1^2}{n_1} + \frac{V_2^2}{n_2}}}$$

m_1 = Average of the first sample
n_1 = First sample size
V_1^2 = Variance of the first sample
m_2 = Average of the second sample
n_2 = Second sample size
V_2^2 = Variance of the second sample

- If t < 1.96, the difference is not significant at the 5% threshold.
- If t > 1.96, the difference is significant and the risk of error corresponding to $t_{0\alpha}$ ddl read in the reduced-spread table fixes the degree of significance.

Results

The study included 366 maxillary and mandibular casts of 183 girls and boys. A total of 1411 deciduous maxillary and mandibular molars were counted, including 712 first molars and 699 second molars. The average values of the coronal dimensions are given in millimeter.

Average coronal diameters of the deciduous molars according to the sample

Comparison test of two observed means t < 1.96 means that the difference between the mean diameters of the molars of the right hemi-arch and their left counterparts is not significant.

Comparison test of two observed means t > 1.96 means that the difference between the average diameters of the first and second molars is significant.

Average coronal diameters of deciduous molars by gender

The difference between the average diameters of girls and boys is not significant.

Discussion

This study gives us an indication of the measurements of deciduous molars in the Ivorian child.

The diameters of the deciduous molars of the right hemi-arch and their counterparts in the left hemi-arch are statistically identical, both at the maxilla and mandible. The coronal diameters of the first and second maxillary molars are identical, except for the mesiodistal palatal and mesiodistal occlusal diameters. On the other hand, the coronal diameters of the second mandibular molars are larger at the mandible than those of the first molars, except for the vestibulolingual diameter. The mean coronal diameters of the deciduous molar group of boys are slightly larger than those of girls at the maxilla and mandible; however, there is no statistically significant difference between the coronal diameters of their deciduous molars.

To achieve these results, a justified methodological approach was adopted. Thus, in this study, indirect measurement on cast was preferred because of certain difficulties, described by N'gom[1] unlike the direct measurement in the mouth used by N'cho-Oka and Kouamé:[18,19] Sterilization of the measuring instrument, inaccessibility of the molars related to anatomical structure, discomfort of the patient, and size of the measuring device.[1] To minimize dimensional variations during measurements, hard plaster was used immediately after the impression was taken to cast and fabricate the models.

The descriptive analysis of the data, at the level of the symmetry of the right and left molars [Table 1], shows that, for the first deciduous molar at the maxillary as well as at the mandible, our results agree with the measurements of the vestibular mesiodistal diameter obtained by Keith *et al.*[2] and N'cho-Oka and Kouamé.[18,19] However, several authors such as Yuen *et al.*,[3]

Byeong-Ju *et al.*,[4] Liu *et al.*,[5] and N'cho-Oka *et al.*[18,19] noted an asymmetry for the second right and left molars. This asymmetry could be attributed to environmental factors according to N'gom[1] or has a specific congenital origin according to Ngom *et al.*[1] cited by N'gom or even linked to the measurement method adopted by each study. However, the symmetry between the teeth and their contralateral counterparts would have led some authors to suppose that tooth measurements in humans could be limited to only one side of the hemi-arch.[1,5]

The first and second maxillary molars are identical except for their mesiodistal palatal and mesiodistal occlusal diameters [Table 2]. Indeed, in the vestibulopalatal direction, the mean diameters determined at the largest contour (ØVP) and occlusal ($ØVP_O$) are similar. This conclusion disagrees with the results of Eigbobo *et al.*[6], N'cho-Oka, and Kouamé, Marseillier.[11,18,19] In the mesiodistal sense, with the exception of the vestibular mesiodistal diameter (ØMDV), the second deciduous maxillary molars are larger than those of the first deciduous maxillary molars, as reported in most of the literature review.[6,18-20] In contrast, at the mandible, the second deciduous molars have statistically larger diameters than those of the first deciduous mandibular molars except for the vestibulolingual diameter [Table 2]. They have ascending serial dimensions at the mandible. These conclusions corroborate the data from the literature review [6,10,11,18] Indeed, N'cho-Oka and Kouamé[18] noted that the second mandibular molar is larger than the first deciduous mandibular molar. In addition, the vestibulobuccal occlusal and mesiodistal occlusal diameters of all deciduous molars are smaller than the vestibulobuccal and mesiodistal diameters at the largest contour as confirmed by the results of Marseillier.[11]

This finding indicates a narrowing of the occlusal surface of the deciduous molars, which would be the consequence of the convergence of the vestibular and buccal walls in the occlusal direction. All the maxillary molars in our study are elongated in the vestibulopalatal direction; conversely, at the mandible, they are wider in the mesiodistal direction, as confirmed by some work reported in the literature.[18,19,21] This provision could explain the overlap of the mandibular molars by the deciduous maxillary molars. Of all deciduous molars, the second maxillary molar is the largest in the vestibulopalatal direction; on the other hand, the second mandibular molar is the widest in the mesiodistal direction.

With regard to sex, the coronal diameters of the maxillary deciduous molar group of boys are slightly larger than those of girls [Table 3]. The same applies to the mandible. However, the statistical test shows no difference between the two sexes [Table 4]. These results are consistent with those of previous work reported in the literature.[2,7,20,22] According to these authors, although the mean values of mesiodistal and vestibulolingual coronal diameters are important in boys and girls, the difference is still small or not statistically significant in their respective populations.[2,7,20,22] Thus, Harris and Lease,[22] in a global survey, noted that sexual dimorphism was low in deciduous teeth, with an average of 2% for the 10 tooth types. However, some authors have reported results that do not correspond to those of our study.[3,5,8,23] Indeed, Kuswandari and Nishino[23] in Japan observed a sexual dimorphism between girls and boys, for the mesiodistal diameters of the first maxillary molars and the first and second deciduous mandibular molars. In addition, Liu *et al.*[4] noted a statistically significant difference in the vestibulolingual diameter of the second mandibular molar between the two sexes. According to Melvin and Moss-Salentijn,[24] this sexual dimorphism would be more expressive in the canine and linked to a period of amelogenesis, absolutely longer for deciduous teeth than permanent teeth.

Table 1: Mean and comparison test of the coronal diameters of the first and second deciduous maxillary and right and left mandibular molars

Arch	Mean	Mean	*t*-test	Mean	Mean	*t*-test
Maxillary						
Teeth	54	64		55	65	
ØVP	8.76+0.64	8.82+0.58	0.06	9.78+0.57	9.68+0.69	0.11
$ØVP_O$	4.90+0.45	4.99+0.47	0.13	5.64+0.54	5.71+0.51	0.17
ØMDV	7.92+0.57	7.93+0.52	0.01	9.46+0.60	9.40+0.57	0.07
ØMDP	6.88+0.52	6.82+0.48	0.08	8.71+0.54	8.63+0.56	0.10
$ØMD_O$	6.00+0.50	6.08+0.49	0.11	8.00+0.56	8.01+0.54	0.01
Mandible						
Teeth	74	84		75	85	
ØVL	7.43+0.62	7.61+0.65	0.19	8.97+0.60	9.05+0.60	0.09
$ØVL_O$	4.18+0.36	4.11+0.39	0.13	5.58+0.53	5.61+0.55	0.03
ØMDV	8.57+0.54	8.60+0.54	0.03	10.62+0.60	10.62+0.57	0
ØMDL	7.99+0.55	7.95+0.54	0.05	9.81+0.60	9.80+0.54	0.01
$ØMD_O$	7.08+0.53	7.06+0.52	0.02	8.89+0.63	8.89+0.61	0

Table 2: Overall mean of molar groups and statistical comparison tests of coronal diameters between the first and second deciduous molars at the maxilla and mandible

Teeth	Maxillary			Mandible		
	54/64//55/65			74/84//75/85		
	54/64	55/65	*t*-test	74/84	75/85	*t*-test
ØVP/L	8.79+0.60	9.73+0.61	1.19	7.52+0.63	9.01+0.60	1.88
$ØVPo/L_O$	4.94+0.26	5.67+0.30	1.05	4.14+0.22	5.59+0.30	2.18
ØMDV	7.92+0.54	9.43+0.58	1.85	8.58+0.54	10.62+0.58	2.52
ØMDP/L	6.85+0.36	8.67+0.46	2.44	7.97+0.42	9.80+0.53	2.25
ØMDo	6.04+0.31	8.00+0.43	2.64	7.07+0.38	8.89+0.48	2.19

Conclusion

This work on molar morphometry in melano-African children in Côte d'Ivoire is a basic study that needs to be extended to the incisivo-canine group to obtain complete odontometric data in deciduous teeth. The diameters determined will make it possible to design plates and atlases for teaching the coronary morphology of the deciduous molars of melano-African children in Côte d'Ivoire. They will also be an essential tool for the establishment of appropriate diagnoses and treatments and will enable the forensic

Table 3: Mean coronal diameters of the deciduous molar group and their standard deviations in girls and boys at both the maxilla and mandible

Gender	Mean+SD	*n*	Mean+SD	*n*	Mean+SD	*n*	Mean+SD	*n*
Teeth	54/64		55/65		74/84		75/85	
Boys								
ØVP/L	8.90+0.64	189	9.87+0.72	184	7.62+0.55	187	9.15+0.67	183
$ØVP_O/L_O$	4.99+0.36	188	5.73+0.42	182	4.20+0.30	185	5.68+0.42	183
ØMDV	8.00+0.57	189	9.50+0.59	179	8.65+0.54	186	10.70+0.61	182
ØMDP/L	6.91+0.50	189	8.77+0.65	180	8.02+0.58	186	9.87+0.73	180
$ØMD_O$	6.08+0.44	189	8.10+0.60	180	7.13+0.52	184	8.97+0.67	179
Girls								
ØVP/L	8.66+0.66	170	9.58+0.73	170	7.39+0.57	166	8.85+0.69	162
$ØVP_O/L_O$	4.89+0.37	167	5.60+0.43	170	4.08+0.31	165	5.49+0.43	158
ØMDV	7.84+0.51	169	9.36+0.57	169	8.50+0.53	166	10.53+0.53	160
ØMDP/L	6.78+0.52	169	8.56+0.66	168	7.90+0.61	166	9.71+0.77	158
$ØMD_O$	5.98+0.46	169	7.90+0.61	167	700+0.55	162	8.78+0.70	157

SD: Standard deviation, N: Number

Table 4: Statistical comparison tests between the coronal diameters of the first and second deciduous molars of girls and boys at the maxilla and mandible

Arch	*t* observed	Result	*t* observed	Result	*t* observed	Result	*t* observed	Result
Maxillary								
Teeth	54 b/54 g		64 b/64 g		55 b/55 g		65 b/65 g	
ØVP	0.33	NS	0.22	NS	0.31	NS	0.34	NS
$ØVP_O$	0.22	NS	0.1	NS	0.18	NS	0.16	NS
ØMDV	0.27	NS	0.15	NS	0.17	NS	0.16	NS
ØMDP	0.18	NS	0.17	NS	0.21	NS	0.33	NS
$ØMD_O$	0.15	NS	0.14	NS	0.21	NS	0.31	NS
Mandible								
Teeth	74 b/74 g		84 b/84 g		75 b/75 g		85 b/85 g	
ØVL	0.25	NS	0.26	NS	0.20	NS	0.14	NS
$ØVL_O$	0.26	NS	0.20	NS	0.17	NS	0.35	NS
ØMDV	0.24	NS	0.15	NS	0.23	NS	0.16	NS
ØMDL	0.16	NS	0.02	NS	0.21	NS	0.18	NS
$ØMD_O$	0.016	NS	0.19	NS	0.20	NS	0.23	NS

b: Boy, g: Girl, NS: The difference between the average diameters of girls and boys is not significant

doctor to identify victims in the event of an accident. Finally, research in the West African region to establish dimensional standards for African melanoderm could help in the manufacture and industrialization of dental materials adapted to this population.

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How to cite this article: Kolomdou K, Ramata B, Kakou S, Manuel STM, Ebrottie E. Coronal morphometry of deciduous molars of melano-Ivorian children, West Africa. Int Dent Med J Adv Res 2018;4:1-6.