



## RESEARCH ARTICLE

### CONE-BEAM COMPUTED TOMOGRAPHY STUDY OF MORPHOMETRIC EVALUATION OF PTERYGOIDHAMULUS

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#### ABSTRACT

**aim:** The aim of the study was morphometric evaluation of pterygoidhamulus using CBCT.

**Material and Methods:** CBCT images of 40males and 40females with age >20years were evaluated. The length, width, inclination and incidence of shape of PH was evaluated with respect to side and gender. Independent t-test was used for statistical analysis.

**Results:** The mean length of PH of both sides in males and females was found to be  $11.5 \pm 0.75$  and  $10.09 \pm 0.45$  mm, inclinations in sagittal plane was  $12.74^\circ \pm 30.45$  and  $15.22^\circ \pm 30.65$  in anterior direction, inclinations in coronal plane was  $11.5^\circ \pm 31.05$ ,  $19.7^\circ \pm 39.15$  in medial direction whereas, it was  $79.13^\circ \pm 30.4$  and  $71.5^\circ \pm 38.7$  in lateral direction. Incidence of shapes of PH was 2.6, 2.4 for triangle 1.7 and 2.2 for slender respectively with statistically significant difference. Mean width values in males & females was found to be (left)  $3.04 \pm 0.6$ ,  $3.06 \pm 0.5$  and (right)  $2.01 \pm 0.4$  and  $2.02 \pm 0.3$  mm, inclination in sagittal plane (left) was  $47.2^\circ \pm 20.1$  and (right)  $47.28^\circ \pm 22.1$ ,  $47^\circ \pm 20.1$  and  $47.1^\circ \pm 22.1$  in posterior direction respectively with statistically insignificant difference. No statistically significant difference was found between left and right side except the inclination in coronal plane was more in left as compared to right side. Inclination in coronal and sagittal plane was more on lateral and posterior side respectively.

**Conclusion:** Appraisal of the morphology of PH is helpful as it provides insight for differential diagnosis of the imperceptible pains in oral cavity and pharynx.

#### INTRODUCTION

Tracing an unusual pain in the soft palate and pharyngeal region has been a diagnostic dilemma since years. Symptoms in this area forms a complex, which can include hearing disorders, TMD's., uncontrolled movements of facial muscles, stylo-hyoid ligament calcification or stylo-mandibular ligament inflammation (Eyrich *et al.*, 1997; Shankland, 1996; Ramirez *et al.*, 2006). Also any of the following factors may be responsible such as bursitis or an osteophyte in the tensor velipalatini, elongation of the Pterygoidhamulus (PH), consistent repetition of minimal trauma to the overlying soft tissue and of PH, hyper awareness of the PH, muscular discoordination, or fracture of the PH after extensive and repeated manipulation (Eyrich *et al.*, 1997). PH is a structure beneath the skull base, which has been scarcely described till now. It is biomechanically unique in its position (Putz Kroyer, 1999). The position, length, and inclination of PH are of great importance for the function of several muscles: tensor velipalatini, palatopharyngeus, and upper part of the upper pharyngeal constrictor. These muscles contribute to the separation of the oral from the nasal cavity during sucking and

swallowing during growth and development and into adulthood (Hjorting-Hansen and Lous, 1987). Anatomically, the PH and the edge of the medial pterygoid plate give rise to the origin of the superior constrictor muscle of the pharynx. The palate pharyngeus muscle originates in layers from the PH as well as from the border of the hard palate and from the fibers of the levator velipalatini (LVP) muscle. It is generally considered that the lowest and most anterior fibers of the LVP arise from the base of the pterygoid process and reach up to and a little beyond the base of the PH (Orhan *et al.*, 2011; Krmpoti *et al.*, 2006). According to Krmpoti c-Nemani *et al.*, 2006 if the PH remains short, as it is in newborns, then cephalopharyngeus does not have firm support and its contraction will lead to uncontrolled narrowing of the upper pharynx, causing problems such as snoring or sleep apnea (Krmpoti *et al.*, 2006; Jo, 2006). Variations in the distance between the left and right PH influence the volume of the epipharynx (Krmpoti *et al.*, 2006; Jo, 2006). Ulas *et al.* (2016) has shown in his study that the PH length is inversely associated with sleep apnea severity. He concluded, that the size of PH seems to play an important function in affecting the level of muscle activity and thereby the airway collapse. (10) Hjorting-Hansen and Lous (Hjorting-Hansen and Lous, 1987) were the first to coin the term pterygoidhamulussyndrome which described pain in the palate and pharyngeal area as a result of an abnormal growth of a pterygoidhamulus.

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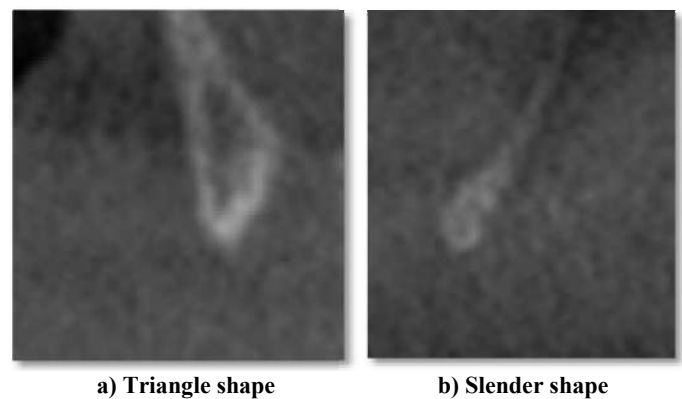
**Table 1. Mean measurements with standard deviations (SD) of Pterygoidhamulus( PH ) of different parameters of left side**

	Left pH Measurements (Mean ±SD)								
	L	W	CPI		SPI	SH		T	SL
			CPI-L	CPI-M	SPI-A	SPI-P			
M	7.72 ±0.5	2.04±0.4	53.01°±20.3°	7.72°±20.7°	8.46°±20.3°	47.22°±20.1°	1.8	1.2	
F	6.78±0.3	2.05±0.4	47.95°±26.18	13.91°±26.1°	10.17°±21.1°	47.28°±22.1°	1.5	1.5	
p VALUE	< 0.01**	>0.05	< 0.05*	< 0.05*	< 0.05*	>0.05	< 0.01**	< 0.01**	

**Table 2. Mean measurements with standard deviations (SD) of Pterygoidhamulus (PH) of different parameters of right side**

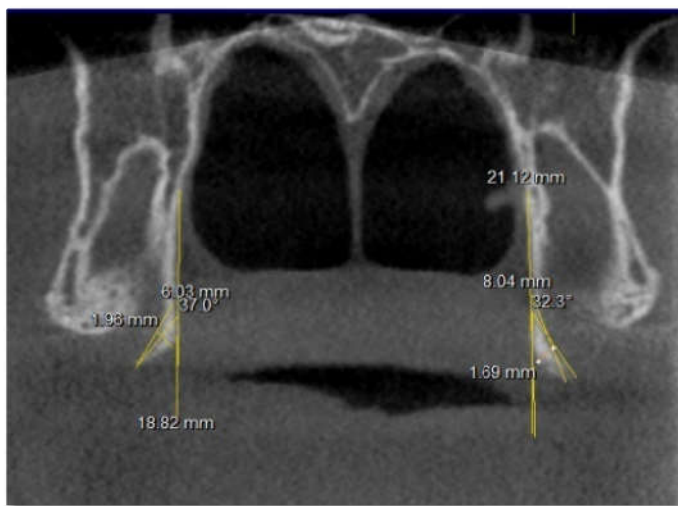
	Rightph Measurements (Mean ±SD)								
	L	W	CPI		SPI	SH		T	SL
			CPI-L	CPI-M	SPI-A	SPI-P			
M	7.56±0.5	2.01±0.4	52.24°±20.3°	7.6°±20.7°	8.56°±20.3°	47°±20.1°	1.7	1.1	
F	6.62±0.3	2.02±0.3	47.23°±25.18	13.03°±26.1°	10.01°±20.1°	47.12°±22.1°	1.4	1.5	
p VALUE	< 0.01**	>0.05	< 0.05*	< 0.05*	< 0.05*	>0.05	< 0.01**	< 0.01**	

No significant difference was found between right and left side except the coronal plane inclination (posterior) was greater of left side as compared to right side. Also, in coronal and sagittal plane inclination, lateral and posterior inclination was seen more and among shapes more incidence of triangular shape PH were found.



**a) Triangle shape                      b) Slender shape**

**Figure 3. Shape of PH**

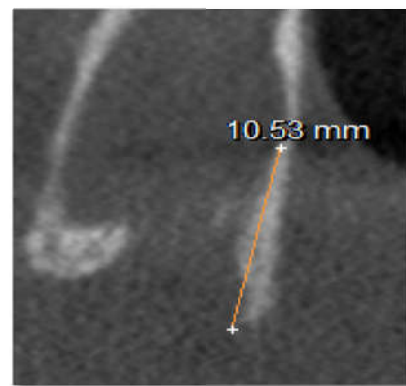


**a) Coronal plane (Lateral direction)**



**b) Sagittal plane (Anterior direction)**

**Figure 2. Inclination of PH**



**Figure 4. An elongated PH case of length 10.53mm of a young female.**

**DISCUSSION**

If PH plays the etiological role, deviant or uncharacteristic pain is caused. Common symptoms include sharp or burning pain in the palatal and pharyngeal region that may remain localized or refer to the ipsilateral ear or temporomandibular joint. This may occur spontaneously or elicited by touch or eating and drinking (Naidoo *et al.*, 2014). Firm swelling, erythema and sometimes ulceration of the palatal mucosa over the hamulus are also common signs (Sasaki *et al.*, 2001; Shankland, 1996). Occasional soreness upon swallowing and while manipulating the area with the tongue or finger are seen. After several months of elapsation, they may be history of occasional exacerbations and remissions of swelling and discomfort (Charbeneau and

Blanton, 1981). The following symptoms present are not always associated with elevation in the soft palate. Although an excessively long hamulus could have been present in such cases, it is conceivable that one of the three other relationships could have existed, the medial pterygoid plate (and the PH) may have been situated in more inferior position than normal or the soft palate mucosa may have been situated more closer than normal or soft palate would have been thinner than usual in thickness (Charbeneau and Blanton, 1981). Several studies describe the morphology of PH in different populations. Eyrich et al. 1997 found the mean length of the left hamulus to be 5 mm and the right to be 4.9 mm. But, the present study showed mean length in left and right side in males and females as 7.726, 6.78, 7.56 and 6.62 mm respectively. Putz and Kroyer (1999) reported the average length to be 7.2 mm and the sagittal and transverse diameter to be 1.4 mm and 2.3 mm, respectively. Whereas in present study the mean width values found were 2.04, 2.05, 2.01 and 2.02 mm respectively. Sasaki et al. 2001 reported an elongated PH case of 13 mm. Also they found the mean length of PH to be 6.8 mm. In the present study, an elongated PH of 10.53 mm in a young female patient (Figure 4) and shortest PH found of 6.63 mm was reported. The inclination of PH in Putz and Kroyer's (1999) study was found to be 75° in the sagittal plane and 58° in the coronal plane. Whereas, in the present study, it was found to be 47° and 53° in sagittal and coronal plane respectively. Also as per their findings of Putz and Kroyer's study, all the hamuli found were inclined dorsolaterally. Similar to this study, the present study findings showed more number of scans with dorsolateral inclination but few scans with ventromedial inclination were also noted. The incidence of shape of PH of triangle shape in present study was found to be 30.43%, which was not in accordance with the percentage found to be 12% in NIOSang et al (2005). Incidence of 28.12 % of slender shape PH was found in present study which was in accordance to Nio sang et al study, which found it to be 29.33%.

Orhan et al. in 2011 showed the mean length of PHs for left and right sides were 5.48 (SD 1.94) and 5.40 (SD 2.0) mm, respectively with no significant difference according to gender and location. They reported an elongated PH (10.9 mm) in a young female. Whereas in present study, comparing gender wise, males had greater degree of inclination in both the planes than females. But with respect to location, all the parameters were almost of same value for both the sides (left and right) except the coronal inclination, which was found to be more in left side as compared to right side. The strength of the present study is use of CBCT which provides high-resolution images of high diagnostic quality with significantly reduced acquisition time and radiation burden. Reformatted from CBCT imaging data have been shown to have measurement accuracy equivalent to MDCT imaging data (2014). However, limitation of this study is that this is a retrospective study which was conducted in limited geographic areas.

## Conclusion

The length, width, inclination in coronal and sagittal plane of PH is greater in males as compared to females. The inclination in coronal plane is more of lateral than medial and that of sagittal plane is more of posterior than anterior. There was no difference in the metric measurements of left side when compared with right side, except the inclination in coronal

plane. (Left side > Right side) The triangular shape of PH shows higher incidence than slender shape in both the genders. CBCT is an excellent imaging modality for the identification of PH. The morphometric evaluation of PH helps us to trace and manage obscure and conflicting symptoms related to its morphology. So henceforth; consideration of the PH as a pain-inducing factor should be included in the diagnosis list.

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