Original Article

MORPHOLOGY OF THE MANDIBULAR CONDYLE IN A KENYAN POPULATION

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SUMMARY

Use of condylar prostheses in mandibular reconstructive surgery is increasing in Kenya. To retain functional capability, condylar prostheses have to preserve the form of the condyle. Although condylar shape and size have been shown to vary between populations, few studies of these have been done in Africans. This study aimed to describe the morphology of the mandibular condyle in a Kenyan population. Sixty three mandibles of African origin were used. Condylar shape was assessed from the anterior, superior and lateral aspects as per a scheme used by Wedel et al. (1978). Data collected were analyzed using SPSS v.17 for frequencies and represented using tables, charts and photographs. The commonest shapes were: slightly convex anteriorly (71.43%); oblong superiorly (73.02%); and convex laterally (80.16%). Only the lateral shape displayed sexual dimorphism, with 100% of females but 88.33% of males having the C1 (convex) shape. Asymmetry was found in 12 (19.05%) of the mandibles. Right and left condyles are similar in shape in most cases but the frequency of the convex lateral shape displayed sexual variation. The mandibular condyles of Kenyans were different in frequency of convex lateral and anterior shapes from condyles of other populations recorded in literature. These differences in morphology imply that condylar measurements cannot be generalized in the manufacture of condylar prostheses and have to be customized for the local population as well as for male and female condyles.

Key words: Mandibular condyle, shape

Introduction

The mandibular condyle is the part of the mandible that articulates with the articular fossa of the temporal bone. Its shape and morphometry affect the functional properties of the temporomandibular joint. For instance, the morphology and morphometry of the condyle in relation to the articular fossa have been shown to affect occlusal properties of the mandible (Kurusu et al., 2009). Condylar prostheses therefore have to be of such form as to return the function of the temporomandibular joint (TMJ) to as close to normal as possible.

Condylar prostheses are commonly used to correct traumatic injury or in procedures requiring resection with disarticulation, such as tumours, trauma, congenital malformations and degenerative diseases (Patel and Maisel, 2001). The aim of condylar replacement in such instances is to maintain functional height, avoid malocclusion and prevent jaw hypomobility.

Tumours of the facial region are commonly seen in maxillofacial practice, with one Ghanaian study reporting a majority (63%) occurring in the mandible (Parkins et al., 2007). In a recent Kenyan study, 59.3% of benign odontogenic tumours required resection with disarticulation of the TMJ due to extension of the tumour into the condylar process (Butt et al., 2012).

While information on the morphology of the condyle in other populations abounds in

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literature, a paucity of information on African mandibular condyles was noted. Mandibular morphometry differs significantly between populations (Hinton, 1983). Thus, condylar prostheses manufactured to such specifications may not be an anatomical fit in the African populations leading to TMJ dysfunctions post operatively. The aim of this study was therefore to collect data on the shape of the Kenyan mandibular condyle.

Materials and methods

Data from 63 mandibles (126 condyles) were collected. Of these, 12 were female, 30 were male and 21 were of unknown gender. The sexed mandibles were sourced from the National Museums of Kenya, and belonged to bodies exhumed between 1955 and 1956. Those of unknown gender were obtained from the Human Anatomy Department, University of Nairobi. No edentulous mandibles were used. All the mandibles were of Kenyan origin.

Mandibles with the second or third molar erupted were included. Broken mandibles or those with chipped condyles were not included in the study. Mandibles with any sign of previous fracture in life were also not included in the study.

The shape of the condyles was assessed and recorded according to a scheme provided by Wedel et al. (1978) as shown in Table 1 below. The term "anterior shape" was used to refer to the shape as viewed from anteriorly, "superior shape" refers to the shape as viewed from superiorly and "lateral shape" as viewed from the lateral perspective.

Results

ANTERIOR SHAPE

The commonest shape as seen from the anterior aspect was plane or slightly convex (A2) which was seen on 44 (69.84%) of the right condyles and 46 (73.02%) of the left condyles. Convex (A1) condyles were seen in 18 (28.57%) of right condyles and 15 (23.81%) of the left condyles. One right condyle (1.59%) and two left condyles (3.17%) were described as inverted-V-shaped (A3). Table 2 and Figures 1 to 3 summarize these data.

Table 1: Wedel classification of mandibular condyle shape

Viewpoint	Designation	Classification	Description of shape
Anterior	A	1	Round/convex
		2	Plane/slightly convex
		3	Pointy or inverted-V-shaped
		4	Others
Superior	B	1	Oblong
		2	Rounded/oval
		3	Pear-shaped; laterally tapered
		4	Pear-shaped; medially tapered
		5	Other
Lateral	C	1	Convex
		2	Plane/slightly convex
		3	Pointed or inverted-V-shaped
		4	Other

(Wedel et al., 1978)

Table 2: Anterior shape classification

		Sex							
		F		M		U		Overall	
	Designation	n	%	n	%	n	%	n	%
Ant. Shape (R)	A1-R	5	41.67	5	16.67	8	38.10	18	28.57
	A2-R	7	58.33	24	80.00	13	61.90	44	69.84
	A3-R	0	0.00	1	3.33	0	0.00	1	1.59
	A4-R	0	0.00	0	0.00	0	0.00	0	0.00
Ant. Shape (L)	A1-L	4	33.33	6	20.00	5	23.81	15	23.81
	A2-L	7	58.33	23	76.67	16	76.19	46	73.02
	A3-L	1	8.33	1	3.33	0	0.00	2	3.17
	A4-L	0	0.00	0	0.00	0	0.00	0	0.00

A1 – convex, A2 – plane or slightly convex, A3 – inverted-V-shaped, A4 – other

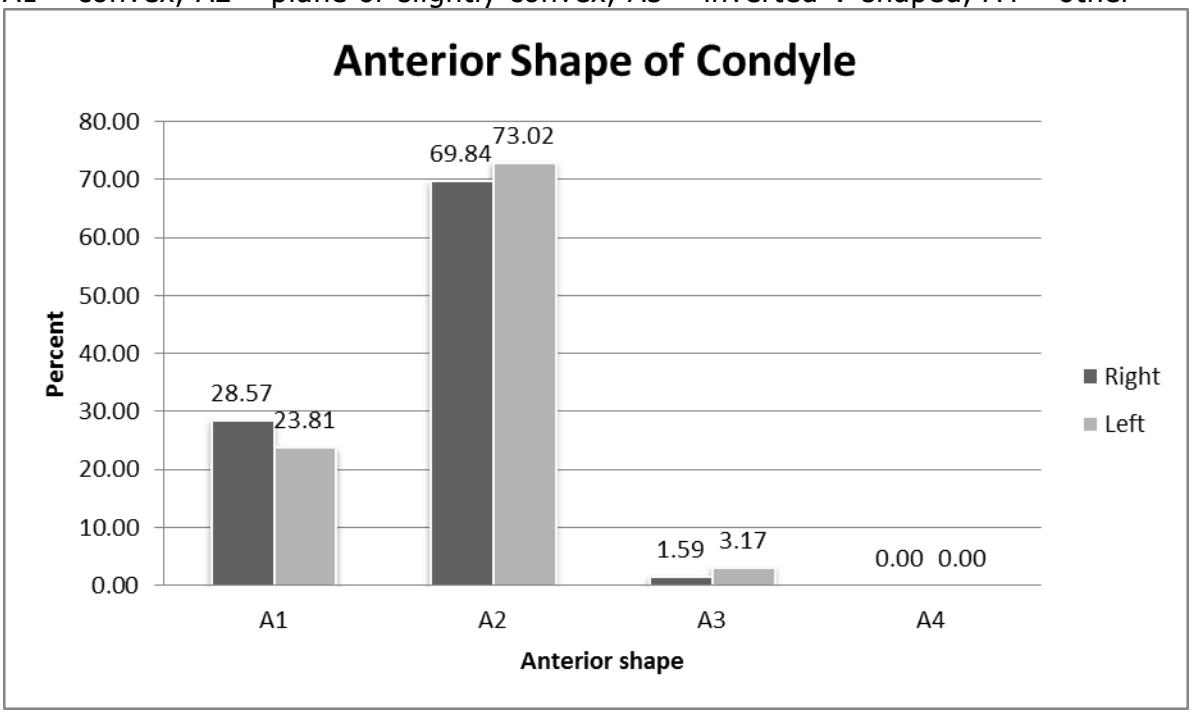

Figure 1: Graph showing comparison of anterior shape by side

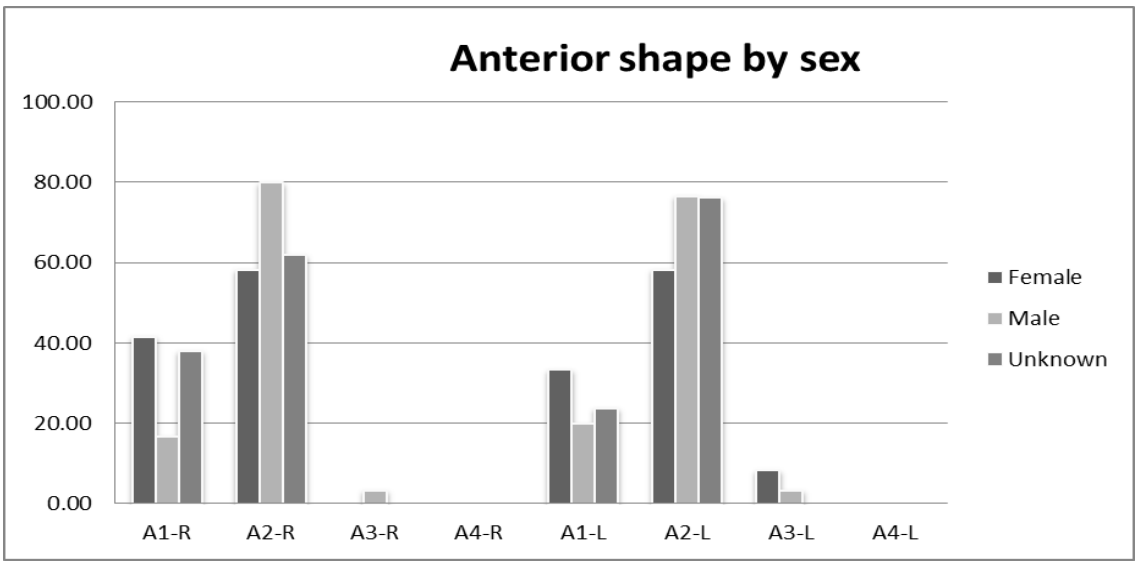

Figure 2: Graph showing classification of anterior shape by sex

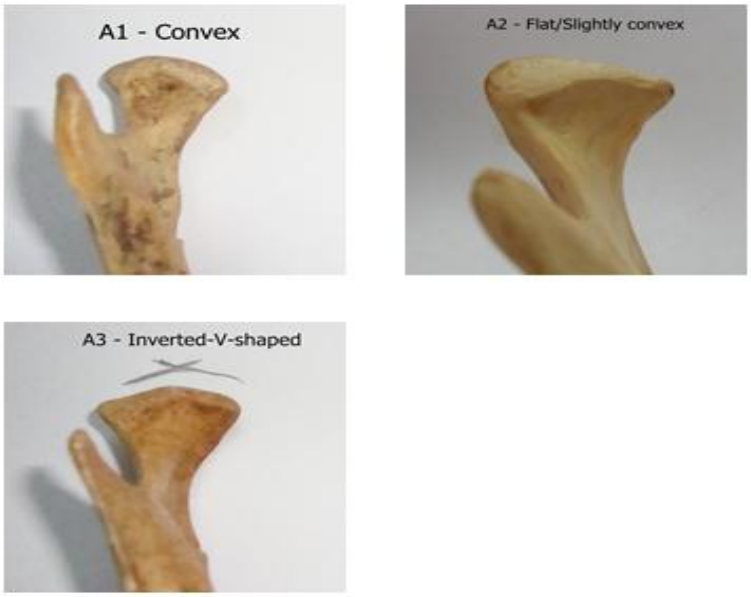

Figure 3: Photograph of anterior condylar shapes

SUPERIOR SHAPE

The commonest shape as seen from the superior aspect was oblong (B1) which was seen on 46 (73.02%) of the right condyles and 46 (73.02%) of the left condyles. Pear-shaped condyles with a medial taper (B4) condyles were seen in 10 (15.87%) of right condyles and 9 (14.29%) of the left condyles. Round (B2) condyles had equal frequencies on both sides, with 3 condyles (4.76%) on each side. One right condyle (1.59%) and two left condyles (3.17%) were pear-shaped with a lateral taper. The only other shape found was planoconvex, which was thus designated B5; 3 condyles (4.76%) on either side had this shape. Table 3 and Figures 4 to 6 summarize these data.

Table 3: Superior shape classification

		Sex							
		F		M		U		Overall	
	Designation	n	%	n	%	n	%	n	%
Sup. Shape (R)	B1-R	9	75.00	23	76.67	14	66.67	46	73.02
	B2-R	1	8.33	0	0.00	2	9.52	3	4.76
	B3-R	0	0.00	0	0.00	1	4.76	1	1.59
	B4-R	2	16.67	5	16.67	3	14.29	10	15.87
	B5-R	0	0.00	2	6.67	1	4.76	3	4.76
Sup. Shape (L)	B1-L	8	66.67	23	76.67	15	71.43	46	73.02
	B2-L	1	8.33	0	0.00	2	9.52	3	4.76
	B3-L	0	0.00	1	3.33	1	4.76	2	3.17
	B4-L	3	25.00	4	13.33	2	9.52	9	14.29
	B5-L	0	0.00	2	6.67	1	4.76	3	4.76

B1 - Oblong, B2 - Round or oval, B3 - Pear-shaped, lateral taper, B4 - Pear-shaped, medial taper, B5 - Planoconvex.

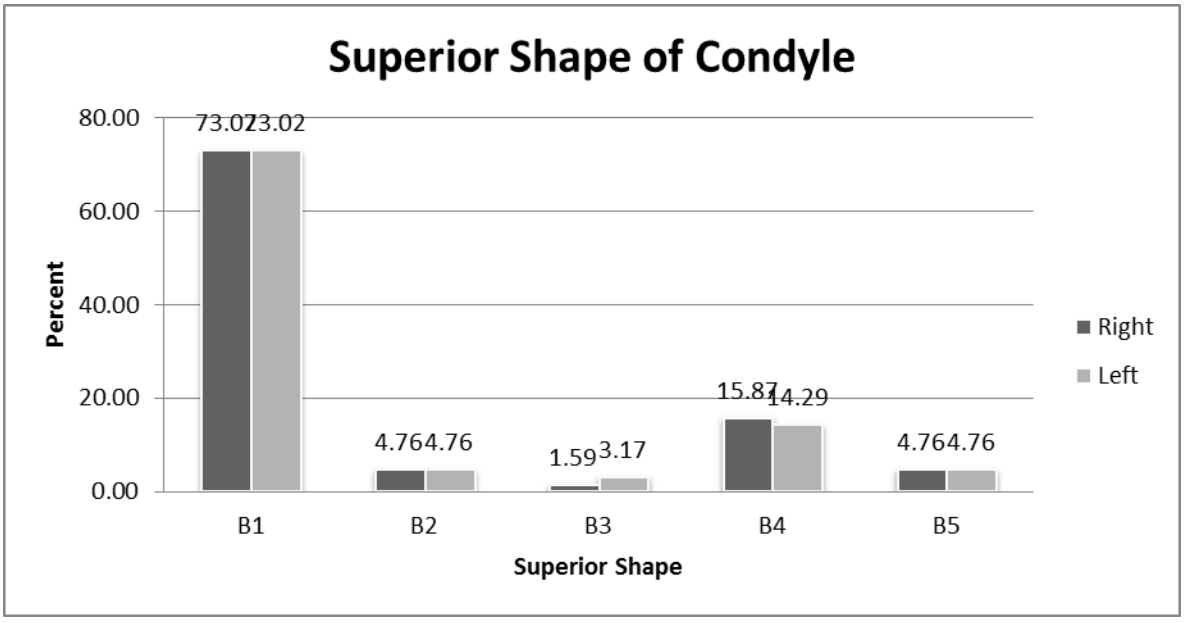

Figure 4: Graph showing comparison of superior shape by side

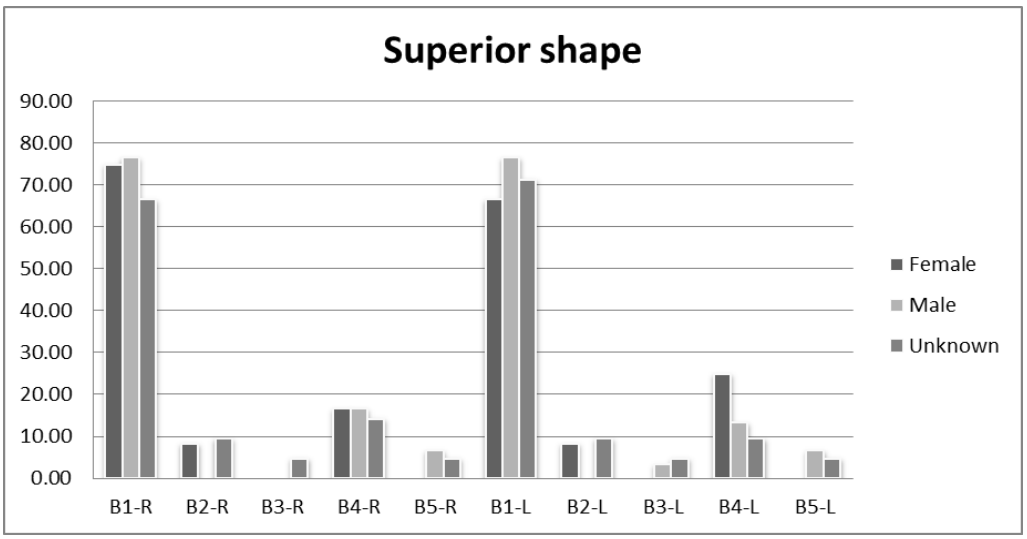

Figure 5: Graph showing classification of superior shape by sex

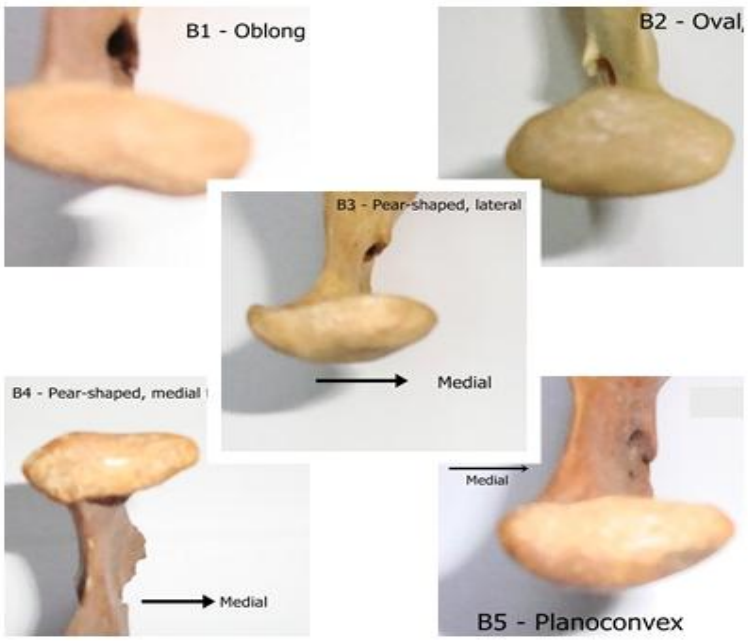

Figure 6: Photograph of superior condylar shapes

LATERAL SHAPE

The commonest shape as viewed on the lateral aspect was convex (C1) which was seen in all 24 female condyles and 53 male condyles (88.33%). Overall, it was found in 77.78% of all right condyles and 82.54% of the left condyles. Inverted-V-shaped condyles (C3) were found in 12 (19.05%) and 9 (14.29%) of the condyles on the right and left sides respectively. The least common were flat or slightly convex condyles (C2), which comprised 2 (3.17%) of the condyles on either side. No other condylar shapes were discernible. Table 4 and Figures 7 to 9 summarize these data.

Table 4: Lateral shape classification

		Sex							
		F		M		U		Overall	
	Designation	n	%	n	%	n	%	n	%
Lat. Shape (R)	C1-R	12	100.00	26	86.67	11	52.38	49	77.78
	C2-R	0	0.00	0	0.00	2	9.52	2	3.17
	C3-R	0	0.00	4	13.33	8	38.10	12	19.05
	C4-R	0	0.00	0	0.00	0	0.00	0	0.00
Lat. Shape (L)	C1-L	12	100.00	27	90.00	13	61.90	52	82.54
	C2-L	0	0.00	0	0.00	2	9.52	2	3.17
	C3-L	0	0.00	3	10.00	6	28.57	9	14.29
	C4-L	0	0.00	0	0.00	0	0.00	0	0.00

C1 – Convex, C2 – Flat or slightly convex, C3 – Inverted-V-shaped, C4 – Other

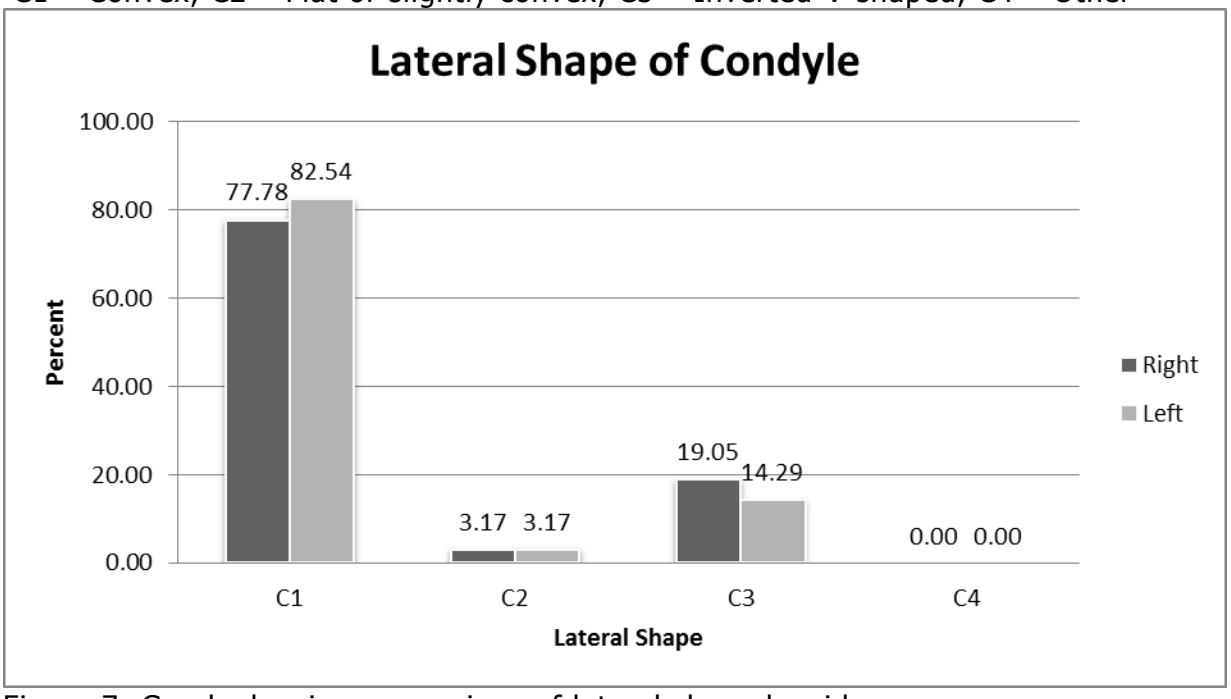

Figure 7: Graph showing comparison of lateral shape by side

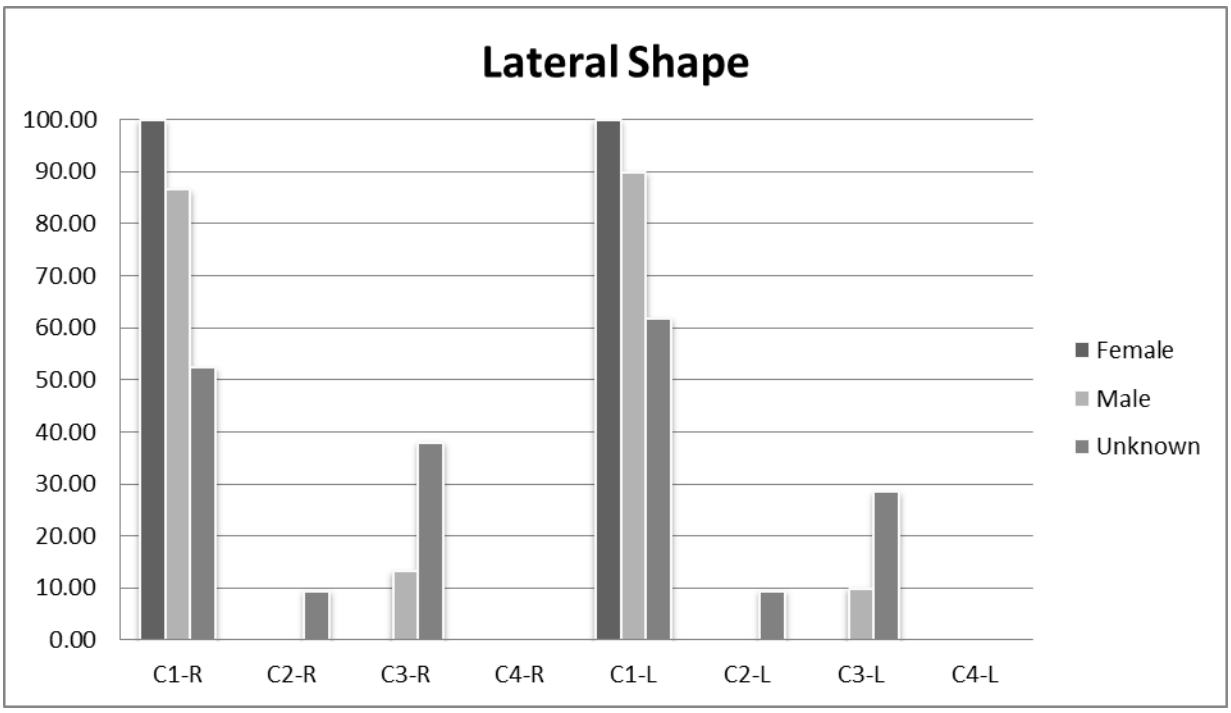

Figure 8: Graph showing classification of lateral shape by sex

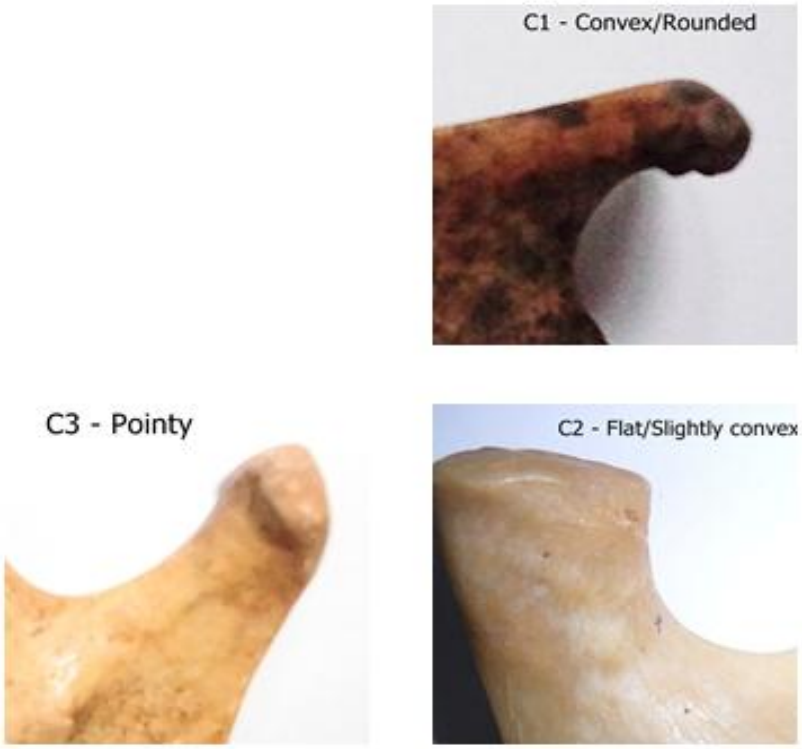

Figure 9: Photograph of lateral condylar shapes

ASYMMETRY IN CONDYLAR SHAPE

Condylar asymmetry was observed in 12 of the 63 mandibles (19.05%). Asymmetry in anterior, superior and lateral shapes separately was observed in 6 (9.52%), 3 (4.76%) and 5 (7.94%) of mandibular condyles respectively.

Discussion

The commonest shapes found from the anterior and superior aspects in the current study were flat/slightly convex (A2) and oblong (B1) respectively. Similar results on the shape of the condyle from the anterior and superior aspect were found by Matsumoto et al. (1995), however from the lateral aspect, the commonest shape was pointy/inverted-V-shaped (C3), while in the current study it was convex (C1). This difference may be either due to inter-population variation or a difference in the between the two groups. Yale et al. (1966) noted that a convex superior aspect was more common in males than in females. However, the current study noted a higher frequency of the convex shape in women than in men, whether seen from the lateral perspective (100.00% vs. 88.33%) or from the anterior perspective (37.50% vs. 18.33%). Fuller condyles in females may be suggestive of lesser mechanical stress of occlusion, due to lesser muscle mass, thereby causing retention of the initial convex shape of the condyle. This is in line with electromyogram recordings of the activity of the masseter muscle, which showed heavier activity in males than females (Raustia and Salonen, 1997). Right and left condyles were similar in shape in the majority of the mandibles. However, the frequency of a convex lateral shape displayed sexual variation.

Table 5: Comparison of shape frequencies in literature

Shape		Yale et al (1966)	Wedel et al (1978)	Matsumoto et al (1995)	Magnusson et al (2008)	Oliveira et al (2009)	**Current study (2011)**
Anterior	**A1**	**61.0%**	**51.0%**	25.0%	**50.0%**	-	26.19%
	A2	25.0%	29.0%	**58.4%**	13.0%	-	**71.43%**
	A3	12.0%	14.0%	16.6%	22.0%	-	2.38%
	A4	2.0%	6.0%	-	15.0%	-	-
Superior	**B1**	-	**62.0%**	**60.0%**	**62.0%**	-	**73.08%**
	B2	-	6.0%	1.6%	6.0%	-	4.76%
	B3	-	6.0%	20.0%	11.0%	-	2.38%
	B4	-	5.0%	18.4%	11.0%	-	15.08%
	B5	-	18.0%	-	11.0%	-	4.76%
Lateral	**C1**	**58.0%**	-	31.7%	-	**41.0%**	**80.18%**
	C2	25.0%	-	13.3%	-	4.0%	3.17%
	C3	12.0%	-	**55.0%**	-	23.0%	16.67%
	C4	3.0%	-	-	-	32.0%	-

Conclusion

The mandibular condyles of Kenyans were different in frequency of convex lateral and anterior shapes from condyles of other populations recorded in literature. The differences in morphology imply that condylar measurements cannot be generalized in the manufacture of condylar prostheses and have to be customized for the local population as well as for male and female condyles. Future research should

focus on the incidence of TMJ dysfunction post-operatively on patients who have had the insertion of regular condylar prosthesis currently in use with the group that has had a custom made prosthesis. This will justify fabrication of anatomical condylar prosthesis for different populations.

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