

# MORPHOLOGICAL AND MORPHOMETRICAL ANALYSIS OF SPHENOIDAL TUBERCLE IN DRY HUMAN SPHENOID BONE AND ITS ANATOMICAL VARIATIONS

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**Running title: Morphometrical analysis of sphenoidal tubercle in dry human sphenoid bone**

## **Abstract**

**Introduction:** Sphenoid bone is an individual bone in the cranium which is unpaired. Its shape resembles a butterfly or bat shaped containing a central body. Sphenoidal tubercle is the bony projection present within the anterior aspect of the infratemporal crest. The purpose of this research work is to bring out the morphometrical variations of sphenoidal tubercle in dry sphenoid bone and its anatomical deviations.

**Materials and Methods:** The osteometric study was did in 42 dry processed cranial cavity of unidentified gender. Also skulls having large breakage and developmental defects were rejected. Good selected bones were collected

from Department of Anatomy, Basic Medical Science, Saveetha Dental College and Hospitals for estimation. Statistical analysis was performed in the SPSS, using a paired sample 't' test.

**Results:** Morphological analysis shows that sphenoidal tubercle represent a different morphology and measurements. Morphometrical analysis shows that the average of right sphenoidal tubercle and left sphenoidal tubercle is 3.901 and 3.394.

**Conclusion:** Since the groove for maxillary artery and groove for maxillary nerve are situated nearer to the sphenoidal tubercle, it is a remarkable landmark in anatomical structures. This key landmark could be regarded as a criterion for the surgical methodology to the infratemporal fossa.

**Keywords:** Morphology, Morphometry, anatomical variations, sphenoid bone, sphenoidal tubercle.

### Introduction

Sphenoid bone is situated at the centre of cranial base, antecedent to basilar part of sphenoid-occipital bone. Topic of discussion of this study is description and denomination of morphologically varied sphenoid bone. This study is done to see anatomical variations of sphenoidal tubercle in regard to the sphenoid bone spine. Sphenoidal tubercle is also called infratemporal spine (1). Sphenoid bone is one among the vital bones of neurocranium. The shape of the sphenoid bone is butterfly or bat shaped containing a central body. There are bony elevations located within the anterior fringe of infratemporal crest at sphenoidal greater wing where temporal muscle, lateral muscle and lateral pterygoid muscles have origin (2). Sphenoidal tubercle has varied morphology and measurements. The anatomical relations has an vital neurovascular contents like maxillary nerve and maxillary artery (3)(4).

In a previous study, 60 dry skulls was used in the morphological and morphometrical analysis. Sphenoidal tubercle's diameters, anteroposterior, transverse and vertical was very near distances to grooves arteria maxillaris and the maxillary nerve(V<sub>2</sub>) (5). Sphenoidal tubercle has occurrence of 98.4% in analyzed dry skulls, present bilaterally within 76.6 % of the population. The pyramidal form is the foremost frequent with percentage of 25.7 % occurrence rate. The typical diameters was found to be 4.12mm in anteroposterior, 5.50mm in transverse, 3.89 mm in vertical and the average distance arteria maxillaris (9.04) and maxillary nerve (7.6mm) to the grooves (4,6).

In another study, author stated that sphenoidal tubercle must be incorporated in anatomical terminology as sphenoidal tuberculum and bifidity and giant shape of this sphenoidal tubercle must be regarded as anatomical variants (7)(8)(9).

This research is needed to find any anatomical variations in sphenoidal tubercle. The anatomical relation has an vital neurovascular contents like maxillary nerve and maxillary artery nearer to the tubercle. It is going to be used as a point of reference for surgical access to the infratemporal fossa (10). Our scientist experts with their encompassing information, research experience, data has transformed to several publications globally in well reputed indexed Journals (11–18),(19),(20),(21),(22,23), (24),(25),(26–30). The purpose of this research work is to bring out the morphometrical variations of sphenoidal tubercle in dry sphenoid bone and its anatomical deviations.

### Materials and methods

The osteometric study was did in 42 dry processed cranial cavity of unidentified gender. Also skulls having large breakage and developmental defects were rejected. Good selected bones were collected from Department of Anatomy, Basic Medical Science, Saveetha Dental College and Hospitals for estimation. This study is SRB approved. Statistical analysis was performed in the SPSS, using a paired sample 't' test.

**Results**

**Morphological analysis:**

Sphenoidal tubercle represents a different morphology and measurements which shows that receive peripheral impacts, probably related to muscular adhesion produced by the profound part of lateral pterygoid and temporalis muscle. Figure 1 shows the photograph of sphenoidal tubercle in the sphenoid bone of the skull.

**Morphometrical analysis:**

The facts obtained from the morphometrical dimensions of sphenoidal tubercle of this study from the Table: 1 and Figure 2 shows that the mean of right sphenoidal tubercle obtained is  $3.901 \pm 0.47\text{mm}$  and left sphenoidal tubercle is  $3.394 \pm 0.59\text{mm}$ .

Average measurement of length of sphenoidal tubercle on right and left side showed there was no significant difference in the length between right and left tubercles. Paired sample t test was done and  $p = 0.337$  ( $p > 0.05$ ) indicating statistically no difference.



Figure 1: Photograph shows the sphenoidal tubercle in the sphenoid bone of the skull.

Table 1: Showing the mean, minimum, maximum, and the range of right and left sphenoid tubercles in the skull. All the values are expressed as Mean  $\pm$  SE.

Parameters	Right sphenoidal tubercle	Left sphenoidal tubercle
Mean	3.9010	3.3940

Minimum	1.26	1.62
Maximum	7.66	4.79
Range	6.40	4.17
Standard Error	0.47	0.59

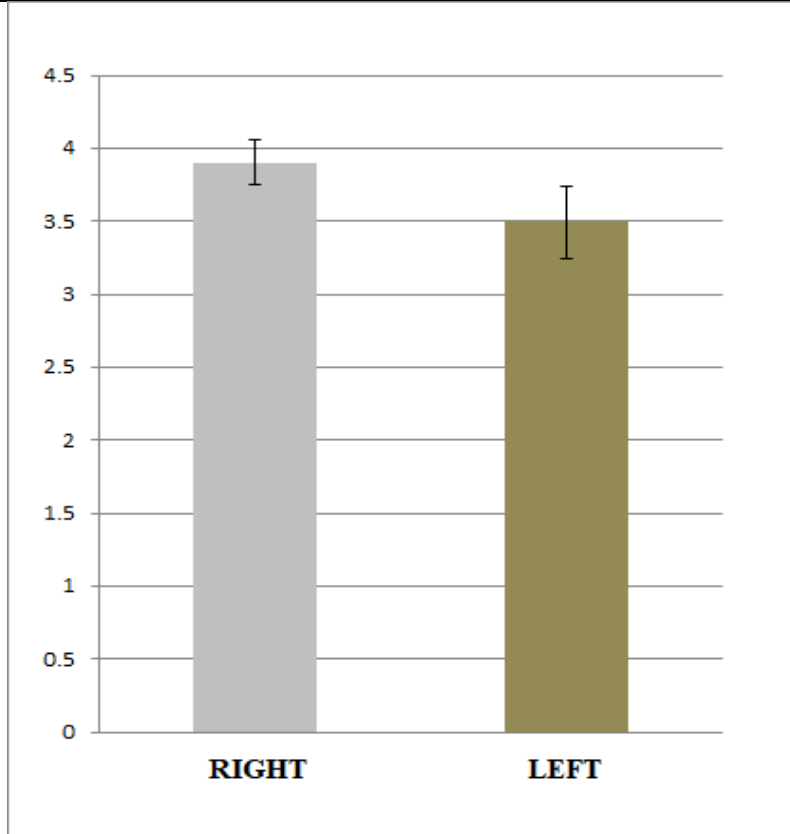


Figure 2: Bar graph depicts the association showing average measurement of length of sphenoidal tubercle on right and left side. X axis represents the right and left side of the sphenoidal tubercle and Y axis represents the length of the sphenoidal tubercle. Grey colour represents the length of the right side of the sphenoidal tubercle and green colour represents the length of the left side of the sphenoidal tubercle. There was no significant difference in the length between right and left tubercles. Paired sample t test was done and  $p = 0.337$  ( $p > 0.05$ ) indicating statistically no difference.

**Discussion**

Morphological analysis of sphenoidal tubercles reveals that the location and dimension of the sphenoidal tubercle vary in different bony skeletons and a correct and clear knowledge of its structural variations provides some basic information on its clinical implications. In a reference study, morphological analysis reveals that the sphenoidal tubercle has varied morphology (31). By assessing morphology of the sphenoidal tubercle is divided into several morphological pattern as pyramidal, truncated pyramid laminar, smooth, spiniform and irregular (6). In a study, the available literature did not mention any precise anatomical characteristics and distribution and bony element within the population (4,6). In another study, the author understood that the laminar morphology is the foremost with pyramidal and frustum. Inside the laminar morphology, the spineform subtype is less frequent and the morphological distribution of left and right have equivalent patterns (7)(32).

Morphometrical analysis from the SPSS statistical software revealed that the mean of right sphenoidal tubercle is greater than the left sphenoidal tubercle [Figure:1]. The mean vertical size of the SphT was found in 98.4% of 60 dry skulls, being bilateral in 76.6% of those cases; its average vertical diameter was of 3.89 mm [18]. because the SphTs we found had quite twice that average vertical size (the main left SphT:9.17 mm and therefore the right SphT: 14.80 mm) they might be considered as “giant” SphTs (4,6,7)(33)(34)(35). Moreover Morphometric variations in the location, dimensions of the spine of sphenoid in different dry human skulls have varied applications in various surgical procedures (36).

#### **Limitations of the study:**

The limitations of this study is only with very few dry cranial cavity, the study was conducted and the study was completed in very less time. If this study is conducted with more dry human cranial cavity and more time taken significant results can be obtained in future.

#### **Conclusion**

Since the groove for maxillary artery and groove for maxillary nerve are situated nearer to the sphenoidal tubercle, it is a remarkable landmark in anatomical structures. This key landmark could be regarded as a criterion for the surgical methodology to the infratemporal fossa.

#### **AUTHOR CONTRIBUTIONS**

Author 1: Padmalochini Sudharsan, carried out the study by collecting data and drafted the manuscript after performing the necessary statistical analysis and in the preparation of the manuscript.

Author 2: Karthik Ganesh Mohanraj, aided in conception of the topic, designing the study and supervision of the study, correction and final approval of the manuscript.

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#### **Conflicts of interest**

None declared.

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