

# The Determination of the Piriform Aperture Morphometry and Golden Ratio in Healthy Turkish Subjects. A CT Study

Determinación de la Morfometría de la Apertura Piriforme y la Proporción Áurea en Sujetos Turcos Sanos. Un Estudio con TC

Ayşe Gül Kabakci<sup>1</sup>; Sema Polat<sup>1</sup>; Mahmut Öksüzler<sup>2</sup>; Fatma Yasemin Öksüzler<sup>3</sup> & Ahmet Hilmi Yücel<sup>1</sup>

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**SUMMARY:** This study was undertaken to determine the morphometry of the piriform aperture width and height in Turkish population aged between 18-60 years. It was a retrospective study in which 200 subjects were included 106 males and 94 females, ranging from 18 up to 60 years. Subjects having brain CT in the Radiology Department. Statistical analysis were evaluated with SPSS 21.00 programme. ANOVA Test were used to determine the significance between measurements and age group. The  $p < 0.05$  value was considered as significant. The groups were divided into four groups according to age. The overall means and standard deviations of the measurements were: piriform aperture height,  $45.19 \pm 2.91$  mm; piriform aperture width,  $24.98 \pm 2.85$  mm; the golden ratio,  $1.84 \pm 0.19$  in males, respectively whereas, the same measurements were  $42.84 \pm 2.88$ ;  $23.46 \pm 2.15$  mm;  $1.83 \pm 0.19$  in females, respectively. Also there were an increase in piriform aperture width measurement as the age increased. These anatomical values provides more important knowledge to determine the dimensions of these structures in clinic, surgical processes.

**KEY WORDS:** Piriform aperture width; Piriform aperture height; Piriform aperture morphometry; Turkish population.

## INTRODUCTION

Piriform aperture is a pear shaped structure and limits nasal skeleton anteriorly (Hwang *et al.*, 2005; Papesch & Papesch, 2016). Shapes and widths piriform aperture and the sufficient width and stability of the osseous and cartilaginous nasal skeleton have an important feature both for physiologic nasal respiration and assessing patients for functional nasal surgery (Hommerich & Riegel, 2002; Hwang *et al.*; Aksu *et al.*, 2013; Papesch & Papesch). A narrowed piriform aperture may limit the success of septoplasty and inferior turbinates reduction. Widening of the piriform aperture could be warranted in patient suffer from previous failed septoplasty or turbinate surgery (Papesch & Papesch). Also, there are race differences in piriform aperture width and length. These differences are necessary for areas of the otolaryngology and anthropology (Ofodile, 1994; Hwang *et al.*; Aksu *et al.*). Piriform aperture's anatomy and relation with nasal airway resistance provides an important knowledge to surgery about nasal piriform aperture (Papesch & Papesch). There are many studies about piriform aperture, however we

found few studies regarding piriform aperture morphometry according to age groups, However, we found only one study about Golden ratio (Seto *et al.*, 2001; Hwang *et al.*; Aksu *et al.*; Meyvaci *et al.*, 2019). Also, the purpose of this study was to exhibit the normal values related to piriform aperture dependent on age groups and sex in Turkish population.

## MATERIAL AND METHOD

This study was carried out from the 200 healthy adult subjects (106 Males; 94 females) aged 18-60 years. This study has been approved by the Cukurova University, Clinical Researches Ethics Committee, with Decision No:2019/100-86. All the test procedures were performed after ethics committee approval. This study was a retrospective observational study carried out in Department of Radiology at Medline Hospital in Turkey and subjects

<sup>1</sup> Cukurova University Faculty of Medicine, Department of Anatomy, Adana, Turkey.

<sup>2</sup> Adana Medline Hospital, Department of Radiology, Adana, Turkey.

<sup>3</sup> Adana City Research and Training Hospital University of Health Sciences, Department of Radiology, Adana, Turkey.

who were admitted to the hospital for various reasons between January 2018 and December 2019 were participated. All CT scans were obtained using a 64x2-slice multidetector CT (Siemens Somatom Definition AS, Siemens Healthcare). The axial image was used to obtain the piriform aperture, morfometry (width and height).

Subjects who had a history of tumors or pathology of the nasal septum, piriform aperture or having rhinoplasty or septoplasty were not included in this study.

The data were divided into both two groups according to gender (healthy adult female and male subjects), and age groups (Group I, 18-30 years; Group II, 31-40 years; Group III, 41-50 years; and Group IV, 51-60 years). Estimations were expressed as millimeters. Measurements were performed bilaterally.

The SPSS 21.0 program was used for statistical analysis of the measurement results. From these measurements, means, standard deviations (SD), minimum and maximum values were calculated; In all statistical analyses; p value under 0.05 was considered statistically significant. Furthermore, ANOVA, and Paired Samples T Test were used.

These parameters were as follows:

The piriform aperture height: Maximal height was measured from below the rhinion to the anterior nasal spine (Aksu *et al* ; Meyvaci *et al.*).

The piriform aperture width: the widest distance between the left and right bone margin on transverse plane was measured (Aksu *et al* ; Meyvaci *et al.*).

Golden Ratio: The ratio of piriform aperture height to piriform aperture width was defined as golden ratio (Meyvaci *et al.*).

## RESULTS

The measurements of the piriform aperture width and height in CT are shown in Figure 1. The values of minimum, maximum, mean and standard deviation of the piriform aperture width and height calculated in 200 healthy subjects (106 males and 94 females) were shown in Tables I and II. Significant differences were found in piriform aperture width, and piriform aperture height between females and males. All measurements were higher in females than males (Table I). Moreover, significant differences were found in piriform aperture width, and golden ratio between different age groups (Table II). When analyzed the values, there was an increase until the age of 51 years in piriform aperture height both genders. Also the increase was shown between piriform aperture width and age. The highest value of golden ratio was seen in the ages of 18-30 years while the lowest value were in the ages of the 51 and 60 years. There was a reduction in golden ratio as age increased (Table II).

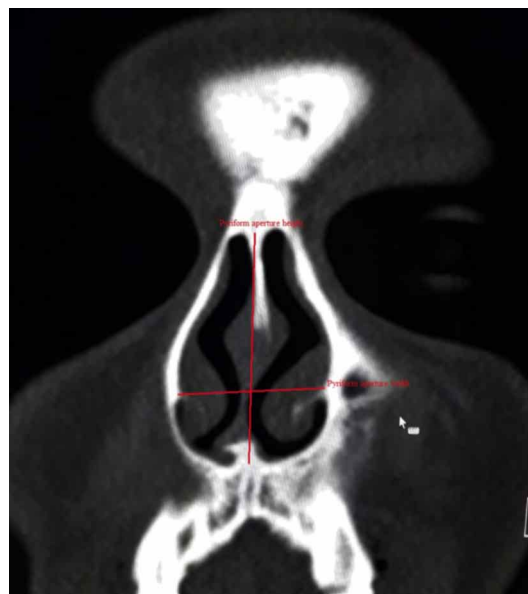


Fig. 1. The measurements of the piriform aperture width and height in CT.

Table I. Piriform aperture width, height and Golden ratio measurements according to sex.

Parameters	Males (106)	Females (94)	p
Piriform aperture height	45.19 ± 2.91	42.84 ± 2.88	<0.001
	38.90 - 53.40	37.60 - 50.60	
Piriform aperture width	24.98 ± 2.85	23.46 ± 2.15	<0.001
	19.00 - 34.80	19.00 - 30.30	
Golden Ratio	1.84 ± 0.19	1.83 ± 0.19	0.631
	(1.39 - 2.30)	(1.42 - 2.36)	

Table II. Piriform aperture width, height and Golden ratio measurements according to decades.

Parameters (mm)	Group 1 N=59	Group 2 N=72	Group 3 N=45	Group 4 N=24	P
Piriform aperture height	43.89 ± 3.00 (37.90 - 51.10)	43.90 ± 2.97 (37.60 - 53.40)	44.72 ± 3.18 (38.30 - 52.20)	43.93 ± 3.71 (38.00 - 50.50)	0.489
Piriform aperture width	23.27 ± 1.89 (19.20 - 27.60)	24.20 ± 2.52 (19.00 - 32.00)	24.80 ± 2.79 (20.50 - 34.80)	25.89 ± 3.39 (19.10 - 33.70)	<0.001
Golden Ratio	1.89 ± 0.17 (1.46 - 2.31)	1.83 ± 0.19 (1.39 - 2.36)	1.82 ± 0.17 (1.42 - 2.18)	1.72 ± 0.21 (1.43 - 2.25)	0.001

## DISCUSSION

Piriform aperture is a structure showing more variation between races (Ofodile; Hwang *et al.*; Aksu *et al.*). The piriform aperture is more significant in some areas such as plastic surgery, pulmonology, bucco-maxillofacial surgery, otolaryngologists (de-Araújo *et al.*, 2018). The moistening and heating of the inspired air are more related with narrow piriform aperture (de-Araújo *et al.*). It was shown that piriform aperture width was wider in Blacks than Whites. Nasal respiration was greater in Blacks than Whites. So, Blacks are more successful in many sports branches because, piriform aperture may be bigger (Hommerich & Riegel; Aksu *et al.*). Also, subjects having bigger piriform aperture may show more physical capacity (Aksu *et al.*). Consequently, if physical capacity decreases with age, the diameters of the piriform aperture should be reduced in direct proportion. Additionally, the width of the piriform aperture increases from infancy to adulthood. Its size continues to develop after the second decade (Cantin *et al.*, 2009; de-Araújo *et al.*). In a study performed in Black skulls having different ethnic groups, the piriform aperture width was found as 26.50 mm in West Africans Ashanti; 21.60 mm in Austrians; 25.20 mm in American Indians; and 23.40 mm in Black Americans (Ofodile). In West Anatolian skulls, the same parameter was 23.24 mm (Aksu *et al.*). Hommerich & Riegel stated the piriform aperture width as 22.6 mm and 23.6 mm in females and males (total 23.1 mm). The lowest value of piriform aperture was in the age of 10-19 years, while the highest value was found at the age of 40-49 years (Hommerich & Riegel). In Korean female and male skulls, the corresponding value was measured as 25.4 mm and 25.7 mm, respectively (Hwang *et al.*). In a study of Moreddu *et al.* (2013) the PA width was measured as 24.00 mm in French females and 25.32 mm in males. In our study, the lowest value of the piriform aperture width was found in the Group 1 (second & third decades), while the highest value was seen in Group 4 (sixth decades). In Brazilian females and males, the same measurements were found as 25.7±2.5 mm - 25.27 mm and 25.70±1.9 mm - 26.87 mm (Cantin Lopez *et al.*, 2009; de-Araújo *et al.*). In Turkish females and males, The

corresponding value was 23.3 mm and 24.6 mm, respectively (Yüzbasıoğlu *et al.*, 2014).

In Brazilian females and males, the piriform aperture heights was measured between 29.4 mm-47.53 mm and 31.4 mm- 50.83 mm (Cantin Lopez *et al.*, 2009; de-Araújo *et al.*). In Korean males and females, this measurement was found as 30.1 mm and 28.0 mm, respectively (Hwang *et al.*). In Turkish females and males, the corresponding value was 29.28 mm and 32.72 mm, respectively (Meyvacı *et al.*). Ofodile declared the mean of the piriform aperture height was 25.80 mm in West African Ashanti population, 31.40 mm in Australian, 28.60 mm in American Indians, and 28.20 mm in Black Americans, respectively (Ofodile). In a study performed with dried skull of the West Anatolian, the same measurement was found as 33.03 mm (Aksu *et al.*). In French population, this was 36.35 mm and 32.54 mm in males and females, respectively (Moreddu *et al.*). In present study the piriform aperture height was measured as 45.19 mm and 42.84 mm in males and females, respectively. Our measurements of two genders were higher than studies stated above except Cantin Lopez *et al.*'s study.

The ratio of piriform aperture height to piriform aperture width was defined as golden ratio. Also, this ratio was accepted approximately equal to 1.618. The ratio was found as 1.41±0.17 mm and 1.34±0.17 mm in males and females (Meyvacı *et al.*). This ratio was calculated 1.84 and 1.83 in males and females in present study. This differences may be arisen from aperture piriform height, and age differences. Because the piriform aperture width was close to the other population. Additionally, golden ratio was determined to be effected from age because as age increased, the golden ratio value decreased as significant (P=0.001).

The study showed that the piriform aperture height and width were higher in males than in females, with significant differences. Also, as piriform aperture width increased, age increased. The highest value was obtained in 51-60 years. The piriform aperture height increased until

age of the 50 years, then this value decreased in 51-60 years. The lowest value obtained in second and third decades. Golden ratio was decreased the age increased with significant differences. The piriform aperture morphological data may provide an important reference value for surgical and medical practices in plastic reconstructions and otolaryngology.

**KABAKCI, A. G.; POLAT, S.; ÖKSÜZLER, M.; ÖKSÜZLER, F. Y. & YÜCEL, A. H.** La determinación de la morfometría de apertura piriforme y la proporción áurea en sujetos turcos sanos: Un estudio de TC. *Int. J. Morphol.*, 38(2):444-447, 2020.

**RESUMEN:** El estudio se realizó para determinar la morfometría del ancho y la altura de la abertura piriforme en la población turca de entre 18 y 60 años. Se llevó a cabo un análisis retrospectivo en el que se incluyeron 200 sujetos 106 hombres y 94 mujeres, entre los 18 y 60 años. Sujetos con TC cerebral en el Departamento de Radiología. El análisis estadístico se evaluó con el programa SPSS 21.00. La prueba ANOVA se utilizó para determinar la importancia entre las mediciones y el grupo de edad. El valor  $p < 0,05$  se consideró significativo. La muestra se dividió en cuatro grupos según la edad. Las medias generales y las desviaciones estándar de las mediciones fueron: altura de apertura piriforme,  $45,19 \pm 2,91$  mm; ancho de apertura piriforme,  $24,98 \pm 2,85$  mm; la proporción áurea,  $1,84 \pm 0,19$  en varones, mientras que las mismas medidas fueron  $42,84 \pm 2,88$ ;  $23,46 \pm 2,15$  mm;  $1,83 \pm 0,19$  en mujeres. También hubo un aumento en la medición del ancho de apertura piriforme a medida que la edad aumentó. Estos valores anatómicos proporcionan un conocimiento más importante para determinar las dimensiones de estas estructuras en procesos clínicos y quirúrgicos.

**PALABRAS CLAVE:** Ancho de apertura piriforme; Altura de apertura piriforme; Morfometría de apertura piriforme; Población turca.

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Corresponding author:

Dr. Sema Polat  
Cukurova University Faculty of Medicine  
Department of Anatomy  
Adana  
TURKEY

Email: sozandac@cu.edu.tr

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