

# A morphometric analysis of occipital condyle

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## Abstract

**Objective:** The objective of the study was to find the morphometry of occipital condyle in human dry skulls.

**Methods:** Measurements were taken from 100 occipital condyles of 50 adult human dry skulls of unknown age and sex from anatomy department of Saveetha dental college. Five parameters (length, width, height, anterior intercondylar distance, posterior intercondylar distance) were measured using Vernier caliper and an analysis was performed

## Results:

The average length of right occipital condyle was  $22.3 \pm 2.4$ mm.  
The average width of the right occipital condyle was  $13.1 \pm 1.9$ mm.  
The average height of right occipital condyle was  $7.9 \pm 1.3$ mm.  
The average anterior intercondylar distance was  $21.6 \pm 2.7$ mm.

## Conclusion:

Occipital condyle may be present in various shapes, length, width, and it requires a careful radiological analysis before craniovertebral junction surgery. These anatomical parameters should be taken into consideration during posterior and lateral approaches to craniovertebral junction surgery

**Keywords:** occipital condyle, morphometry, skull, intercondylar distance, craniovertebral junction

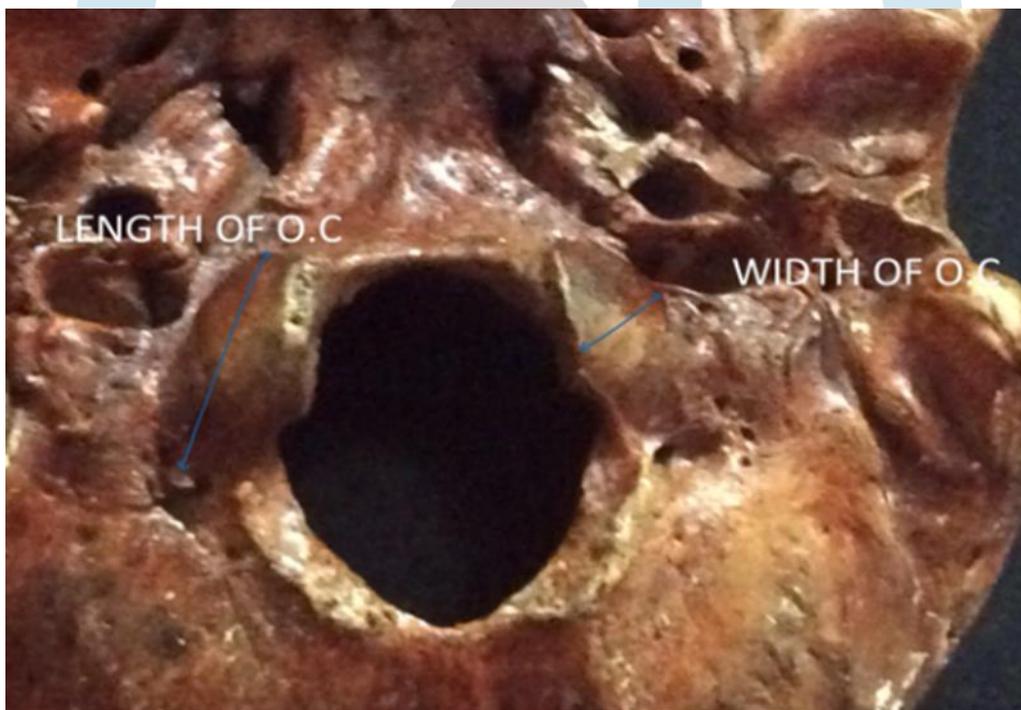
## Introduction

The occipital condyles (OC) of the skull are located with the superior articular facets of the atlas vertebra and form an important junction between the cranium and the vertebral column. Occipital condyle is an oval or kidney shape protuberance in the occipital bone [1,2]. Each occipital condyle is oriented oblique so that the anterior extremities directed forward and medially and close together than the posterior [1]. The inferior surface of the occipital condyle is the only ball-pivot articulation between the occiput and the atlas. Occipital condyle is important for the stability of the craniovertebral Junction [1, 3,4,5,6,7]. The condylar parts of the

occipital bone flank the foramen magnum. The inferior surface of the occipital condyles present for articulation with the superior facets present on the lateral mass of the atlas. This articulation is the only one between the skull and first cervical vertebra. The stability of this craniovertebral junction depends largely on the morphometric data of the occipital condyles. Most of the previous studies were confined to the morphometric analysis of some parts of the occipital condyle. Morphometric analysis including metric and non-metric study for most of the parameters of occipital condyle are rare found. The deep lesions at the level of foramen magnum can be reached surgically by using ventral and dorsal approach. As the ventral approach is dangerous and has a high rate of morbidity, the dorsal approach is preferred to reach the space occupying lesion ventral to the spinal cord at the craniovertebral junction. Occipital condyle may be present in various lengths, width requiring a careful radiological analysis before craniovertebral junction. These anatomical parameters of occipital condyle should be taken into consideration during posterior and lateral approaches to craniovertebral junction [1,10,11,12,13,14,15,16]. The main aim of this study is to analyse the morphometry of occipital condyle.

#### Materials and methods:

Morphometric analysis was performed on 50 dry skulls. Measurements were taken from 100 occipital condyles of 50 adult human dry skulls of unknown age and sex from anatomy department of Saveetha dental college and hospitals, ponnammalle, Tamilnadu. Five parameters (length, width, height, anterior intercondylar distance, posterior intercondylar distance) were measured using Vernier caliper accurate to 0.1mm and an analysis was performed. Measures for each parameter were performed by two researchers and mean was taken to minimize the error. Length is the longest anterior-posterior axis from the anterior end to the posterior end of the condyle. width is the largest diameter from medial to the lateral border of the condyle. Height of the condyle was measured at the center of the condyle. Anterior inter-condylar distance is the distance between anterior tips of right and left occipital condyles. Posterior inter-condylar distance is the distance between posterior tips of right and left occipital condyles. The measurements were tabulated and mean and standard deviation was found for each parameter. [8,9,14,15,17,18,19,20]. Exclusion criteria: All the fractured and foetal skulls were excluded from this study



**Fig1: base of the skull showing the length and width of the occipital condyle Results**

The mean (average), standard deviation maximum, minimum of the length, width, height, anterior intercondylar distance, posterior intercondylar distance was calculated.

The average length of right occipital condyle is 22.3.4mm.  
 The average length of the left occipital condyle is 24.3±2.5mm.  
 The average width of the right occipital condyle is 13.1±1.9mm.  
 The average width of left occipital condyle is 14.8±1.7mm.  
 The average height of right occipital condyle is 7.9±1.3mm.  
 The average height of the left occipital condyle is 9.4±1.8mm.  
 The average anterior intercondylar distance is 21.6±2.7mm.  
 The average posterior intercondylar distance is 37.9±4.6 mm.

**Table 1: value of different parameters**

	MEAN (mm)	S.D(mm)	Max(mm)	Min(mm)
Length(right)	22.3	2.4	28.0	15.9
Length (left)	24.3	2.6	30.1	19.7
Width(right)	13.2	2.0	18.6	9.2
Width(left)	14.8	1.8	19.2	10.2
Height(right)	7.9	1.3	10.3	5.2
Height(left)	9.4	1.8	12.6	7.1
Anterior intercondylar distance	21.6	2.7	25.9	14.8
Posterior intercondylar distance	37.9	4.6	47.5	25.9

**Frequency table of parameters****Table: 2 Length of right occipital condyle (mm)**

15.5-20.4	9
20.5-25.4	35
25.5-30.4	6

**Table: 3 Length of left occipital condyle (mm)**

15.5-20.4	3
20.5-25.4	35
25.5-30.4	12

**Table: 4 width of right occipital condyle (mm)**

5.5-10.4	4
10.5-15.4	40
15.5-20.4	6

**Table:5 width of left occipital condyle (mm)**

5.5-10.4	1
10.5-15.4	35
15.5-20.4	14

**Table: 6 height of right occipital condyle (mm)**

3.5-5.4	1
5.5-7.4	15
7.5-9.4	27
9.5-11.4	7

**Table: 7 height of left occipital condyle (mm)**

5.5-7.4	8
7.5-9.4	24
9.5-11.4	8
11.5-13.4	10

**Table: 8 anterior intercondylar distance (mm)**

10.5-15.4	1
15.5-20.4	21
20.5-25.4	21
25.5-30.4	7

**Table: 9 posterior intercondylar distance (mm)**

25.4-30.5	3
30.5-35.4	12
35.5-40.4	22
40.5-45.4	10
45.5-50.4	3

### Discussion

In this study, Morphometric analysis was performed on 50 dry skulls. Measurements were taken from 100 occipital condyles of 50 adult human dry skulls of unknown age and sex from anatomy department of Saveetha dental college and hospitals, Poonamallee, Tamil nadu. Five parameters (length, width, height, anterior intercondylar distance, posterior intercondylar distance) were measured using Vernier caliper and an analysis was performed. Measures for each parameter were performed by two researchers and mean was taken to minimize the error. Length is the longest anterior –posterior axis from the anterior end to the posterior end of the condyle. width is the largest diameter from medial to the lateral border of the condyle. Height of the condyle was measured at the center of the condyle. Anterior inter-condylar distance is the distance between anterior tips of right and left occipital condyles. Posterior inter-condylar distance is the distance between posterior tips of right and left occipital condyles. The measurements were tabulated and mean and standard deviation was found for each parameter. [8,9,15,17,18,19,20].

On examining the length of the right occipital condyle, the maximum value obtained from the collected records was 28mm and the minimum value was 15.9mm. Number of right occipital condyle with the length between 15.5mm to 20.4 mm was 9. Number of right occipital condyle with the length between 20.5mm to 25.4mm was 35. Number of right occipital condyle with the length between 25.5mm to 30.4mm was 6. The mean value of the length of right occipital condyle was 22.3mm with a standard deviation of 2.4mm.

On examining the length of the left occipital condyle, the maximum value obtained from the collected records was 30.1mm and the minimum value was 19.7mm. Number of left occipital condyle with the length between 15.5mm to 20.4 mm was 3. Number of left occipital condyle with the length between 20.5mm to 25.4mm was 35. Number of left occipital condyle with the length between 25.5mm to 30.4mm was 12. The mean value of the length of left occipital condyle was 24.3mm with a standard deviation of 2.6mm.

On examining the width of the right occipital condyle, the maximum value obtained from the collected records was 18.6mm and the minimum value was 9.2mm. Number of right occipital condyle with the width between 5.5mm to 10.4 mm was 4. Number of right occipital condyle with the width between 10.5mm to 15.4mm was 40. Number of right occipital condyle with the width between 15.5mm to 20.4 mm was 6. The mean value of the width of right occipital condyle was 13.2 mm with a standard deviation of 2.0mm.

On examining the width of the left occipital condyle, the maximum value obtained from the collected records was 19.2mm and the minimum value was 10.2mm. Number of left occipital condyle with the width between 5.5mm to 10.4 mm was 1. Number of left occipital condyle with the width between 10.5mm to 15.4mm was 35. Number of left occipital condyle with the width between 15.5mm to 20.4mm was 14. The mean value of the width of left occipital condyle was 14.8 mm with a standard deviation of 1.8mm.

On examining the height of the right occipital condyle, the maximum value obtained from the collected records was 10.3mm and the minimum value was 5.2mm. Number of right occipital condyle with the height between 3.5mm to 5.4 mm was 1. Number of right occipital condyle with the height between 5.5mm to 7.4mm was 15. Number of right occipital condyle with the height between 7.5mm to 9.4mm was 27. Number of right occipital condyle with the height between 9.5mm to 11.4mm was 7. The mean value of the height of right occipital condyle was 7.9 mm with a standard deviation of 1.3mm.

On examining the height of the left occipital condyle, the maximum value obtained from the collected records was 12.6mm and the minimum value was 7.1mm. Number of left occipital condyle with the height between 5.5mm to 7.4mm was 8. Number of left occipital condyle with the height between 7.5mm to 9.4mm was 24. Number of left occipital condyle with the height between 9.5mm to 11.4mm was 8. Number of left occipital condyle with the height between 11.5mm to 13.4mm was 10. The mean value of the height of right occipital condyle was 9.4 mm with a standard deviation of 1.8mm.

On examining the anterior inter condylar distance, the maximum value obtained from the collected records was 25.9mm and the minimum value was 14.8mm. Number of skulls with the anterior inter condylar distance between 10.5mm to 15.4mm was 1. Number of skulls with the anterior intercondylar distance between 15.5mm to 20.4mm was 21. Number of skulls with the anterior inter condylar distance between 20.5mm to 25.4mm was 21. Number of skulls with the anterior intercondylar distance between 25.5mm to 30.4mm was 7. The mean value of the anterior intercondylar distance was 21.6 mm with a standard deviation of 2.7mm.

On examining the posterior inter condylar distance, the maximum value obtained from the collected records was 47.5mm and the minimum value was 25.9mm. Number of skulls with the posterior inter condylar distance between 25.5 mm to 30.4mm was 3. Number of skulls with the posterior intercondylar distance between 30.5mm to 35.4mm was 12. Number of skulls with the posterior inter condylar distance between 35.5mm to 40.4mm was 22. Number of skulls with the posterior intercondylar distance between

40.5mm to 45.4mm was 10. Number of skulls with the posterior intercondylar distance between 45.5mm to 50.4mm was 3. The mean value of the anterior intercondylar distance was 37.9mm with a standard deviation of 4.6mm.

In the current study average values of the parameters are as follows

The average length of right occipital condyle is 22.3.4mm.

The average length of the left occipital condyle is 24.3±2.5mm.

The average width of the right occipital condyle is 13.1±1.9mm.

The average width of left occipital condyle is 14.8±1.7mm.

The average height of right occipital condyle is 7.9±1.3mm.

The average height of the left occipital condyle is 9.4±1.8mm.

The average anterior intercondylar distance is 21.6±2.7mm.

The average posterior intercondylar distance is 37.9±4.6 mm.

The measured length of right occipital condyle was comparable and the results were similar to Naderi.et.al (23.6±2.5)[1], Emel AVCU(23.7±2.6)[3],Fathy(23.5±2.5)[5],Jae tark HONG(22.9±2.5)[4].

The measured length of left occipital condyle was compared and the results were similar to the measurement obtained from Naderi (23.2±2.6)[1], Emel AVCU (24±2.7)[3], Fathy (23.7±2.7)[5], Jae tark HONG (14.1±1.8)[4].

The measured width of the occipital condyle was comparable and the result were similar to the measured width reported by Naderi(10.6±1.4)[1],Emel AVCU (12.2±1.2)[2],Fathy (13.5±1.8)[5],Jae tark HONG(14.1±1.8)[4].

The measured height of occipital condyle was comparable and the results were similar to the measured height reported by Naderi(9.2±1.4)[1],Fathy(9.6±1.4)[5].

The anterior intercondylar distance was also comparable and the results were similar to measurements reported by Naderi (21.0±2.8)[1] and Fathy (20.6±2.8)[5].

The posterior intercondylar distance was also comparable and the results were similar to measurements reported by Naderi (41.6±2.9) [1] and Fathy (41.4±3.48) [5].

### Conclusion

Occipital condyle may be present in various shapes, length, width, and it requires a careful radiological analysis before craniovertebral junction surgery. These anatomical parameters should be taken into consideration during posterior and lateral approaches to craniovertebral junction surgery.

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