Content available at: https://www.ipinnovative.com/open-access-journals

IP International Journal of Forensic Medicine and Toxicological Sciences

Journal homepage: http://www.ijfmts.com/

Original Research Article

Identification of dental sexual dimorphism in deciduous teeth: A cross sectional study

Soumboundou Sankoung[1]*, Ayat Ben Aziz[1], Mamadou Lamine Ndiaye[1], Soukeye Ndoye[2]

[1] *University Cheikh Anta Diop of Dakar, Dakar, Senegal*
[2] *Dept. Odontology, University Cheikh Anta DIOP, Dakar, Senegal*

ARTICLE INFO

Article history:
Received 14-01-2024
Accepted 20-02-2024
Available online 27-04-2024

Keywords:
Sexual dimorphism
deciduous teeth
odontometric analysis
forensic odontology

ABSTRACT

Introduction: The study of sex diagnosis is essential to reconstruct the biological profile of an unknown individual. Two approaches are often used: morphometric and scopic. This three-dimensional morphometric study aimed to assess sexual dimorphism in temporary dentition.
Materials and Methods: A total of 200 dental impressions digitized in 3D using the Revopoint® POP2 3D scanner were used for this odontometric analysis.
Results: Discriminant statistical analysis (Student's t-test) revealed that boys had higher mean values than girls for all distances measured. A highly significant sexual dimorphism was observed in the temporary second molars. The distance between the mandibular canines was slightly greater in boys, although this difference was not statistically significant.
Conclusion: In conclusion, odontometric parameters are a simple, reliable, and inexpensive method of sex determination. The temporary canines and second molars are the most dimorphic.

1. Introduction

With the increase in crime, road accidents, and natural disasters, the use of forensic science has become essential to identify victims for moral reasons, to allow the family to mourn, and or for legal reasons (to establish the circumstances of the death and to define the rights of succession, insurance, inheritance)2.[1,2]

The identification protocol generally includes two approaches (comparative and evaluative) depending on the nature of the ante-mortem and post-mortem elements.

In the absence of comparative data, identification is estimated or evaluative. It aims to define the person's biological profile by determining the victim's age, sex, stature, and biogeographical origin.

In terms of sex determination, DNA is the gold standard, with a sex prediction rate of up to 100%. However, its use may be limited in the case of heavily charred or fragmented skeletal remains and because of its high cost.

Morphoscopic (non-metric) and morphometric methods are used to predict sex. In the morphoscopic approach (visual assessment), the coxal bone is highly dimorphic due to the physiological changes that occur during childbirth in women, the forensic tool of choice. The skull, clavicle, and teeth are also used in its absence, with satisfactory results. Teeth show dimorphism about the size and morphology of the crown, especially in the canine.[3,4] Genetic factors, notably the Y chromosome, influence dental dimensions, which leads to a slower and longer enamel maturation process than the X chromosome.[5] Environmental factors such as prenatal and postnatal diseases, diet, drugs used by the mother during pregnancy, and climatic differences also

* *Corresponding author*.
E-mail address: aladjisa12@gmail.com (S. Sankoung).

https://doi.org/10.18231/j.ijfmts.2024.004

affect tooth morphology and structure.[6]

Brook and colleagues report that children with low birth weight had more enamel defects at a statistically significant level.[7]

Numerous studies of adults have shown that dental dimensions vary from one population to another and that teeth are sexually dimorphic.[6–8]

The forensic literature contains only a limited number of studies on dental dimensions in children.

The present study aimed to investigate tooth size and sexual dimorphism in the temporary dentition of Senegalese children.

2. Materials and methods

2.1. Materials

This descriptive study was carried out from March to July 2023 in the forensic odontology department of the Faculty of Medicine in Dakar. Two hundred dental casts were selected from 100 Senegalese children, including 50 boys and 50 girls aged between 4 and 10. An anonymization procedure was applied as soon as the sample was constituted. Only the sex of the participants was known. Subjects with severe crowding, caries, proximal wear, and restorations were excluded.

The dental casts selected were digitized in three dimensions using the Revopoint® 3D scanner (Figure 1).

In version 2022 of MeshLab, the mesio-distal and bucco-lingual diameters of the maxillary and mandibular canines and molars were measured.

2.2. Methods

2.3. Odontometric analysis

In MeshLab version 2022, measurements were taken on the mesiodistal and buccolingual diameters of the maxillary and mandibular canines and molars (Figure 2).

Measurements are taken on the diameters:

Mesiodistal diameter (MD) is defined as the most significant distance between the points of contact on the proximal surfaces of the dental crown

Buccolingual/palatal diameter (BL/BP) is the most significant distance between the crown's vestibular and lingual surfaces perpendicular to the tooth's mesiodistal diameter.

Intercanine distance is defined as the linear distance between the cusp tips of the canines on the right and left sides.

2.4. Statistical analysis

The data collected were recorded and processed in SPSS version 2019 software. A descriptive analysis was first performed. The relevance of certain factors was then tested using the Student's T-test. A significance level of $P < 0.05$ was used.[9]

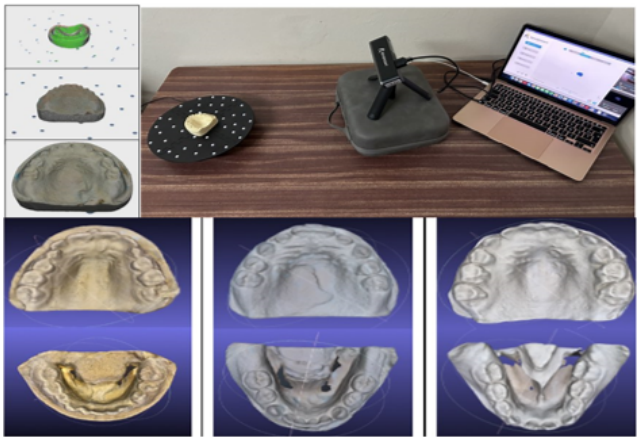

Figure 1: 3D acquisition of cast models

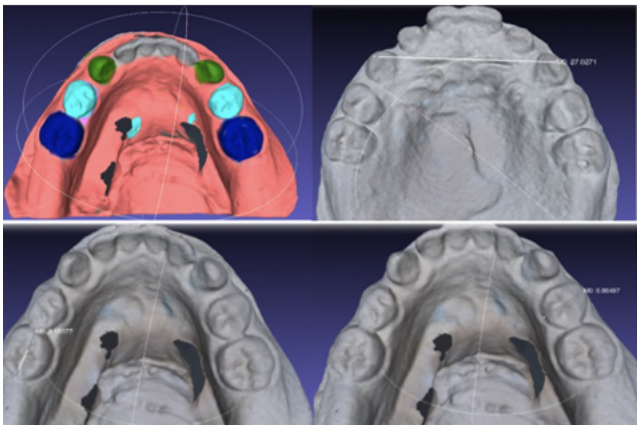

Figure 2: distance measurements in Meshlab

2.5. Mesio-distal (MD and bucco-lingual (VP; VL diameters)

Overall, the mean distances calculated were higher in boys than in girls. No significant difference was noted in the mesio-distal and buccolingual distances for the maxillary canines. However, a statistically significant difference was found for the mandibular canines for the buccolingual distance (Table 1).

Similarly, for the maxillary first temporary molar, the mean difference was more significant in the buccolingual distance (Table 2).

There was no statistically significant difference for the mandibular first temporary molar according to sex. All mesiodistal and buccolingual tooth diameters were found to be larger for boys than for girls (Table 3). Statistically significant differences were found between the sexes in the majority of teeth (except in the buccolingually distance).

Table 1: Mean and standard deviation mesiodistal and buccolingual/ palatal distance of the right and left maxillary canine.

	Girls			Boys		
	n	**Mean**	**SD**	**Mean**	**SD**	**P**
63-MD	50	6.48	0.480	6.59	0.458	0,267
63-BP	50	6.21	0.492	6.23	0.415	0,812
53-MD	50	6.54	0.493	6.57	0.468	0,767
53-BP	50	6.28	0.462	6.26	0.357	0,784
83-MD	50	5.82	0.428	5.87	0.376	0,55
83-BL	50	5.61	0.409	5.80	0.404	0,041
73-MD	50	5.77	0.360	5.95	0.412	0,39
73-BL	50	5.78	0.408	5.68	0.345	0,025

P<0 ;05
* * = highly significant

Table 2: Mean and standard deviation of the mesiodistal and buccolingual distance of the maxillary and mandibular first molars, right and left.

	Girls			Boys		
	n	**Mean**	**SD**	**Mean**	**SD**	**P**
54-MD	50	6.98	0.486	7.02	0.474	0,732
54-VP	50	8.47	0.587	8.73	0.444	0,023
64-MD	50	7.10	0.542	7.08	0.549	0,853
64-VP	50	8.56	0.603	8.68	0.440	0,029
74-MD	50	8.00	0.569	8.17	0.504	0,177
74-VL	50	7.25	0.485	7.37	0.471	0,267
84-MD	50	8.03	0.526	8.20	0.572	0,224
84-VL	50	7.31	0.412	7.30	0.479	0,861

P<0.05
* * = highly significant

Table 3: Mean and standard deviation mesiodistal and buccolingual distance of the maxillary and mandibular right and left second molar.

	Girls			Boys		
	n	**Mean**	**SD**	**Mean**	**SD**	**P**
55-MD	50	9.06	0.573	9.28	0.608	0,082
55-BP	50	9.57	0.652	9.89	0.552	0,01*
65-MD	50	8.99	0.573	9.27	0.570	0,033
65-BP	50	9,59	0,60	9.73	0.477	0,319
75-MD	50	10.01	0.553	10.53	0.570	0,001**
75-BL	50	9.06	0.461	9.17	0.411	0,233
85-MD	50	9.87	0.566	10.36	0.508	0,001**
85-BL	50	8.98	0.461	9.22	0.471	0,013

P<0 ;05
* * = highly significant

Table 4: Intercanine distance

	Grirls			Boys		
	n	**Mean**	**SD**	**Mean**	**SD**	**P**
IC-MAX	50	32.8	2.81	33.4	2.80	0,306
IC-MAN	50	25.2	2.48	26.0	2.52	0,169

IC-MAX : Maxillary intercanine distance
IC-MAN : Mandibular intercanine distance

Sexual dimorphism was better or more pronounced in the canines and the two-second molars.

2.6. Maxillary and mandibular inter-canine distance

In the maxilla, the mean value was 32.8 mm ± 2.81 in girls and 33.4 mm ± 2.80 in boys. There were no statistically significant differences.

The mean value of the mandibular inter-canine distance was 25.2 mm ± 2.48 in girls and 26.0 mm ± 2.52 in boys (Table 4).

3. Discussion

A person's biological profile is determined by age, stature, sex, and biogeographical origin. Determining the sex of a living person is pretty straightforward because of the development of secondary sexual characteristics. For a charred or skeletonized body, however, the task proves difficult. Morphometric and morphoscopic assessment of the skull, coxal bone, teeth, and even genetic analysis are necessary for sex determination.

In forensic odontology, dimensions are often used to assess sex. Studies carried out on permanent and temporary dentition confirm the existence of sexual dimorphism. Canines and molars are considered to be the most dimorphic teeth. [10,11]

This dental study evaluated 200 dental casts of children aged between 4 and 10 years, scanned in 3D with the Revopoint Scanner.

The mesodistal and buccolingual diameters of the molars and temporary canines were measured, as were the distances between the canines.

The sample size used in this study (100 children) is within the average of studies in this field. Liu HH et al. and Yuen KK et al. worked with samples of 90 and 112 children, respectively. [12,13]

Sex determination from teeth is essential at prepubertal age, as other sexual characteristics are not yet well developed. During this period, the crowns of the temporary teeth are fully formed. [14] Overall, boys showed higher values than girls for all the distances measured. The mean value for the mesiodistal diameter of the right mandibular canine was 5.87 mm ± 0.376 in boys and 5.82 mm ± 0.428 in girls. In the buccolingual diameter, the mean diameter was 5.80 mm ± 0.409 in boys and 5.61 mm ± 0.404 in girls. T-test showed a significant difference in the buccolingual diameter ($p < 0.041$)

In contrast, on the left side, a statistically significant difference was found only in the mesiodistal diameter ($P < 0.039$).buccopalatal diameters.

The results of the study conducted by Singh et al. confirm the present study's findings. However, in their work, significant differences were found in the mesiodistal diameters of all temporary canines. [15] The sexual dimorphism of the right mandibular canine has also been confirmed by research by Guemas J et al. Ingaleshwar P et al. have mainly highlighted a dimorphism in the mesiodistal and vestibule-lingual diameters with a significant difference for the maxillary and mandibular canines. [16]

For the mesiodistal diameter of the the mean value was 7.02 mm ± 0.474 in boys and 6.98 mm ± 0.486 in girls. In the buccolingual direction, the mean diameter was 8.73 mm ± 0.444 in boys and 8.47 mm ± 0.587 in girls. The only significant difference was in the buccomolar, the mean value of the mesiodistal diameter was 8.17 mm ± 0.504 in boys and 8.00 mm ± 0.569 in girls. In the buccolingual direction, the mean diameter was 7.37 mm ± 0.471 in boys and 7.25 mm ± 0.485 in girls. However, there was no significant difference between the mesiodistal and buccolingual diameters.For the right mandibular first molar, the mean mesiodistal diameter was 8.20 mm ± 0.572 in boys and 8.03 mm ± 0.526 in girls. In the buccolingual direction, the mean diameter was 7.30 mm ± 0.479 in boys and 7.31 mm ± 0.412 in girls. There was no significant difference between the sexes for these measurements.

Studies by J. Viciano et al. and Singh et al. confirm the results of the present study. [17,18] The results of the study by Shankar S et al. differ from ours, as they found a statistically significant difference for the mesiodistal diameter of the maxillary right first molar. [18]

Boys had higher mean values for the maxillary and mandibular second molars than girls. The mean mesiodistal diameter of the right maxillary molar was 9.28 mm ± 0.608 in boys and 9.06 mm ± 0.573 in girls. In the buccolingual direction, the mean diameter was 9.89 mm ± 0.552 in boys and 9.57 mm ± 0.652 in girls. There was a significant difference in buccolingual measurements ($P < 0.001$) but not in mesio-distal measurements.

For the upper left second molar the mean mesiodistal diameter was 9.27 mm ± 0.570 in boys and 8.99 mm ± 0.573 in girls. In the buccolingual direction, the mean diameter was 9.73 mm ± 0.477 in boys and 9.59 mm ± 0.60 in girls. mesiodistal and buccolingual diameters were more considerable in boys, with a significant difference in mesiodistal measurements ($P < 0.033$) but not in buccolingual measurements. In girls, the mean mesiodistal diameter of the left mandibular second molar was 10.01 mm ± 0.553, whereas it was 10.53 mm ± 0.570 in boys. In the buccolingual direction, the mean diameter was 9.06 mm ± 0.461 in girls and 9.17 mm ± 0.411 in boys. The mesiodistal and buccolingual diameters were larger in boys, with a significant difference in the mesiodistal measurements ($P < 0.001$), but not in the buccolingual measurements.molar was 10.36 mm ± 0.508 in boys and 9.87 mm ± 0.566 in girls. In the buccolingual direction, the mean diameter was 9.22 mm ± 0.471 in boys and 8.98 mm ± 0.461 in girls. The mesio-distal and vestibulo-lingual diameters were larger in boys,

with a significant difference for mesio-distal ($P < 0.001$) and buccolingual ($P < 0.013$) measurements.

These results agree with those of S. Kondo et al., who showed that the mesiodistal and buccolingual diameters of the maxillary and mandibular second molars were higher in boys than in girls.[19] The work of Margetts B et al. and Singh A et al. also confirms the results of this study.[15,20] There was no statistically significant difference between maxillary and mandibular inter-canine distance. Boys had a maxillary inter-canine distance of 33.4 mm ± 2.80 and girls 32.8 mm ± 2.81. The mean value of the mandibular inter-canine distance was 26.0 ± 2.52 in boys and 25.2 ± 2.48 in girls. Abu Alhaija et al., also obtained similar results for maxillary and mandibular inter-canine distance, which were greater in boys than in girls.[21].

4. Conclusion

In conclusion, the results confirm sexual dimorphism in the temporary dentition, particularly in the mandibular canine and second molars. The method used in this study is simple and easy to perform, but further studies are needed to confirm the results of this study.

5. Source of Funding

None.

6. Conflict of Interest

None.

References

1. Shamim T. Forensic pediatric dentistry. *J Forensic Dent Sci*. 2018;10(3):128–59.
2. Fernandes L, Veloso C, Oliveira J, Genu PR, Santiago BM, Rabello PM. Odontometric analysis of molars for sex determination. *Braz J Oral Sci*. 2016;15(1):35–43.
3. Masroor S, Nagaveni N, Poornima P. Identification of dental sexual dimorphism in deciduous teeth using craniometry and odontometry: A cross sectional study. *Int J Oral Health Dent*. 2023;9(1):5–9.
4. Viciano J, Tanga C, Anastasio D, Belcastro R, Capasso MG. Sex estimation by odontometrics of nonadult human remains from a contemporary Italian sample. *Am J Phys Anthropol*. 2021;175(1):59–80.
5. Garn SM, Lewis AB, Swindler DR, Kerewsky RS. Genetic control of sexual dimorphism in tooth size. *J Dent Res*. 1967;46(5):963–72.
6. Henrique R, Silvia D, Peres A, Oliveira AS, Oliveira R. Use of DNA technology in forensic dentistry. *J Appl Oral Sci*. 2007;15(3):156–61.
7. Fatih A, Hulya C, Osman Y. Sexual Dimorphism in the Permanent Dentition of a Turkish Population. *Indian J Orthod Dentofac Res*. 2017;3(4):226–30.
8. Brook AH. Multilevel complex interactions between genetic, epigenetic and environmental factors in the aetiology of anomalies of dental development. *Arch Oral Biol*. 2009;54:3–17.
9. Lund H, Mörnstad H. Gender determination by odontometrics in a Swedish population. *J Forensic Odontotomatol*. 1999;17(2):30–4.
10. Cardoso H. Sample-specific (universal) metric approaches for determining the sex of immature human skeletal remains using permanent tooth dimensions. *J Archaeol Sci*. 2008;35(1):158–68.
11. Bartha D. Determination of sex by teeth. *Dtsch Z Gesamte Gerichtl Med*. 1963;54:10–5.
12. Liu HH, Dung SZ, Yang Y. Crown diameters of the deciduous teeth of Taiwanese. *Kaohsiung J Med Sci*. 2000;16(6):299–307.
13. Yuen KK, So LL, Tang EL. Mesiodistal crown diameters of the primary and permanent teeth in southern Chinese a longitudinal study. *Eur J Orthod*. 1997;19(6):721–52.
14. Lunt RC, Law DB. A review of the chronology of the eruption of deciduous teeth. *J Am Dent Assoc*. 1974;89(4):872–81.
15. Singh A, Bhatia HP, Sood S, Sharma N. Demystifying the Mysteries: Sexual Dimorphism in Primary Teeth. *J Clin Diagn Res*. 2017;11(4):110–4.
16. Ingaleshwar P, Vaswani V, Bhosale SS, Deepak V, Redder P, Smitha T. Evaluation of canine sexual dimorphism in deciduous and permanent dentition. *J Oral Maxillofac Pathol*. 2018;22(3):450.
17. Viciano J, Anastasio D, Capasso R. Odontometric sex estimation on three populations of the Iron Age from Abruzzo region (central-southern Italy). *Arch Oral Biol*. 2015;60(1):100–5.
18. Shankar S, Anuthama K, Kruthika M. Identifying sexual dimorphism in a pediatric South Indian population using stepwise discriminant function analysis. *J Forensic Leg Med*. 2013;20(6):752–8.
19. Kondo S, Funatsu T, Wakatsuki E. Sexual dimorphism in the tooth crown dimensions of the second deciduous and first permanent molars of Taiwan Chinese. *Okajimas Folia Anat Jpn*. 1998;75(5):239–85.
20. Margetts B, Brown T. Crown diameters of the deciduous teeth in Australian Aboriginals. *Am J Phys Anthropol*. 1978;48(4):493–502.
21. Alhaija A, Qudeimat MA. Occlusion and tooth/arch dimensions in the primary dentition of preschool Jordanian children. *Int J Paediatr Dent*. 2003;13(4):230–9.

Author biography

Soumboundou Sankoung, Assistant Professor

Ayat Ben Aziz, Docteur

Mamadou Lamine Ndiaye, -

Soukeye Ndoye, -

Cite this article: Sankoung S, Aziz AB, Ndiaye ML, Ndoye S. Identification of dental sexual dimorphism in deciduous teeth: A cross sectional study. *IP Int J Forensic Med Toxicol Sci* 2024;9(1):13-17.