DENTAL ARCH DIMENSIONS AND FORMS IN THE NIGER DELTA REGION OF NIGERIA

Etetafia Mabel Okiemute[1], Ese Anibor[2*], Benita Kelechi Ijenwa[3]

[1]Department of Oral/Maxillofacial Surgery, Delta State University Teaching Hospital, Oghara, Nigeria
[2]Department of Human Anatomy and Cell Biology, Faculty of Basic Medical Sciences, Delta State University, Abraka, Nigeria, Phone: +2348180404966*
[3]Department of Human Anatomy and Cell Biology, Faculty of Basic Medical Sciences, Delta State University, Abraka, Nigeria

Corresponding Author:
eseovo2000@yahoo.com

Abstract

This scrutiny assessed the dental arch dimensions and arch forms in a Niger Deltan population from Nigeria. The enquiry identified variations in tooth arch size. The inquiry compared the influence of gender on the dental parameters. This cross-sectional survey was done between February, 2021 and March, 2022. This study is a biometric analysis of dental casts of 206 subjects (104 males and 102 females) recruited from Teem Dental Clinic, Ekpan, Delta State, Nigeria. The dental arch sizes were determined. The proportions detailed are arch length, arch width, and arch form. The data were analyzed via the Statistical Package for the Social Sciences, version 22.0. Dental arch proportions (inter-canine width, inter-premolar width, inter-molar width and arch length) were lesser in females than in males. The Chucks arch form was considered in this scrutiny and the outcome was as follows: Tapered (49.5%), Ovoid (36.4%) and Square (14.1%). The dominant arch form was tapered, and the least common was square. Males mostly portrayed greater dental arch proportions than females.

Keywords: *Dental, Arch, Forms, Maxillofacial, Surgery, Orthodontic*

INTRODUCTION

It is very important to maintain teeth arch proportions as well as arch forms during orthodontic and surgical treatment of patients with fractured jaws and also in reconstruction of facial bones and soft tissues affected by tumours and other facial defects like cleft palate. These features have substantial impact on the space available, dental aesthetics, dental occlusion and the stability of the dentition. Dental arch measurements and characteristics differ among ethnic groups and populations (Hashim and Adil, 2009). Dental arch proportions are not fixed; they vary systematically in the course of rapid growth and development and less so in later life (Mohammad *et al*, 2020).

Even with several studies, inconsistent evidence exist concerning the archetype shape and size of an orthodontic arch form (Oliva *et al.*, 2018). A good number of the inquiries done on arch form focused on discovery of a single form in conformity for a specific sample's dental arch. Despite individual differences, when the ethnic variations are reflected, the use of a precise arch for every individual could affect the post treatment, functional, ethnic and balanced arch form outcomes (Olmez and Dogan, 2011).

Individuals have various skeletal facial proportions, varied facial traits, and different superior and inferior teeth, relative to gender. Researchers have ventured to categorize dental arches (Omar *et al.*, 2018). Chuck (1934) first classified the arch forms as tapered (narrow), ovoid (normal) and square (wide).

Even though researches have considered dental arch sizes, arch forms in selected populaces, literature appraisal propose that very few were performed in Nigeria. Thus, the purpose of this research was to delineate the dental arch proportions and arch categories of patients seeking dental treatment, to recognize the variation in tooth arch size and to ascertain the influence of sexual category on the dental parameters.

METHODS AND METHODOLOGY

This cross-sectional survey was done between February, 2021 and March, 2022. The sample comprised of dental casts of 206 subjects (104 males and 102 females).

Inclusion criteria

Subjects were included if they had: permanent dentition, complete dentition in both arches, excluding third molars, Class I, II, and III malocclusion and complete pretreatment dental and orthodontic models of adult patients.

Exclusion criteria

Persons with mixed or primary dentition, missing teeth, dental anomalies, and posterior crossbite were not included. Retained deciduous teeth, casts withconsiderable transverse arch discrepancies and casts with major crowding were also excluded.

A digital sliding calliper was utilized to measure these proportions on the dental casts (Figure 1):

i) **Arch length:** the dimension from the center of the palatal incisal papilla to the midpoint of a line joining the right and left first molars.

ii) **Inter-molar dimension**: extends from the buccal groove on the first molar's occlusal surface to the contralateral first molar.

iii) **Inter-premolar dimension:** extends from the buccal cusp tip of the first premolar to the contralateral counterpart

iv) **Inter-canine measurement:** extends from the cusp tip of the canine to the contralateral canine tooth.

v) **Arch form:** Dental arch forms were classified as proposed by Chuck into ovoid, tapered and square types (Figure 2)

vi) **Class of Malocclusion:** The dental casts were also classified into the three types of malocclusion - Class I, Class II and Class III.

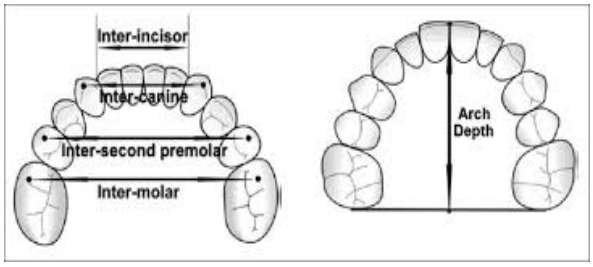

Figure 1: Arch parameters measured

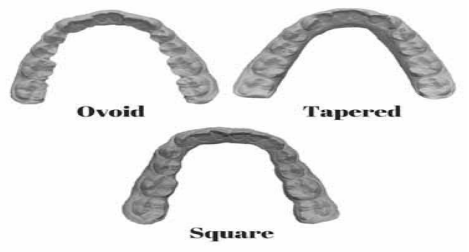

Figure 2: Chucks' Arch forms

The dental arch measurements were done on the dental casts by one examiner. Data were analysed with SPSS version 22.0. Descriptive statistics defined the arch proportions by way of counts, mean and standard deviation.

RESULTS

Dental arch dimensions

The average inter- canine proportions in the superior arch was 36.24±3.57 mm and inter-molar distances was 51.08±3.56 mm; but in the inferior arch, the results were 28.74±3.66 mm and 46.14±3.56 mm, respectively. The arch sizes were larger in males than in females (Table 2).

Dental arch form

This inquiry referenced the mandibular arch for the arch form determination. The arch categories are as follows: Tapered (49.5%), Ovoid (36.4%) and Square (14.1%). The widespread arch shape in males (46.1%) and females (53.9%) was also tapered. In all occlusions, the dominant arch form was narrow tapered, and next was the ovoid (Table 3).

Table 1: Specifics of the 206 subjects

Demographics	Frequency	Percentage (%)
Gender		
Male	104	50.5
Female	102	49.5
Total	206	100.0
Class		
Class I	143	69.4
Class II	39	18.9
Class III	24	11.7
Total	206	100.0

Table 2: Valuation of arch sizes in male and female

Arch Measurements (mm)	All cases (Mean ± SD)	Male (Mean ± SD)	Female (Mean ± SD)	p-value
Upper arch				
Inter-canine width (mm)	36.24 ± 3.57	37.67 ± 3.47	34.78 ± 3.06	0.001
Inter-premolar width (mm)	40.43 ± 3.33	41.93 ± 3.20	38.91 ± 2.72	0.001
Inter-molar width (mm)	51.08 ± 3.56	52.65 ± 3.14	49.49 ± 3.25	0.001
Arch length (mm)	40.97 ± 4.37	42.00 ± 4.55	40.42 ± 4.14	0.078
Lower arch				
Inter-canine width (mm)	28.74 ± 3.66	29.55 ± 3.83	27.90 ± 3.30	0.001
Inter-premolar width (mm)	36.20 ± 3.48	37.29 ± 3.61	35.09 ± 2.97	0.000
Inter-molar width (mm)	46.14 ± 3.56	47.19 ± 3.47	45.06 ± 3.32	0.000
Arch length (mm)	38.33 ± 3.85	38.55 ± 4.05	38.10 ± 3.66	0.409

Table 3: The dental arch shapes

	Ovoid	Square	Tapered	P-value
Gender				
Male	42 (56%)	15 (51.7%)	47 (46.1%)	0.423
Female	33 (44%)	14 (48.3%)	55 (53.9%)	
Class				
Class I	58 (77.3%)	17 (58.6%)	68 (66.7%)	
Class II	9 (12%)	8 (27.6%)	22 (21.6%)	0.300
Class III	8 (10.7%)	4 (13.8%)	12 (11.8%)	

Table 4: Age correlation with parameters

Arch Measurements	r	p-value
Upper arch		
Inter-canine width	0.407	0.001
Inter-premolar width	0.462	0.001
Inter-molar width	0.493	0.001
Arch length	0.119	0.088
Lower arch		
Inter-canine width	0.240	0.001
Inter-premolar width	0.266	0.001
Inter-molar width	0.334	0.001
Arch length	0.002	0.978

DISCUSSION

This enquiry assessed arch sizes and forms directly on casts of dental and orthodontic patients including those with different categories of malocclusion. The results provided base line information on arch forms and proportions which could serve as guide in management of Nigerian patients and possibly others globally.

Various researches have investigated the inferior arch instead of the superior arch to find out the dominance of arch forms, particularly in diverse malocclusion cases (Nojima *et al*, 2001; Mohammad *et al*, 2011, Omar *et al*, 2018). This is because in usual occlusion, the upper arch form will follow the mandibular arch form, and this is the reference for fabrication of arch wires for patients. Furthermore, post-orthodontic harmony hinges critically on the preservation of inferior inter-canine dimension during management, without significant expansion.

The Chucks' arch types were considered in assessing the arch shapes of the patients. It consists of three arch forms which are ovoid, tapered and square arch forms. The widespread arch sort was tapered in both genders and also in the three classes of malocclusion. This ought to define the choice of preformed orthodontic arch wires in the management of dental patients in Nigeria. The study of Omar *et al* (2018) used the Ricketts metamorphic arch forms consisting of five arch sorts: normal, ovoid, tapered, narrow ovoid, and narrow tapered; and noted that the dominant arch form was the narrow tapered and the narrow ovoid.

Male subjects had significantly larger arch widths than female subjects. This finding backs up the results of previous studies on the Jordanian population by Bishara *et al* (1997). The findings of Al-Khateeb and Alhaija (2006), as well as Uysal *et al* (2005) are in line with the present results. According to Carter and McNamara (1998), even longitudinal studies noted that male arch width was larger than female arch width.

The findings from the present inquiry also support the notion that the superior arch length is greater than the lower arch length, which is supported by a Swedish study (Harris, 1997), an Italian study (Sampson, 1981), and a British study (Rudge, 1981).

CONCLUSION

The predominant arch form in the Niger Deltan sample from Nigeria is the tapered arch form. Males largely displayed significantly gr0eater dental arch sizes than females.

REFERENCES

[1]. Ahmed, N. and Fida, M. (2010). *Journal of Pakistan Dental Association*. 19(2):94-98.
[2]. Al-Khateeb, S.N. and Alhaija, E.S. (2006). *Angle Orthodontist.* 76:459-465.
[3]. Bishara, S.E., Ortho, D., Jakobsen, J.R., Treder, J. and Nowak, A. (1997). *American Journal of Orthodontics Dentofacial Orthopedics.* 111:401-409.
[4]. Carter, G.A. and McNamara, J.A. (1988). *American Journal of Orthodontics Dentofacial Orthopedics*. 114(1):88-99.
[5]. Daniel, M.J., Khatri, M., Srinivasan, S.V., Jinsha, V.K. and Marak, F. (2014). *Journal of Indian Academy Forensic Medicine*. 36(2):168-172.
[6]. Hashim, H.A. and Al-Ghamdi, S. (2005). *Journal of Contemporary Dental Practice.* 6(2):36–51.
[7]. Labib, A., Refai, W. and Esawy, B. (2009). *Egyptian Orthodontic Journal.* 35:67-80.
[8]. Mohammad, H.A., Hassan, A. and Hussain, S.F. (2011). *American Journal of Applied Sciences.* 8(11):1061–1066.
[9]. Nojima, K., McLaughlin, R.P., Isshiki, Y. and Sinclair, P.M. (2001). *Angle Orthodontist*. 71:195-200.
[10]. Oliva, B., Sferra, S., Greco, A.L., Valente, F. and Grippaudo, C. (2018). *Progress in Orthodontics.* 19(34):1-8.
[11]. Omar, H., Alhajrasi, M., Felemban, N. and Hassan, A. (2018). *Saudi Medical Journal.* 39(1):86–91.
[12]. Rudge, S.J. (1981). *European Journal of Orthodontics*. 3:279-384.
[13]. Saeed, H.K. and Mageet, O.A. (2018). *The Journal of Contemporary Dental Practice.* 19(10):1235-1241.
[14]. Uysal, T., Sari, Z., Basciftci, F.A. amd Memili, B. (2005). *Angle Orthodontist.* 75: 208-213.