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Prevalence and Inheritance Pattern of Midline Diastema among Ijaws of Nigeria

Johnson I, Olotu EJ and Ordu KS

Department of Anatomy, Faculty of Basic Medical Sciences, College of Health Sciences, University of Port Harcourt, Rivers State, Nigeria

Corresponding Author: Johnson I

Email: ibinaj321@gmail.com; +2348037247071

ABSTRACT

Midline diastema is the space between the mesial surfaces of central incisors greater than 0.5mm. The prevalence of midline diastema varies greatly with age, gender and race. The present study was conducted to establish the prevalence and inheritance pattern of natural midline diastema among the Ijaw ethnic group of South-South Nigeria. The study involved 363 respondents (109 males and 254 females) with natural midline diastema. With an informed consent after clearance by graduate school ethics committee, data was obtained from the subjects both by a structured questionnaire and direct measurement of the width of midline diastema and then subjected to statistical analysis. The mean value for the width of midline diastema was 2.16 ± 0.91 mm and 1.87 ± 0.87 mm for the natural maxillary and mandibular width respectively. It was more prevalent in females and age group between 28-30years with 70% and 40.8% respectively than males with prevalent rate of 30% and older age group at $p < 0.05$. The maxillary arch showed highest prevalent of 70%, followed by the co-existing with 17.1% and 12.9% for mandibular. The trait midline diastema occurs in two contrasting allelic forms and genetically transmitted by Mendelian recessive-dominant pattern with the presence of the diastema dominant over its absence. Therefore midline diastema has sexual dimorphism showing more prevalence in females. This study can be used in comparative anatomy and genetic analysis as well as in dentistry.

Keywords: Midline diastema, Prevalence, Inheritance-pattern, Ijaw

INTRODUCTION

“*Diastema*” is a Greek word which means “space between”. It was therefore adopted by odontology as an opening between two or more consecutive teeth¹. Diastema are most frequently located between the two central incisors, thus regarded as midline, median, or central diastema² however it can be found in between almost or all the teeth in the dental arch³. From a dimensional perspective, Keene⁴ defined midline diastema as the space between the mesial surfaces of central incisors of the maxilla greater than 0.5mm. There is usually high occurrence of diastema at the early stages of dental development in the paediatric age-group⁵. However, majority of them closes naturally, after the permanent teeth erupt. On the other hand, the opening can persist after the permanent incisors and canine erupts and at this point, closure is unlikely^{3,4}.

Various researchers;⁶⁻⁷ have suggested that multiple factors may be involved in the development of midline diastema which includes; undersized or missing lateral incisors - mesiodens², Para-functional habits such as bruxism, thumb sucking, tongue thrusting and mouth breathing⁸. Developmental anomaly such as anodontia, macroglossia, dentoalveolar disproportion, flared or

rotated incisor and localized spacing are among suggested features leading to diastema⁹. From a holistic view, the formation of midline diastema can be divided into the following; genetic, environmental, oral habit and pathology^{6,10-13}. Physical traits just like diastema are observable characteristics in humans and these traits are obviously inherited from their parents; however the expressivity of these traits are determined by the pattern in which it is inherited¹⁴.

Inherited human traits which have been associated with facial beauty include; presence or absence of dimples or freckles, skin and hair colour, naturally curly or straight hair, presence or absence of cleft chin, and presence or absence of diastema and lots of others yet identified^{15,16}.

However, the distribution by proportion may vary from one population to another population¹⁶.

In most parts of Africa, midline diastema especially that of the maxilla, is often viewed as an attractive and beauty defining dental feature, especially within the female circle, and it is frequently used as forecastable success trademark¹⁷. Also in Nigeria, most socio-cultural groups agrees that the midline diastema enhances the attractiveness of an individual, especially

women^{3, 18, 19}, hence, many people alter the gap between their incisors in order to create one, thus achieving a degree of attractiveness^{20, 21}. However, the perspective of people of western origin is quite different, as diastema is regarded as an anatomical malformation called malocclusion^{22, 23}; therefore they seek medical solutions in an attempt to close it^{19, 24}.

Studies have shown that the prevalence of centralised diastema differs with gender, age-group, population and race¹. Oesterle and Shellhart²⁵ identified a prevalence of 97% midline diastema of the maxilla among 5-year, which decreased with age, while 37% prevalence was identified among adolescents in Nigeria¹⁷.

Studies have shown that age-group, sex, race, genetics and socio-cultural inclination are factors that determine the prevalence of midline diastema^{3, 5, 18, 26}.

The aim of the study was to establish the prevalence and inheritance pattern of natural midline diastema among the Ijaw ethnic group of South-South Nigeria.

MATERIALS AND METHODS

A total of 363 subjects (comprising 109 males and 254 females) between the ages of 16 to 63 years of Ijaw

ethnic group by paternal association to their second generation, with midline space of about 0.5mm and above between their central incisors, without any congenital deformity such as cleft lip and/or palate, who possess all anterior teeth and with no form of orthodontic treatment and or having filling or veneer crowns on the anterior region of their teeth were included in this study.

The data was collected using a well-structured questionnaire as well as a digital vernier calliper. Demographic data such as age, sex and tribe were extracted from the questionnaire. Written and signed informed consent was obtained from each participant after explaining the purpose of the study.

The respondents were then asked to reflect their teeth; dimensional screening using a digital vernier calliper was done to determine respondents that met the 0.5mm minimum gap for true midline diastema.

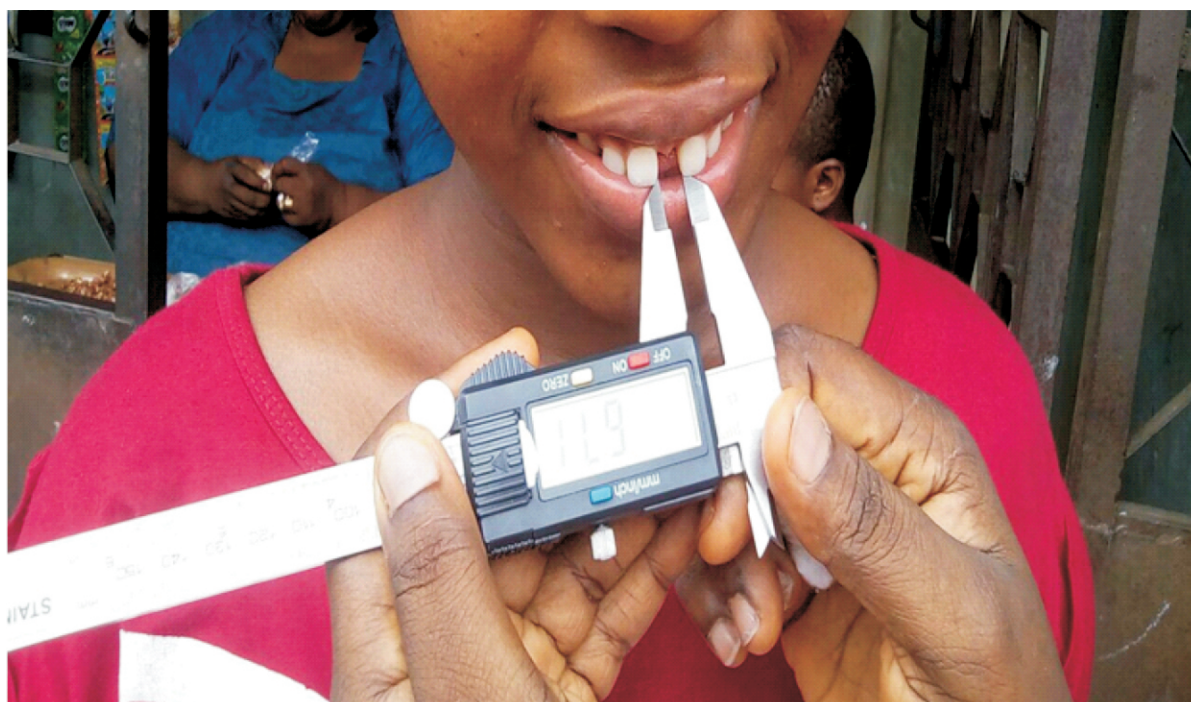


Figure 1: Method of measuring the midline diastema

The data collected was subjected to analysis using Statistical Package for the Social Sciences (SPSS) version 22.0.

RESULTS

Figure 2 shows the distribution of the subjects according to the age groups. The result is arranged in the following order, starting with the age group where diastema is most prevalent to the least, 28-39 years (40.8%), 16-27 years (28.7%), 40-51 years (19.6%) and 52-63 years (11%).

Table 1 shows the descriptive characteristics of maxillary and mandibular midline diastema. The mean width of the natural midline diastema for the Ijaws is 2.16 ± 0.91 mm and 1.87 ± 0.87 mm for maxillary and mandibular respectively. When tested for difference, higher maxillary diastema width than mandibular was observed in the studied population, thus statistically significant at $p < 0.05$ as shown in table 1.

Table 2 represents the sex associated distribution of midline diastema amongst the studied population. Analysis of all individuals drawn from across the four states studied (n=363) revealed that females had a higher occurrence of midline diastema at 70% and males at 30%, chi-square analysis indicated sexual

dimorphism ($p < 0.05$) as shown in table 2.

Table 3 shows the distribution of the natural midline diastema with respect to the location. Analysis of the four states drawn together clearly revealed that 70.0% of the population had maxillary midline diastema, 12.9% had mandibular midline diastema of the mandible, while 17.1% of the study population had maxillary and mandibular midline diastema occurring simultaneously. The chi-square analysis showed sex association with respect to the location of the diastema ($P < 0.05$).

Mendelian chi-square test for allele distribution of observed to expected outcome: Frequency, percentage and distribution is presented in table 4a. The total (and sex separated) offspring who presented with the diastema trait when both parents, either parents or none of the parents presented with the traits were observed. In Table 4b, the result for the Mendelian Chi-square tests for significance comparing the observed and expected outcome for the offspring for the possibility of the trait being dominant or recessive was presented.

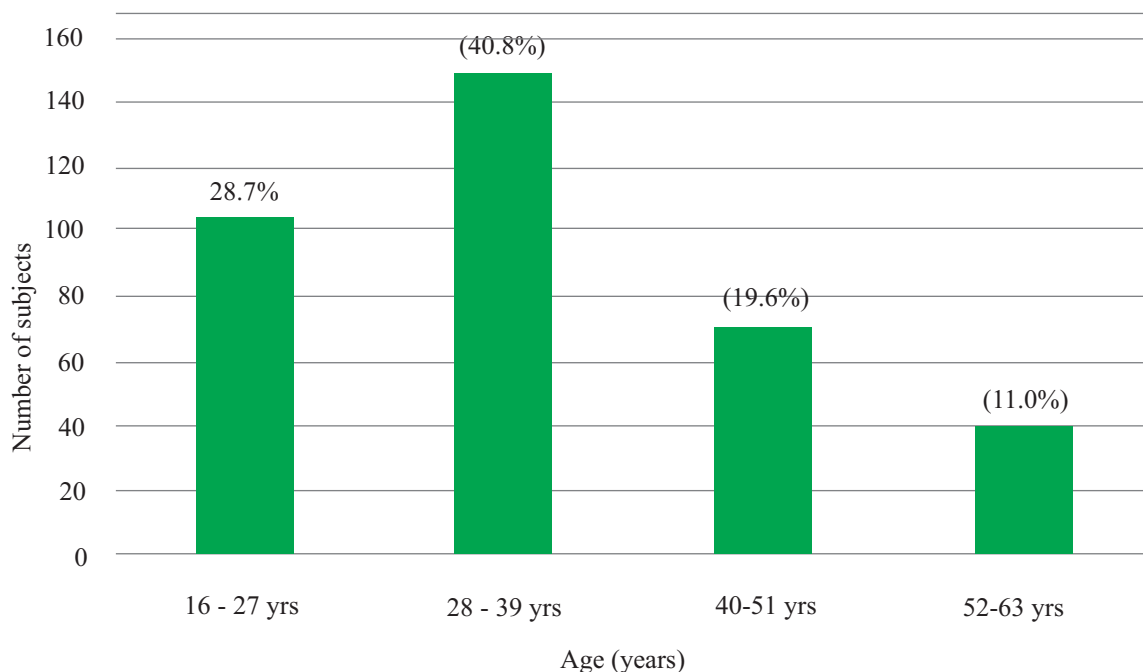


Figure 2: Distribution of the subjects with natural midline diastema according to their age group

Table 1: Descriptive characteristics of mandibular and maxillary diastema

State	Parameters	Range (Min – Max) (mm)	Mean \pm SD (mm)	t-test	
				t-value	P-value
Bayelsa	Width of maxillary diastema	0.56 - 4.10	1.82 \pm 0.79	-7.95	<0.01*
	Width of mandibular diastema	0.68 - 2.60	1.57 \pm 0.58	-0.98	0.33
Delta	Width of maxillary diastema	0.83 - 5.44	2.45 \pm 0.97	-1.19	0.24
	Width of mandibular diastema	0.44 - 4.20	2.04 \pm 0.95	-0.88	0.38
Edo	Width of maxillary diastema	0.60 - 5.56	2.31 \pm 1.05	-3.94	<0.01*
	Width of mandibular diastema	0.72 - 3.91	2.01 \pm 1.05	-	-
Rivers	Width of maxillary diastema	0.69 - 6.20	2.15 \pm 0.73	-4.58	<0.01*
	Width of mandibular diastema	0.89 - 4.89	1.93 \pm 0.92	-2.01	0.05
Total	Width of maxillary diastema	0.56 - 6.20	2.16 \pm 0.91	-8.44	<0.01*
	Width of mandibular diastema	0.44 - 4.89	1.87 \pm 0.87	-3.58	<0.01*

*= test was significant at $p < 0.05$, Min = minimum, Max = maximum, SD = standard deviation, t-test = student's t-test, t-value = t-test value, P-value = probability value

Table 2: Sex associated distribution of midline diastema among the selected states

State	Male	Female (%)	Total (%)	Chi-square test	
				X ²	P-value
Bayelsa	24 (23.3)	79 (76.7)	103 (100)	2.40	0.13
Delta	33 (42.9)	44 (57.1)	77 (100)	16.09	<0.01*
Edo	20 (24.1)	63 (75.9)	83 (100)	6.28	0.01*
Rivers	32 (32.0)	68 (68.0)	100 (100)	5.02	0.04*
Total	109 (30.0)	254 (70.0)	363 (100)	25.54	<0.01*

* = Test was significant at $P < 0.05$, M = Male, F = Female, X² = Chi-square value

Table 3: Distribution of natural midline diastema with respect to location

State	Sex	Location of Midline Diastema			Chi-square test	
		Mandible (%)	Maxilla (%)	Both (%)	X ²	P-value
Bayelsa	M	5 (20.8)	17 (70.8)	2 (8.3)	3.54	0.17
	F	7 (8.9)	57 (72.2)	15 (19.0)		
	Total	12 (11.7)	74 (71.8)	17 (16.5)		
Delta	M	8 (24.2)	19 (57.6)	6 (18.2)	3.56	0.17
	F	4 (9.1)	28 (63.6)	12 (27.3)		
	Total	12 (15.6)	47 (61.0)	18 (23.4)		
Edo	M	1 (5.0)	14 (70.0)	5 (25.0)	4.23	0.12
	F	5 (7.9)	53 (84.1)	5 (7.9)		
	Total	6 (7)	67 (81)	10 (12.0)		
Rivers	M	9 (28.1)	17 (53.1)	6 (18.8)	4.69	0.10
	F	8 (11.8)	49 (72.1)	11 (16.2)		
	Total	17 (17.0)	66 (66.0)	17 (17.0)		
Total	M	23 (21.1)	67 (61.5)	19 (17.4)	9.62	0.01*
	F	24 (9.4)	187 (73.6)	43 (16.9)		
	Total	47 (12.9)	254 (70.0)	62 (17.1)		

* = Test was significant at P < 0.05, M = Male, F = Female, X² = Chi-square value

Table 4a: The Frequency, percentage and distribution for diastema with respect to parental combination

Parents and diastema Combinations	Total number of Offspring			Male Offspring			Female Offspring		
	Present	Absent	Total	Present	Absent	Total	Present	Absent	Total
Present in both parents	306 (86.4%)	48 (13.6%)		137	24	161	169	24	193
Exp. outcome (if presence of diastema is dominant)			354						
Exp. outcome (if absence of diastema is dominant)									
Absent in both parents	46 (39.7%)	70 (60.3%)		17	38	55	29	32	61
Exp. outcome (if presence of diastema is dominant)			116						
Exp. outcome (if absence of diastema is dominant)									
Present in father and absent in mother	490 (67.4%)	237 (32.6%)		233	118	351	257	119	376
Exp. outcome (if presence of diastema is dominant)			727						
Exp. outcome (if absence of diastema is dominant)									
Absent in father and present in mother	807 (68.3%)	374 (31.7%)		358	186	544	449	188	637
Exp. outcome (if presence of diastema is dominant)			1181						
Exp. outcome (if absence of diastema is dominant)									
Total	1649(%)	729(%)	2378	745	366	1111	904	363	1267

Table 4b: Mendelian chi-square test for inheritance of diastema (expected to observed outcome)

Presence or absence of diastema	If presence is dominant			If absence is dominant		
	Calculated	Critical	Inference	Calculated	Critical	Inference
Present in both parents	2.347	3.841	Insignificant *	280.347	3.841	Significant
Absent in both parents	18.241	3.841	Significant	42.241	3.841	Significant
Present in father and absent in mother	22.394	3.841	Significant	697.061	3.841	Significant
Absent in father and present in mother	28.006	3.841	Significant	1182.673	3.841	Significant

DISCUSSION

This is a cross sectional study carried out to investigate the prevalence and inheritance pattern of midline diastema among the Ijaw Ethnic group of selected South-South states of Nigeria.

Variations abound in the prevalence of midline diastema among people of different age-group, gender and population^{3,18-19,26-32}.

Findings from current study, shows that 70% of the studied population had maxillary midline diastema, 12.9% had mandibular midline diastema while 17.1% had the co-existing maxillary and mandibular diastema. This result conforms to result obtained by Olotu *et al.*, 2015²⁷ in Port Harcourt, Omotosho and Kadir, 2010³ in South-western Nigeria, Hashim *et al.*, 2013³³, in South India and Ayama *et al.*, 2015²⁶ in Owerri, Nigeria. However, the result from current study is not consistent with results by Darwn *et al.*, 2014³⁰.

There was significant difference in the prevalence of midline diastema between the males and females, indicating sexual dimorphism in the trait ($p < 0.05$) of the total sample of 363 subjects. In the current study, midline diastema was more prevalent in females than males, with females accounting for 70% and males 30% at ($p < 0.05$). This result is consistent with findings from previous studies^{3, 26-29, 34-35} who all found midline diastema to be more prevalent among the females than males. Whereas in contrast to the current findings, the frequency of occurrence of midline diastema was the same in males and females in studies done by^{30,36}, while studies by^{19,31} reported higher prevalence in males than females.

The mean width of the natural midline diastema from the current study was 2.16 ± 0.91 mm for the maxillary midline diastema and 1.87 ± 0.87 mm for the mandibular midline diastema. When tested for difference, the result showed significant difference between the maxillary

and mandibular diastema. The maxillary width had higher value than the mandibular width. Result from present work when compared to a work by Hameedullah *et al.*, 2010²⁸ among the Rawalpindi population in Pakistan reported a mean value of the maxillary midline diastema to be 2.62 ± 1.28 mm and this higher than result from present study.

Every trait follows a particular pattern of inheritance³⁷. Diastema is a trait and its inheritance has to follow a particular pattern. The result using Chi-test to test the pattern of inheritance based on Mendelian fashion at $p < 0.05$ significance; showed that the inheritance pattern of diastema amongst the Ijaws follows a dominant pattern. This was evident from the outcome of the parental combinations. This result also agrees with findings by Dissanayake *et al.*, 2003³⁶.

CONCLUSION

The results from the present study clearly revealed that maxillary midline diastema is more prevalent than the mandibular and the co-existing (maxillary and mandibular) midline diastema and that it occurs more frequently in females than in males. Midline diastema is inherited as an autosomal dominant trait.

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