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JOINT EPIDEMIOLOGICAL LONGITUDINAL DENTAL SURVEY IN NIGERIA, ESPECIALLY IN COMPARISON WITH THAT OF JAPANESE

BY

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ABSTRACT

Since 1980 we carried out a longitudinal dental survey in Ile-Ife, as a joint study with the dental school of Ife University, Nigeria, being supported by A Grant under The Monbusho International Scientific Research Program for ten years. One thousand one hundred seventy-one children and adults were examined in the 1991 survey. The data were compared with the data in the previous survey and Japanese survey. Results were as follows: 1) Caries prevalence rate and the average number of DMFT were still very low, especially showing that both the caries prevalence and the average number of DMFT decreased in the rural areas because the attrition proceeded faster than the caries, 2) Nigerian deciduous and permanent dentition were larger than in the Japanese in all items measured, 3) the condylar head was transformed from the round shape to the ultra-flat shape with age, 4) there was a fewer incidence of severe periodontal diseases despite of the marked deposition of calculus, 5) with respect to Nigerian foods, there was no difference between the rainy and dry seasons in both the urban and rural communities, 6) the weaning period of the baby is decided by their mother, taking care of the health of the baby, almost all babies at one year to two years and a few at three years and 7) the menu for the breakfast, lunch and supper of the baby was made considering the nutritional aspect of the baby.

Key words: Longitudinal dental survey, Nigeria, Dental caries, Dental arch, Periodontal disease, Roentogenographic examination, TMJ, Traditional foods, Weaning foods and period

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Introduction

With the aim to make clear the present situation of the dental diseases among the Nigerian children and adults in comparison with those of the Japanese, a joint dental survey has been continued, since 1980, in close collaboration with the Dental School, Faculty of Health Sciences, Obafemi Awolowo University, Ife (Kubota et al., 1981a, b; 1982, 1984a, b, ; 1988; 1990; Hollist et al., 1984; Ono et al., 1985; Kubota, 1987; Yomemitsu et al., 1988) [1–11]. This research project was supported by the Overseas Survey, Grant-in-Aid, for Scientific Research, Ministry of Education, Science and Culture, Japan. During the past ten years, the longitudinal dental survey in the city (Ife) and in the rural villages was conducted by Prof. Kubota et al. three times every five years since 1981.

Last year, 1991, the 3rd survey was carried out as the longitudinal five-year follow-up caries study. The results obtained from the 1991 survey were compared with those of the Japanese (Yomemitsu et al., 1992; Minakuchi et al., 1992; Ono et al., 1992) [12–14]. In this paper, the details of this study will be described under discussion for the future study on this longitudinal dental survey.

Subjects and Methods

In the dental study of 1991, from October 21st to December 1st, one thousand one hundred seventy-one persons were examined in the open air at the respective areas under natural daylight. A total of 617 school children were examined, 294 male and 323 female children. The nursery children, 227 in number, were examined and also the adults, 327 in number, were examined in the rural villages, about 40 km from the ancient city of Ile-Ife (Table 1).

Table 1. Number of Subjects

Age	Urban			Rural		
	Male	Female	Total	Male	Female	Total
3	28	29	57	33	27	60
5	25	28	53	30	27	57
6–8	60	59	119	57	63	120
9–11	41	39	80	29	38	67
12–14	68	75	143	41	47	88
15–19				29	31	60
20–29				54	70	124
30–39				18	43	61
40–49				11	24	35
50–59				13	11	24
60–75				11	12	23
Total	222	230	452	326	393	719

The results were compared, respectively, with those of 514 children in the city and 206 children in the rural area examined in 1981 and of 236 children in the city and 282 children in the rural area examined in 1986; these groups formed the basis of the longitudinal study and were then compared with the Japanese data. The caries criteria were based on the recomendations by WHO, used for the previous surveys [5, 9]. C_1: A tooth has a detectable incipient carious lesion, when there is a detectable stickiness by the examining explorer in the pits and fissures and/or when roughness is felt by the explorer on the smooth surface. Tooth opacity and discolored surfaces were not scored as caries. C_2: A more advanced stage of caries where the explorer can penetrate the pits and fissures to the depth of 2 mm or where there is a detectable soft dentin. C_3: A collapsed tooth with more than one-fifth of its crown lost. C_4: When there is a residual root.

In the 1991 survey, Nigerian food habits were inquired for each of the 880 subjects by the questioner according to the questionnaire of the protocol for research.

Afternoon, at the university dental hospital a roentogenographic examination of

the temporomandibular joint (TMJ), in the antero-posterior, orbit-condylar direction, was made on 144 subjects, ranging from 14 to 75 years in age. For the TMJ examination 178 children were selected and a 10-film dental roentogenographic examination was made on 107 subjects with periodontal diseases, ranging from 12 to 75 years in age, selected from among the 944 subjects assessed for the periodontal status by CPITN in the field survey.

For the morphological study of the tooth and dental arch, the impression of the jaws was taken in 68 Yoruban children, ranging from 3 to 6 years in age, and 64 Yoruban young adults, ranging from 11 to 23 years in age, with a hydrocolloid material to make the plaster casts.

Traditional diets, weaning period and menu of the weaning diets were examined in 123 housewives by a questioner according to the items of the questionnaire, who visited the local health centre for periodical inspection of the body.

All the children for X-ray examination gave us the permission of their parents.

Results and Discussion

1. Caries prevalence rate

The caries prevalence rates (deciduous and permanent teeth combined) of the schoolchildren of 1981, 1986 and 1991 are shown in Table 2. In all school grades, sex and age groups, the caries prevalence rates were lower than those of the Japanese children (Japanese national survey, 1987) [15]. In the urban area, there was a significant decrease in the caries prevalence of 6 to 8-year-old boys and of 9 to 11-year-old girls between the period of 1986 and 1991. Also, there was a significant decrease in the caries prevalence of girls aged 6 to 8 years and boys and girls aged 12 to 14 years in the rural area, from 1981 to 1986. Further, there was a significant decrease in the caries prevalence of 12 to 14-year-old boys and girls in the rural area from 1981 to 1991.

Table 3 shows that the average number of DMFT is extremely low in all groups compared with those of the Japanese and also the same with the caries prevalence rate. There was a statistically significant decrease in the DMFT in the 9 to 11-year-

Table 2. Comparison of Caries Prevalence Rate between 1981, 1986 and 1991 (Primary and Permanent Teeth Combined)

Age group (yr)	Region	Sex	1981		1986		1991		Japan national survey (1987)
			n	%	n	%	n	%	
6–8	Urban	Male	58	29.3	56	37.5	60	16.7	93.6
		Female	67	37.3	47	48.9	59	23.7	
	Rural	Male	29	27.6	29	6.9	57	24.6	94.8
		Female	30	33.3	23	4.4	63	12.7	
9–11	Urban	Male	51	33.3	41	36.6	36	19.4	91.8
		Female	51	31.4	45	40.0	34	14.7	
	Rural	Male	28	21.4	46	13.0	24	16.7	96.0
		Female	38	34.2	42	16.7	34	23.5	
12–14	Urban	Male	79	26.6	26	23.1	63	28.6	92.2
		Female	49	30.6	21	38.1	70	44.3	
	Rural	Male	47	29.8	81	12.4	36	8.3	95.8
		Female	34	41.2	61	4.9	43	14.0	

Table 3. Comparison of Average Number of DMFT in 1981, 1986 and 1991

Age group (yr)	Region	Sex	1981 Mean	1981 sd	1986 Mean	1986 sd	1991 Mean	1991 sd	Japan national survey (1987)
6–8	Urban	Male	0.09	0.22	0.27	0.72	0.07	1.32	1.02
		Female	0.28	0.84	0.45	0.96	0.08	1.50	
	Rural	Male	0.10	0.30	0.00	0.00	0.07	0.26	1.18
		Female	0.07	0.25	0.07	0.36	0.02	0.13	
9–11	Urban	Male	0.37	0.82	0.54	1.08	0.14	0.35	2.93
		Female	0.51	1.00	0.69	1.15	0.38	1.26	
	Rural	Male	0.25	0.83	0.43	0.98	0.21	0.51	3.62
		Female	0.37	0.84	0.20	0.74	0.21	0.48	
12–14	Urban	Male	0.68	1.50	0.46	0.89	0.65	1.40	5.49
		Female	0.96	1.81	0.86	1.39	0.81	1.37	
	Rural	Male	0.51	0.94	0.30	0.74	0.19	0.62	6.41
		Female	1.12	2.07	0.06	0.30	0.23	0.61	

old boys between 1986 and 1991 in the urban area, in the 12 to 14-year-old girls between 1981 and 1986, and in the 12 to 14-year-old girls between 1981 and 1991 in the rural area.

The changes in the caries status in the permanent teeth from 1986 to 1991 among the examinees followed up (43 in the urban area and 69 in the rural area), are shown in Table 4. Sixty-two first molars, 26 second molars and 3 premolars were diagnosed as decayed, missing or filled teeth between the 1986 and 1991 examinations. From 1986 to 1991, twenty-nine intact first molars, 19 second molars and 3 premolars changed to C_1.

In the same period, there was no teeth changed from intact to C_3, C_4 or missing. Teeth which reversed from C_1 to intact were seven first molars and four second molars. Two first molars also reversed from C_2 to intact.

Table 5 shows the caries prevalence rates of 3 and 5-year-old Nigerian infants in 1991. In all the age and sex groups, the caries prevalence rates showed values remarkably low compared with those of the Japanese. In comparison between the urban and the rural areas, the caries prevalence rates from the rural areas were lower than those from the urban areas. There were statistically significant differences between the rural and the urban

Table 4. Changing Pattern of Caries

Rural area (6–8→11–13 yr)

1986→1991	1st molar	2nd molar	Others
Intact→C_1	9	8	2
Intact→C_2		1	
Intact→filled	1	1	
C_1→C_2		1	
C_2→C_3	1		
C_3,C_4→missing	2		
C_2→C_2	4		
C_1→intact	3	4	
C_2→intact	2		
C_2→C_1	2		

Urban area (5–11→10–16yr)

1986→1991	1st molar	2nd molar	Others
Intact→C_1	20	11	1
Intact→C_2	2		
Intact→filled	2		
C_1→C_2	2		
C_1→filled	1		
C_1→missing	2		
C_2→missing	2		
C_1→C_1	2		
C_2→C_2	1		
C_1→intact	4		

Table 5. Caries Prevalence Rates in Deciduous Dentition

Age	Sex	Urban	Rural	Japan (1987)
3	Male	14.29(4/28)	0.00(0/33)	59.38
	Female	10.34(3/29)	3.70(1//27)	73.53
	Total	12.28(7/57)	1.67(1/60)	66.67
5	Male	32.00(8/25)	16.67(5/30)	90.60
	Female	32.14(9/28)	7.41(2/27)	89.11
	Total	32.08(17/53)	12.28(7/57)	89.91

Table 6. Average Number of dft

Age	Sex	Urban	(n)	Rural	(n)	Japan (1987)
3	Male	0.43±1.40	(28)	0.00±0.00	(33)	3.49
	Female	0.21±0.77	(29)	0.04±0.20	(27)	4.31
	Total	0.32±1.12	(57)	0.02±0.14	(60)	3.91
5	Male	0.48±0.82	(25)	0.37±0.96	(30)	7.47
	Female	0.57±1.03	(28)	0.11±0.42	(27)	7.50
	Total	0.53±0.93	(53)	0.25±0.76	(57)	7.48

area in the groups of 3 and 5-year-old (sex combined) and of the 5-year-old girl.

The average number of dft in 1991 is shown in Table 6. There were remarkable differences between the Nigerian and Japanese children, as well as between the caries prevalence rates. The average number of dft from the rural area was lower than that from the urban area, and there was a significant difference between the urban and rural area only in the group of 5-year-old girls.

Table 7 shows the average number of missing teeth in the rural Nigerian adults and Japanese adults. Although the average number of missing teeth increased in the rural Nigerian adults according to their age, this was below 1 in the group up to 50 years and there was about four missing teeth in the 60 to 75-year-old people. On the other hand, this number in the Japanese adults was about 1 in the 20-year-old group, about 2 in the 30-year-old group, about 4 in the 40-year-old group and about 17 in the 60 to 75-year-old group. There was a remarkable increase in the 50-year to 60-year-old group both in the rural Nigerian adults and Japanese adults.

Table 7. Average Number of Missing Teeth in Rural Adults

Age group	Male	Female	Total
20–29	0.13(0.69)	0.11(1.07)	0.12(0.94)
30–39	0.44(1.80)	0.09(2.26)	0.20(2.10)
40–49	0.18(3.03)	0.42(4.46)	0.34(3.93)
50–59	0.92(7.06)	0.55(9.52)	0.75(8.56)
60–75	4.45(14.53)	3.83(18.00)	4.13(16.56)

( ): Japan national survey (1987)

It is known in Japan that the caries experience is higher in the rural areas than in the urban areas today. However in Nigeria, a developing country, the caries experience has been shown to be higher in the urban areas than in the rural area of almost the same condition that the Japanese people showed in the period around the 2nd World War [16].

Although the caries prevalence in the

Nigerian people was extremely low compared with that in the Japanese in total, there have been evidences by observation over the period of 1981 to 1991. There was no remarkable difference in the caries prevalence between the urban and rural areas in 1981. However, in 1986 the caries prevalence decreased in the rural area and in 1991 it decreased in the urban area as well. Until the early 80s, Nigeria developed economically by oil exportation, and, at the same time, the sugar consumption per person per year increased from 2 kg (1975) to 10 kg (1981) [5]. It was supposed that the Nigerian oil economic power must have gone down after 1981, and likewise the sugar consumption decreased first in the rural areas with a tendency of extention to the urban areas gradually. During this decade, the Nigerian economic status has elapsed with a rise in prices.

More than ninety percent of the caries incidence in the Nigerians examined were observed in the pits and fissures. Almost all the caries in all teeth were incipient. Eleven molars with caries (C_1) and two molars with caries (C_2) reversed to intact from the period of 1986 to 1991. This phenomenon also had been observed during 1981 to 1986 [10]. Therefore, we (Kubota et al., 1991) [10] concluded that in Nigeria, tooth attrition proceeded faster than did the caries.

The present authors should not ignore that the decayed teeth diagnosed as caries included some hypoplastic teeth due to acute infectious diseases such as malaria and yellow fever which are rarely found in Japan nowadays.

Up to now it is still popular that the Nigerian people brush their teeth with PACO, a kind of a leaf stick, instead of tooth brush because of the economic problems in Nigeria.

Therefore the oral cleanliness of the Nigerian people is generally poor. Also the fluoride concentrations in the drinking water are about 0.2 or 0.3 ppm, and there is no special program for caries prevention. However, one of WHO's goals [17] for the year 2000 "the average number of DMFT of 12-year-old children should be below 3" is naturally evident.

Moreover, some reasons for the low average number of missing teeth among the Nigerian adult compared with those of the Japanese, depended on the fewer extractions due to caries and periodontal diseases. It has been considered that the low number of dental diseases among the Nigerian people must be influenced by their traditional tough, fibrous and gritty diets [18].

2. Morphological difference of tooth and dental arch

The materials used for this study consist of plaster casts of the jaws of 68 Yoruban children (68 deciduous dentition of 41 males and 27 females) of an age group, ranging from 3 to 6 years, and 64 Yoruban young adults (33 males and 31 females) of the age group ranging from 11 to 23 years. The impression was made with a hydrocolloid material.

The dentall arch width and length were measured at the distance A-E (Fig. 1a, b), and the mesiodistal crown diameter of the tooth was also measured at the greatest distance between the contact points on its approximal surfaces by means of a sliding caliper, held parallel to the occlusal and vestibular surfaces.

1) Comparison between Nigerian and Japanese deciduous dentition (Table 8) [19]

Nigerian deciduous dentition was larger than the Japanese dentition in size of all items of arches, showing a statistically significant difference in the arch length(C) and mandibular dental arch width (A and B) in both sexes. A statistically significant

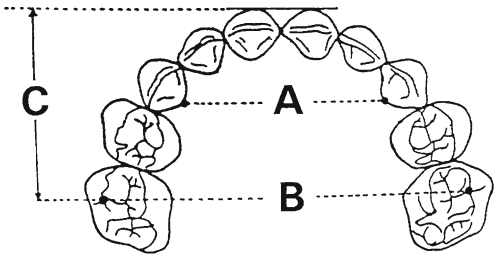


Fig. 1-a Landmarks and diameters of deciduous dentition
A: Dental arch width (distance between lingual cervical of deciduous canines)
B: Dental arch width (distance between terminal sulcus of deciduous second molars)
C: Dental arch length (distance from deciduous central incisors to the level of the terminal sulcus of deciduous second molars)

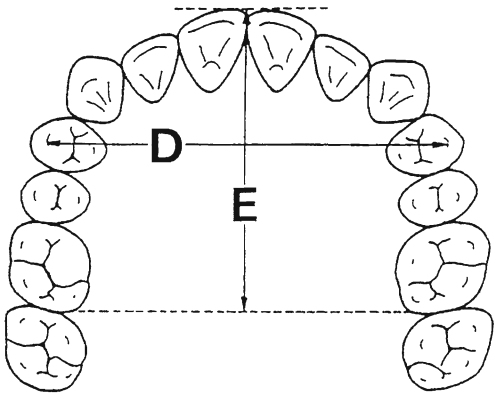


Fig. 1-b Landmarks and diameters of permanent dentition
C: Dental arch width (distance between cuspid of first premolars)
E: Dental arch length (distance from central incisors to the level of distal surface of both first molars)

Table 8. Difference Between Nigerian and Japanese Deciduous Dentition

Mean (S.D.) Unit: mm

	Male					Female				
	Nigerian (n=41)		Japanese (n=120)			Nigerian (n=27)		Japanese (n=120)		
Dental arch width										
Intercanine width (A)										
Upper	26.39	(1.29)	25.48	(1.65)	**	25.74	(1.84)	25.48	(1.65)	n.s.
Lower	20.54	(1.10)	19.55	(1.40)	***	20.25	(1.79)	19.55	(1.40)	*
Interdeciduous second molar width (B)										
Upper	48.3	(2.13)	47.76	(2.14)	n.s.	46.84	(2.33)	46.10	(1.77)	n.s.
Lower	41.21	(1.63)	39.78	(1.86)	***	40.5	(2.18)	38.62	(1.51)	***
Dental arch length (C)										
Upper	24.61	(1.85)	22.85	(1.62)	***	24.28	(2.14)	22.85	(1.62)	***
Lower	20.65	(1.46)	19.59	(1.36)	***	20.36	(1.87)	19.59	(1.36)	*

*: $p<0.05$, **: $p<0.01$. ***: $p<0.001$. n.s.: Non-significant

difference was seen in the maxillary dental arch width (A) of the male.

2) Comparison of the mesiodistal crown diameter between Nigerian and Japanese deciduous teeth (Table 9) [20]

Nigerian deciduous teeth were larger in diameter than those of the Japanese, except the maxillary deciduous second molar. There were also seen the statistically significant differences in all maxillary teeth and mandibular canine and first molar of the male and also in the maxillary central incisor and molars of the female.

3) Comparison of permanent dentition between Nigerian and Japanese (Table 10) [21]

Statistically significant differences were observed in the maxillary and mandibular

Table 9. Mesiodistal Crown Diameters of Nigerian and Japanese Deciduous Teeth

Mean (S.D.) Unit: mm

	Male			Female		
	Nigerian (n=41)	Japanese (n=110)		Nigerian (n=27)	Japanese (n=90)	
Maxilla						
Left						
di_1	7.06(0.44)	6.63(0.37)	***	6.81(0.37)	6.57(0.44)	*
di_2	5.73(0.40)	5.52(0.45)	**	5.53(0.35)	5.47(0.47)	n.s.
de	7.15(0.38)	6.75(0.41)	***	6.8 (0.37)	6.67(0.41)	n.s.
dm_1	7.89(0.50)	7.33(0.46)	***	7.6 (0.48)	7.22(0.46)	***
dm_2	9.15(0.49)	9.36(0.57)	*	9.01(0.65)	9.30(0.57)	*
Mandible						
Left						
di_1	4.36(0.27)	4.26(0.32)	n.s.	4.2 (0.29)	4.22(0.30)	n.s.
di_2	4.85(0.41)	4.83(0.33)	n.s.	4.62(0.37)	4.77(0.36)	n.s.
dc	6.32(0.54)	5.95(0.32)	***	5.99(0.33)	5.87(0.30)	n.s.
dm_1	8.48(0.51)	8.26(0.46)	*	8.23(0.45)	8.03(0.50)	n.s.
dm_2	10.53(0.54)	10.36(0.48)	n.s.	10.17(0.54)	10.09(0.51)	n.s.

*: $p<0.05$, **: $p<0.01$, ***: $p<0.001$, n.s.: Non-significant

Table 10. Difference Between Nigerian and Japanese Permanent Dentition

Mean (S.D.) Unit: mm

	Male			Female		
	Nigerian (n=33)	Japanese (n=45)		Nigerian (n=31)	Japanese (n=55)	
Dental arch width (D)						
Upper	46.97(2.56)	44.77(2.61)	***	45.57(2.88)	41.76(3.19)	***
Lower	37.88(2.27)	36.26(1.99)	**	36.46(2.83)	33.97(2.56)	***
Dental arch length (E)						
Upper	43.01(2.77)	36.09(2.28)	***	42.02(2.42)	34.65(2.43)	***
Lower	38.97(2.41)	31.91(2.10)	***	38.03(1.95)	31.28(2.38)	***

**: $p<0.01$, ***: $p<0.001$

arch width and length in all cases of both sexes, especially remarkable in the dental arch length.

4) Comparison of mesiodistal crown diameter between Nigerian and Japanese (Table 11) (Otsubo, 1957) [21]

Nigerian permanent teeth were larger in mesiodistal diameter than that of the Japanese in all teeth. Statistically significant differences were seen in the maxillary central incisor and canine, and mandibular teeth, except the central incisor in the male and also found in all teeth of the female dentition.

The human race is generally distinguished into the Negroid, Mongoloid and Caucasoid, each race having a race speciality, which appear in the tooth material and dental arch as a characteristic feature of the species (Dahlberg, 1965) [22]. On the other side, it is well known that the dental arch is changeable by the life style. Nige-

Table 11. Mesiodistal Crown Diameters of Nigerian and Japanese Permanent Teeth
Mean (S.D.) Unit: mm

	Male			Female		
	Nigerian (n=66)	Japanese (n=90)		Nigerian (n=62)	Japanese (n=110)	
Maxilla						
I_1	9.12(0.67)	8.59(0.54)	***	9.07(0.56)	8.24(0.41)	***
I_2	7.32(0.82)	7.08(0.77)	n.s.	7.23(0.77)	6.64(0.60)	***
C	8.30(0.46)	8.04(0.40)	***	7.86(0.38)	7.65(0.39)	***
Pm_1	7.52(0.54)	7.52(0.48)	n.s.	7.56(0.51)	7.08(0.36)	***
Pm_2	6.91(0.56)	6.86(0.40)	n.s.	7.02(0.68)	6.57(0.44)	***
M_1	10.92(0.59)	10.91(0.56)	n.s.	10.63(0.43)	10.39(0.51)	**
Mandible						
I_1	5.52(0.45)	5.44(0.43)	n.s.	5.54(0.34)	5.19(0.36)	***
I_2	6.18(0.56)	6.03(0.54)	*	6.13(0.36)	5.81(0.39)	***
C	7.43(0.45)	7.11(0.42)	***	7.04(0.36)	6.58(0.38)	***
Pm_1	7.66(0.51)	7.19(0.42)	***	7.61(0.43)	6.94(0.34)	***
Pm_2	7.64(0.55)	7.11(0.40)	***	7.57(0.45)	6.82(0.45)	***
M_1	11.94(0.55)	11.41(0.58)	***	11.53(0.43)	10.69(0.60)	***

*: $p<0.05$, **: $p<0.01$, ***: $p<0.001$, n.s.: Non-significant

rian tooth and dental arch are larger in size than those of the Japanese, having statistically significant differences. These differences were larger in the permanent dentition than in the deciduous dentition. It might have been caused by the environmental effect of eating habits, because the permanent dentition are exposed to the mechanical stress in mastication longer than the deciduous dentition is exposed.

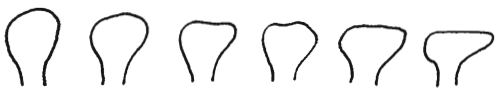
3. Morphological change in the mandibular head in response to occlusal wear

Based on the x-ray photographs of the TMJ, especially the mandibular condylar heads, the roentogenographic survey was carried out on 144 subjects, 71 males and 73 females, ranging from 14 to 75 years in age.

The X-ray photographs were taken of 281 temporomandibular joints in the antero-posterior direction. The shape of the mandibular heads was classified into six types: round, convex, concave, angled, flat and ultra-flat, according to the classification proposed by Yale (1969) [23–25] and modified by Ohnishi and Ono (1992) [26] (Fig. 2). Occlusal wear was assessed according to the four grades proposed by Broca (1879) [27]. Morphological differences in the mandibular heads were compared at each level of four degrees of dental attrition (Table 12).

The convex type of 37 heads was found at 52.8% and proper round shape of 19 heads at 27.1% in grade I (or Broca's 1°) (Broca, 1879) [27].

The convex shape of 22 heads appeared at 30.6%, flat shape of 19 heads at 26.5%, concave shape of 13 heads at 18.0% and angled shape of 9 heads at 12.5% in grade



Round Convex Concave Angled Flat Ultra-flat

Fig. 2 Morphological classification of the shapes of the mandibular head of temporomandibular joint, viewed from the antero-posterior direction in position when the mouth is opened about 30 mm (modified from Yale, S.H., 1969)

Table 12. Classification of Occlusal Wear (Broca 1879)

Grade 0: No attrition
Grade 1°: Attrition of enamel; cusps still visible
Grade 2°: Dentin is exposed,
Grade 3°: Occlusal relief is worn away leaving enamel rim peripherally
Grade 4°: Crown worn down close to collum dentis

II (or Broca's 2°).

The round and convex shapes of the heads decreased to about a fourth and to three-fifths respectively and the ultra-flat shape of the heads appeared at 5.5% in this grade II.

In grade III (or Broca's 3°) the round, convex, concave shape of the heads decreased in number and the angled and flat shape of the heads increased to three times of that in grade I.

In grade IV (or Broca's 4°) the round, convex, concave shape of the heads decreased in number and the angled and flat shape of the heads increased to two times and three times of that in grade I respectively, and the ultra-flat shape of the heads increased to nine times of that of the grade II. These differences were statistically significant at the level of $P<0.001$ among every grade (Table 12).

The advanced attrition of the dentition transformed the condylar head in the direction from the proper round shape to the ultra-flat shape, being due to the intensive decrease in the occlusal height (bite) (Table 13 and Fig. 3).

4. Morphological changes of TMJ in Yoruban children

In the 178 Yoruban children (331 joints), ranging from 3 to 15 year in age, roentogenographic study was done by the same method as mentioned above.

The shape of the mandibular heads was classified into four types proposed by Yale (1963, 1966, 1969) [23–25], to which two more types of the shape, concave and ultra-flat shapes, were added. Then each shape of the condylar head was studied in the IIA, IIIA, IVA stages according to four different developmental stages occlusion proposed by Hellman (1927) [28].

As shown in Figure 4, the proper round shape of the heads appeared in 42.5% at the stage of IIA. The convex shape of the head occurred in 27.5%, then the angled

Table 13. Relationship Between Dental Attrition and Shape of the Mandibular head

	Shape of mandibular head						
	Round	Convex	Concave	Angled	Flat	Ultra-flat	
Grade I (Broca's 1°)	19 (27.1)	37 (52.8)	7 (10.0)	6 (8.6)	6 (8.6)	0 (0.0%)	(75 joints)
Grade II (Broca's 2°)	5 (6.9)	22 (30.6)	13 (18.0)	9 (12.5)	19 (26.5)	4 (5.5%)	(72 joints)
Grade III (Broca's 3°)	2 (3.3)	6 (10.0)	4 (6.6)	16 (26.6)	20 (26.5)	12 (20.0%)	(60 joints)
Grade IV (Broca's 4°)	0 (3.3)	7 (9.5)	4 (2.7)	12 (16.2)	20 (24.3)	12 (47.3%)	(74 joints)

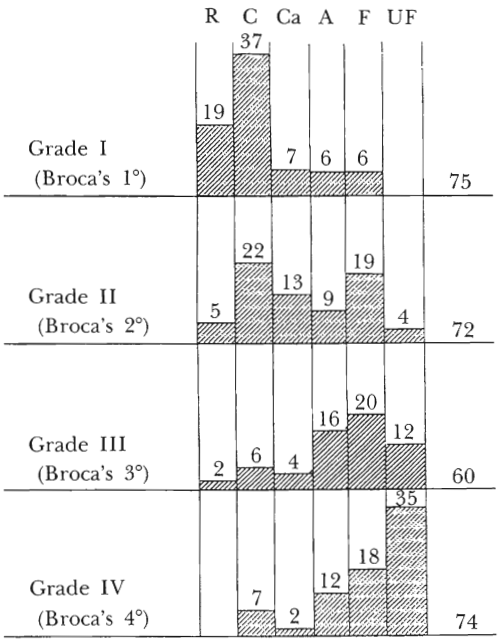


Fig. 3 Relationship between dental attrition and shape of mandibular heads

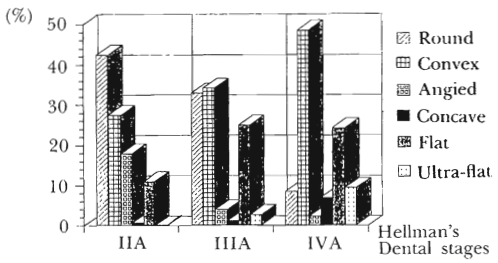


Fig. 4 The frequency of appearance of the shapes of mandibular heads at three developmental stages of occlusion (proposed by Hellman, M., 1927)

shape in 18% and the flat shape was few or in 11%. There was seen no ultra-flat shape of the head. At the IIIA stage, the round shape decreased to 33% at the same level with that of the convex shape of the heads, and the flat shape increased to 25% and the ultra-flat shape appeared very few or in 2.6%. Finally, at the IVA stage of the permanent occlusion, the proper round shape of the heads decreased but the convex shape of the heads increased extremely in 48%. Contrary to this, the flat and ultra-flat shapes of the heads increased to 24% and 9% respectively. The angled shape of the heads nearly disappeared. The results showed a tendency that the proper round and angled types decreased and the convex and flat types increased in frequency at the advanced stage of occlusion. The reason why this phenomenon appears in the developmental stages of occlusion is not clear.

5. Periodontal status

1) prevalence of periodontal disease

The prevalence and incidence of periodontal diseases in Nigeria was assessed according to the Community Periodontal Index of Treatment Needs (CPITN) by WHO [29].

The Nigerian periodontal status described by the survey in 1991 (Table 14) was compared with that [8] in 1986 (Table 15) (Kubota et al., 1988). In this comparison it was recognized that the frequency of no signs of periodontal diseases in 1991 decreased remarkably, while the incidence of signs showing pockets hardly changed. This means that the periodontitis did not seem to increase despite the increase of gingivitis. The Nigerian periodontal status was not always getting worse for the last five years.

Furthermore the Nigerian data in 1991 were compared with the Japanese data from the study on a group of 822 bank employees in Tokyo (Table 16) by Hagiwara et al. (1985) [30] and on a group of 308 female middle high school students, 897 female high school students and 113 inhabitants in Miyagi Prefecture (Table 17) by Suzuki et al. (1985) [31].

It was obvious that the Nigerian periodontal status was characterized by a lower percentage of subjects, especially in the younger age groups, showing signs of pockets, in spite of a much higher incidence of calculus deposit when com-

Table 14. Nigerian Periodontal Status in 1991

Age	No.	No-perio. (%)	Bleeding (%)	Calculus (%)	Shallow pockets (%)	Deep pockets (%)
5–9	244	8.2	18.0	67.6	2.0	4.1
10–14	373	4.8	10.7	80.4	3.8	0.3
15–19	60	0.0	3.3	90.0	6.7	0.0
20–24	91	5.5	6.6	81.3	5.5	1.1
25–29	33	6.1	3.0	81.8	9.1	0.0
30–34	41	4.9	0.0	85.4	7.3	2.4
35–44	44	0.0	2.3	77.3	18.2	2.3
45–54	26	0.0	0.0	69.2	30.8	0.0
55–64	21	0.0	0.0	61.9	28.6	9.5
65–	11	0.0	0.0	54.5	27.3	18.2

Table 15. Nigerian Periodontal Status in 1986

(Kubota et al., 1988)

Age	No.	No periodontal disease (%)	Bleeding only (B) (%)	Calculus (C) (%)	Shallow pockets (P1) (%)	Deep pockets (P2) (%)	Excluded (%)
–5	34	29.4	0.0	52.9	17.6	0.0	0.0
6–8	156	23.7	3.2	62.2	10.9	0.0	0.0
9–11	175	12.6	4.6	76.0	6.9	0.0	0.0
12–14	189	12.2	4.2	70.9	11.1	0.0	1.6
15–17	97	8.2	12.4	59.8	19.6	0.0	0.0
18–	22	18.2	0.0	63.6	18.2	0.0	0.0
Total	673	15.4	4.9	67.5	11.6	0.0	0.4

Table 16. Periodontal Status of Bank Employees in Tokyo (Hagiwara et al., 1985)

Age	No.	No periodontal disease (%)	Bleeding only (%)	Calculus (%)	Shallow pockets (%)	Deep pockets (%)
		Code 0	Code 1	Code 2	Code 3	Code 4
18~19	18	0	6	56	39	0
20~24	209	10	21	50	19	1
25~34	284	8	12	48	29	3
35~44	182	7	4	44	38	7
45~59	128	8	3	35	41	13

pared to the Japanese periodontal status.

2) Degree of alveolar bone absorption

A 10-film dental roentogenographic survey was made on 107 subjects with periodontal diseases, selected from among 944 subjects who were assessed for the periodontal status by CPITN, for the purpose of studying the extent of the alveolar bone loss. Assessment of the degree of alveolar bone absorption was based

Table 17. Periodontal Status in Miyagi Prefecture

(Suzuki et al., 1985)

Age	No.	No-perio. (%)	Bleeding (%)	Calculus (%)	Shallow pockets(%)	Deep pockets(%)
12–14	380	16	31	15	37	1
15–19	897	24	18	22	34	2
20–29	14	21	36	36	7	0
30–44	48	4	13	15	54	15
45–64	45	2	16	9	51	22
65–70	6	0	0	17	33	50

Table 18. Degree of Alveolar Bone Absorption

Age Group	Number of subjects	Average maximum absorption (%)
12–19	48	0.9
20–29	18	3.9
30–49	16	11.9
50–59	15	23.0
60–	10	28.0

on the method of Schei et al. (1959) [32]. Separate measurements were carried out for the mesial and distal surfaces of each remaining tooth, and the average maximum absorption rate for the group was obtained from the highest degree of absorption noted in each individual.

The average maximum absorption rate of the alveolar bone is shown in Table 18, from which it is recognized that the group aged 12 to 19, 20 to 29, 30 to 49, 50 to 59 and above 60 showed 0.9, 3.9, 11.9, 23.0 and 28.0% respectively.

It is possible to point out that the increase of gingivitis for the last five years in the young Nigerians could be due to the increasing tendency of opportunity of eating processed foods. On the other hand, environment surrounding dentistry in Nigeria is not improved, but getting worse because of the socioeconomic status, so it is a fact that patient education for periodontal disease and periodontal treatment have hardly been performed in Nigeria actually.

Despite that gingivitis in the young Nigerians increased for the last five years, it is characterized by the extremely fewer percentage of subjects showing severe periodontal disease in Nigeria in comparison to the Japanese periodontal status. It is highly suggestive that a much higher incidence of calculus deposition in the Nigerian subjects may be due to the differences in the characteristic of saliva and of eating foods between the Nigerian and Japanese subjects. It is also extremely rare for the Nigerian subjects to have an opportunity of obtaining periodontal treatments such as instruction of plaque control and scaling.

Of particular interest is that there is a fewer incidence of severe periodontal disease despite the marked deposition of calculus in Nigeria. Gingivitis is well known to show an extremely high correlation with the amount of dental plaque and calculus. Recently, however, it has been revealed that periodontitis associated with alveolar bone absorption does not always have a correlation with the amount of plaque and calculus but is in strong association with the microflora in the periodontal pockets (Slots, 1982) [33]. Unfortunately, we cannot refer to his idea on this problem because we did not carry out any bacterial examination in the present study.

Because Nigerian children are used to

taking hard foods frequently and masticating them well, this can promote the growth of their healthy teeth and periodontal tissue and advanced jaw. Therefore they can maintain a healthy periodontal tissue, increasing the resistance to the severe periodontal disease at older age. Although the importance of plaque control is beyond dispute, it could be also significant to promote the growth of stomatognathic system, from the younger age.

The degree of alveolar bone loss increases with age. However, it is really surprising that the average maximum absorption of the alveolar bone was only 28%, being about one-third of the root length at above 60 years. Because of no Japanese data to compare, the American data reported by Marshall-Day et al. (1955) [34] concerning 1,187 subjects are compared with our Nigerian data. His finding is that the average maximum absorption of the alveolar bone increased with age, being 53.3% at above 60 years, which was a fairly higher value than that in the Nigerian data. Plaque, Calculus and Gingival Index scores of the Nigerian subjects at above 60 years, being 1.26 ± 0.6, 1.52 ± 0.5 and 1.16 ± 0.6 respectively, displays the poor oral hygiene and remaining inflammation in the gingiva. The lower degree of alveolar bone absorption is to support the results of CPITN examination in which the incidence of severe periodontitis was low in Nigeria.

6. Survey of foods

The food eating in the Nigerian families (880) was inquired by the quetionnaire as shown in Table 19. The foods were grouped into 4 categories proposed by Kagawa and Yanagisawa (1992) [35] and were compared with each other in the rural and urban families, and also in the rainy and dry seasons. Generally, there was not so large difference in foods taken between the rural and urban communities. Commonly, the foods taking very well were beans, cow meat, chicken, fishes in the 2nd category, yam, cassava, gali made from cassava, sugar beet, asparagus, tomato, banana, plantain banana (do do), pepper, papaya in the 3rd category, rice, maize made from corn, bread, coconut, sugar cane, soft drinks, water in the 4th category.

There was no datum of the foods in the 1st category, because the name of foods is not shown on the list of the questionnaire. Contrary to this, the food eaten not so much are the garden beans in the 2nd category, cabbage, augar beet, asparagus and turnip in the 3rd category, rye, oats, barley, barleycorn, beer in the 4th category. Palm wine and beer are taken in the rural community much more than in the urban community. Pea, goat meat, chicken and fowl in the 2nd category, sweet potato, cabbage and carrot in the 3rd category and corn, oats, bread, sugar cane and soft drinks in the 4th category were eaten in the urban community much more than in the rural community.

7. Infant diets and weaning period in rural family

1) About the infant diets and weaning period in the Nigerian family, the questioner inquired of 123 housewives, who visited the local health center for a periodical physical examination. Among the 112 housewives, 47 wives have given a special menu to her baby and 65 wives non-special menu to her baby as shown in Table 20.

The foods are classified into four categories by the nutritional specification (Kagawa and Yanagisawa, 1992) [35]. Category 1 includes the milk and dairy products, having a good quality protein, calcium and vitamin B_2. Category 2 includes the marine products, meat and beans, containing a good quality protein, lipids, vitamins A, B_1 and B_2 and calcium.

Table 19. Survey of Foods

	Rainy season		Dry season	
	Rural(%)	Urban(%)	Rural(%)	Urban(%)
Category 1*				
Category 2				
Fishes	97.1	99.1	97.0	99.4
Cow	92.6	98.2	89.4	97.9
Beans	86.9	98.2	81.3	88.2
Chicken	83.6	97.9	82.6	96.2
Goat	63.1	90.2	63.6	92.3
Soy beans	51.6	43.5	47.4	43.5
Fowl	40.0	79.0	41.0	74.6
Sheep	33.2	35.5	33.4	35.2
Pea	6.3	31.7	4.6	33.7
Category 3				
Yam	98.5	100.0	98.5	100.0
Gali	97.0	100.0	96.4	99.4
Plantain	94.9	99.1	91.9	98.2
Pawpaw (papaya)	94.7	96.4	91.9	97.0
Banana	94.5	99.1	91.9	98.2
Tomato	89.1	95.9	85.3	95.6
Pepper	85.0	91.1	82.3	88.8
Cassava	76.7	73.7	76.5	76.3
Sweet potato	54.4	70.4	53.9	73.1
Carrot	19.0	57.7	17.7	54.4
Cabbage	2.5	10.4	2.3	9.5
Category 4				
Rice	98.3	100.0	97.7	99.7
Maize	95.9	98.8	92.7	99.7
Water	94.2	98.8	95.7	99.7
Coconut	90.2	95.6	89.1	95.6
Sugar cane	86.6	95.3	83.3	94.4
Sweet drinks	82.0	98.5	83.3	98.2
Bread	73.6	95.6	66.1	96.2
Corn	68.8	89.1	66.1	89.3
Palm wine	29.8	8.3	32.1	7.7
Beer	7.4	0.6	0.6	0.3
Oatmeal	0	10.7	0	10.4

*No investigation
The number of persons, who eat a given food daily, is shown in percentage (%).

Category 3 includes the vegetables, taros and fruits, containing vitamin A, B_1, B_2 and C and fibrous substances. Category 4 includes the cereals, sugar, oils, fats and tastes, containing carbohydrates, lipid and protein as a source of energy.

As far as both menus are compared there seemed to be no essential difference in the list of the foods served at a meal between the special and non-speical menu. There were some differences in the list of the foods served at every meal as shown in Tables 20, 21, 22 and 23. Their babies eat the infant meals composing of the foods of 4 categories.

2) Weaning period of the baby

Table 20. Infant Diets of Weaning Period in Rural Family

Special menu Menu for breakfast		Ordinaly menu Menu for breakfast	
1st Category of food			
Milk	8%	Breast Milk	2%
		Milk	23%
Egg	8%	Egg	11%
2nd Category of food			
Beans	57%	Beans	77%
Moinmoin	15%	Moinmoin	37%
Akara	9%	Akara	12%
Fishes	6%	Fishes	9%
Cow meat	6%	Cow meat	8%
Stew	9%	Stew	9%
3rd Category of food			
Yam	72%	Yam	51%
Amala	9%	Amala	8%
Gali	11%		
Okro soup	9%	Vegetable soup	14%
Eba	4%	Eba	9%
Do do	9%	Do do	5%
Orange	9%		
4th Category of food			
Bread	91%	Bread	22%
Rice	60%	Rice	57%
Pap	53%	Pap	55%
Eko	15%	Eko	29%
Ogi	15%	Ogi	29%
Black tea	57%	Black tea	37%

Note: Moinmoin: Bean pudding with palm oil or vegetable oil and steamed to form a cake
Akara: Bean halls fried in oil
Amala: Made from yam
Gali: Made from cassava
Okro soup: Made from pods of the okro cooked with vegetable oil or cooking oil
Eba: Made from the root of cassava
Do do: Plantain banana cooked with palm oil or vegetable oil
Pap, Eko, Ogo: All are made from corn powder
All soups are composed of vegetable and cooking oil.

Special menu means diets different from those of family members, who eat daily. Ordinary menu means diets not different from those of family members.

The number of family members, where a given food was given to the baby, is shown in percentage (%).

The weaning period was inquired of 103 housewives. Their answers were summarized as follows: At one year after birth 24% of their babies were weaned from breast milk. At one year six months 32% of the babies were weaned from breast milk. At two years after birth 33% of the babies were weaned from breast milk. The majority of the 103 housewives weaned their babies during the period from one year to two years after birth. A few wives (10%) delayed weaning their babies from breast milk for two years six months to three years after birth. The mothers decide on

Table 21. Menu of Lunch for Baby

Special menu Menu for lunch		Ordinaly menu Menu for lunch	
1st category of food			
Milk	2%	Milk	2%
Egg	2%	Egg	6%
2nd category of food			
Beans	26%	Beans	55%
Ewedy soup	6%	Ewedy soup	6%
Akara	11%	Akara	3%
Groundnut	2%	Kurikuri	3%
Fishes	13%	Fishes	12%
Cow meat	26%	Cow meat	11%
Chicken	9%	Chicken	5%
		Stew	14%
3rd category of food			
Yam	100%	Yam	100%
Vegetable soup	17%	Vegetable soup	26%
Eba	34%	Eba	34%
Cassava	9%	Cassava	6%
Gali	28%	Gali	42%
Fufu	2%	Fufu	5%
Amala	9%		
Okro soup	12%	Okro soup	15%
Sweet potato	2%	Sweet potato	2%
Egusi soup	6%	Egusi soup	14%
Do do	32%	Do do	11%
Pineapple	13%	Pineapple	2%
Orange	9%	Banana	5%
4th category of food			
Rice	28%	Rice	49%
Bread	9%	Bread	9%
Corn	38%	Eko	23%
Maize	9%	Agidi	5%
Ogi soup	14%	Ogi soup	2%
Pap	2%	Pap	14%
Biscuit	9%		
Coca-cola drink	2%	Black tea	5%

Note: Kurikuri: Made from groundnut, Ewedy soup: Made from bean, Fufu: Made from cassava, Egusi soup: Made from melon seeds, Agidi: Made from corn powder, Maize: Made from corn

weaning their babies from breast milk, taking care of the health of the baby (Table 24).

In Nigeria the weaning period varied case by case according to the health of the baby.

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Table 22. Menu of Supper for Baby

Special menu Menu for supper		Ordinaly menu Menu for supper	
1st category of food			
Milk	6%	Milk	2%
Egg	4%	Egg	2%
2nd category of food			
Beans	49%	Beans	45%
Moinmoin	17%	Moinmoin	15%
Ewedy soup	4%	Ewedy soup	5%
Soybeans soup	2%	Soybeans soup	5%
Akara	2%	Akara	9%
Beans cake	2%		
Bushmeat	4%	Cow meat	2%
Chicken	2%	Chicken	3%
Stew	2%	Stew	12%
		Fishes	9%
3rd category of food			
Yam	85%	Yam	92%
Amala	13%	Amala	68%
Cassava	4%	Cassava	17%
Eba	28%	Eha	25%
Gali	6%	Gali	11%
		Lafun	3%
Fufu	2%	Fufu	2%
Vegetable soup	30%	Vegetable soup	29%
Okro soup	4%	Okro soup	23%
Egusi soup	4%	Egusi soup	29%
Sweet potato	2%		
Do Do	21%	Do Do	15%
Orange	4%	Banana	3%
Melon	2%	Pineapple	2%
4th category of food			
Rice	38%	Rice	38%
Eko	11%	Eko	28%
Pap	34%	Pap	17%
Corn powder	4%	Corn powder	12%
Ogi	4%		
Bread	4%	Bread	5%
Biscuit	8%	Snack	11%
Black tea	11%	Black tea	8%
Coca-cola drink	2%		

Note: Lafun: Made from cassava

Table 23. Menu of Afternoon Refreshments

Milk	1%
Beans	48%
Groundnut	17%
Peanut	4%
Yam	31%
Fufu	1%
Gali	2%
Carrot	1%
Orange	4%
Do do	4%
Banana	3%
Papaya	2%
Pineapple	1%
Fruit	3%
Rice	42%
Biscuit	15%
Sweet	11%
Snack	9%
Bread	2%
Black tea	1%
Sweet drinks	1%
Nico	1%

The number of family members, where a given food was given to the baby daily, is shown in percentage (%).

Table 24. Weaning Period of Baby

Since one year after birth	24%
One year six months	32%
Two years	33%
Two years six months and Three years	11%

The number of housewives, who wean their baby from their breast, are shown in percentage (%)

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