

Evaluation of Styloid Process on Digital Panoramic Radiography in Chhattisgarh Population: A Retrospective Study

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ABSTRACT

Background: The elongated styloid process may produce characteristic head and neck pain syndromes, referred to as Eagle's syndrome. The objective of the study was to assess the elongation of styloid process on digital panoramic radiographs and to evaluate the prevalence of elongation according to age, sex and types.

Materials and methods: The study was conducted on 198 digital panoramic radiographs. The radiographs were taken using a digital panoramic system. Radiographic length of the styloid process was measured on both sides using the measurement toolbars on the accompanying analysis software and then statistically analysed.

Results: Elongated styloid process was seen in 87 out of 198 patients who were aged between 10-70 years. The study revealed the fact that, styloid process elongation increased with age and had male predominance. Type I elongation was most common, with maximum number of patients in the range of 31-40 mm length. Left styloids were more elongated than right. On the right side, Type I and Type III elongation were more common in males and in 31-50 years; Type II in females and in 50-70 years age group. On the left side all the three types of elongation were most commonly found in males and in 31-50 years age groups. Bilateral elongation was more common than unilateral elongation.

Conclusion: Panoramic radiograph provides a correct picture of elongated styloid process, and hence panoramic radiography is economical and the best imaging modality to view the elongation of styloid process.

Keywords: Styloid process, Elongation, Digital Panoramic radiographs.

INTRODUCTION

It is a well known fact that variation is the law of nature. None of the individuals are exactly alike. Not even identical twins are alike. Every individual is different from the other. Here we are talking in context of the Styloid Process. The word "Styloid process" was originally derived from the Greek word 'stylos' which means a pillar. Normally

the length of styloid process is 2 to 3 cm. If its length exceeds 3 cm it is called as elongated styloid process, which causes pain in throat, dysphagia, foreign body sensation and carotid artery compression syndrome. The term "Styalgia" was coined by Watt W Eagle, which describes the pain associated with elongation of styloid process.¹⁻⁶ Italian surgeon Pietro Marchetti, was the first who

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described this elongation of styloid process in 1652.

⁷ The normal anatomy of styloid process is usually a slender, long, cylindrical bony protrusion of the temporal bone, which is located amidst the internal, external carotid arteries and the internal juglar vein and is anteriomedial to stylomastoid foramen.⁸ Several studies have estimated that about 2-28% of the general population have radiographically elongated styloid processes, without any clinical findings as such.⁹

Three radiographic appearances of the styloid process were proposed by Langlais.¹⁰ The present study is to measure and assess the length of styloid process with the help of Digital panoramic radiographs, to determine the variation in age, sex, type and sides of elongated styloid process, to compare the right and left sides of styloid process, to compare type of styloid process with the length visited to the maxillofacial radiology department.

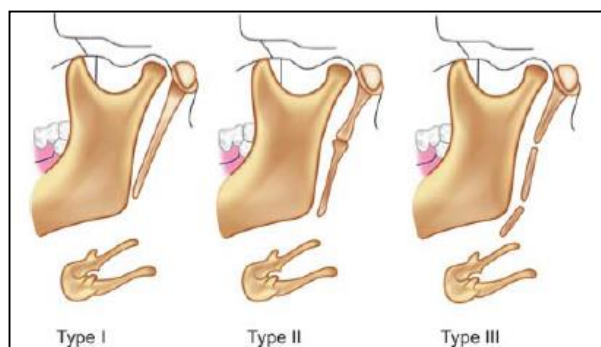


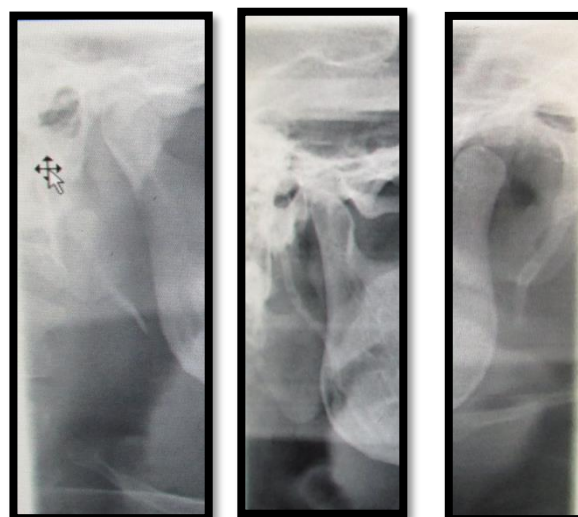
Fig 1: Classification of elongated styloid process.

Table 1: Length of elongation of Styloid (mm) according to age.

Length elongation Styloid (mm)	Age in years			Total	P value
	10-30 (n= 94)	31-50 (n= 75)	50-70 (n=29)		
Right	25.18±5.65	30.40±7.77	36.05±10.96	28.75±8.36	<0.001**
Left	25.46±6.76	30.93±8.74	35.85±7.25	29.05±8.49	<0.001**

Table 2: Length of elongation of styloid process according to gender.

Length elongation Styloid(mm)	Gender		Total	P value
	Male	Female		
Right	29.51±8.06	27.93±8.63	28.75±8.36	0.183



Type -I

Type -II

Type - III

Fig 2: Radiographs of different types of elongation of styloid process.

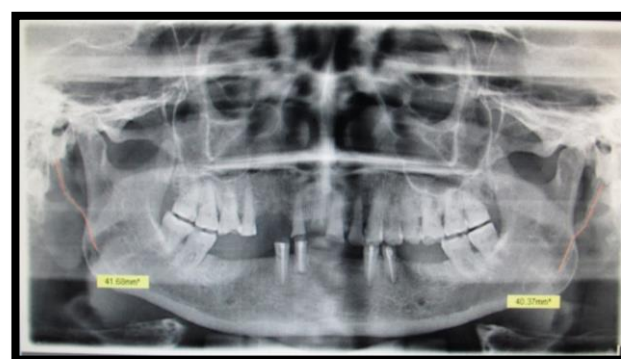


Fig 3: Measurement of styloid process by SIDEXIS XG 2.3 software.

Left	30.67±8.79	27.30±7.82	29.05±8.49	0.005**
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Table 3: Average length of elongated styloid process according to gender.

Length of elongation Styloid(mm)	Gender		Total (n=198)	P value
	Male (n=103)	Female (n=95)		
Right >30 mm	37.28±5.79	35.92±8.72	36.68±7.22	0.413
Left >30 mm	37.48±6.59	35.67±5.08	36.76±6.08	0.177

Table 4: Type of Elongation.

Type of Elongation	No of patients (n=198)	%
Right		
• Normal	120	60.6
• Type I	54	27.3
• Type II	19	9.6
• Type III	5	2.5
Left		
• Normal	111	56.1
• Type I	44	22.2
• Type II	24	12.1
• Type III	19	9.6

Table 5: Length of elongation of styloid (mm) according to Type of Elongation (right).

Length of elongation of styloid	Type of Elongation (right)				Total	P value
	Normal	Type I	Type II	Type III		
Right	23.95±4.12	36.23±5.66	37.14±11.58	31.44±10.74	28.75±8.36	<0.001**

Table 6: Length of elongation of styloid (mm) according to Type of elongation in left.

Length of elongation styloid	Type of Elongation (left)				Total	P value
	Normal	Type I	Type II	Type III		
Left	23.63±4.67	36.07±5.46	36.14±8.88	35.56±8.31	29.05±8.49	<0.001**

Table 7: number of patients according to type of elongation.

Type of elongation (RIGHT)	31- 40 mm	41- 50mm	>50mm
Type I	43	10	1
Type II	14	3	2
Type III	4	1	0
Type of elongation (LEFT)	31-40 mm	41- 50mm	>50mm
Type I	36	6	2
Type II	19	2	3
Type III	11	7	1

Table 8: Correlation of Type **Elongation with age in years**

Type of elongation	Age in years			Total (n=198)	P value
	10-30	31-50	50-70		
	(n=94)	(n=75)	(n=29)		
RIGHT					
Normal	83(88.3%)	34(45.3%)	3(10.3%)	120(60.6%)	<0.001**
Type I	10(10.6%)	32(42.7%)	12(41.4%)	54(27.3%)	
Type II	0(0%)	5(6.7%)	14(48.3%)	19(9.6%)	
Type III	1(1.1%)	4(5.3%)	0(0%)	5(2.5%)	
LEFT					
Normal	76(80.9%)	32(42.7%)	3(10.3%)	111(56.1%)	<0.001**
Type I	10(10.6%)	23(30.7%)	11(37.9%)	44(22.2%)	
Type II	4(4.3%)	12(16%)	8(27.6%)	24(12.1%)	
Type III	4(4.3%)	8(10.7%)	7(24.1%)	19(9.6%)	

Table 9: Correlation of Type Elongation with gender.

Type of elongation	Gender		Total (n=198)	P value
	Male (n=103)	Female (n=95)		
RIGHT				

Normal	59(57.3%)	61(64.2%)	120(60.6%)	0.380
Type I	33(32%)	21(22.1%)	54(27.3%)	
Type II	8(7.8%)	11(11.6%)	19(9.6%)	
Type III	3(2.9%)	2(2.1%)	5(2.5%)	
LEFT				
Normal	49(47.6%)	62(65.3%)	111(56.1%)	0.085+
Type I	27(26.2%)	17(17.9%)	44(22.2%)	
Type II	16(15.5%)	8(8.4%)	24(12.1%)	
Type III	11(10.7%)	8(8.4%)	19(9.6%)	

Table 10: Distribution of unilateral and bilateral elongation of styloid process.

Gender	Unilateral (number)	Unilateral (percentage)
Male	15	17.2%
Female	10	11.4%
Total	25	28.6%
Gender	Bilateral (number)	Bilateral (percentage)
Male	39	44.8%
Female	23	26.6%
Total	62	71.4%

MATERIALS AND METHODS

This study was conducted in the Department of Oral Medicine and Radiology, Chhattisgarh Dental College and Research Institute, Rajnandgaon (C.G). A total of 198 digital panoramic radiographs, which were available as soft copies in the hard drive of the computer in the department, were selected for the study. The patients were selected between age 10-70 years that were further subdivided into 10-30 years (Group-I), 31-50 years (Group-II) and 51-70 years (Group-III). Only those radiographs which showed both the sides of styloid processes were included in the study. Styloid process which measured more than 30 mm were considered as elongated and those which measured up to 30 mm were considered as normal.

Elongated styloid process was categorized according to classification by Langalis et al¹⁰ as Type I-Elongated, Type II-Pseudoarticulated and Type III-Segmented (Fig.1 and 2). Radiographs having positioning and magnification errors were

excluded from the study. In this study, 198 radiographs were taken with a digital panoramic system (SIRONA) under standard exposure factors, as recommended by the manufacturer. The apparent lengths of the styloid process were measured with the help of measurement tools on the accompanying software (SIDEXIS XG 2.3). On the frontal side of the styloid process the length were measured from the point where the styloid process originates from the tympanic plate to the tip of the process, irrespective of whether or not the styloid process was segmented (Fig.3). The collected data was categorized according to age, sex, normal length and elongated length of the styloid process on both right and left side. After that the data was statistically analyzed.

STATISTICAL METHODS

Analysis of variance (ANOVA) has been used to find the significance of study parameters between three or more groups of patients, Student t test (two tailed, independent) has been used to

find the significance of study parameters on continuous scale between two groups Inter group analysis) on metric parameter . To find the significance of study parameters on categorical scale between two or more groups, a test called Chi-square/ Fisher Exact test has been used.

RESULTS

In the present study, elongated styloid process was found in 87 patients out of 198 patients [Table 1]. It was observed that as the age increased, elongation of styloid process increased. Average length of styloid process is more in males as compared to females [Table 2]. The results showed that males have more elongated styloid process than females [Table 3]. It was observed that Type I elongation was more common than other types of elongation in both right and left side [Table 4]. The average length of the elongated styloid process on right side was found to be 34.93 ± 9.32 [Table 5]. The average length of the elongated styloid process on left side was 35.92 ± 7.55 [Table 6]. So the average length of elongated styloid process on the left side was significantly more, compared to right side. It was observed that maximum numbers of patients with all the three types of elongation are found in the range of 31-40mm length [Table 7]. It was observed that in the right side Type I and Type III elongation was more common in 31- 50 years age patients and type II was more common in 50-70 years age patients. In the left side all the three types of elongation were most commonly found in 31-50 years age group patients [Table 8]. In the right side Type I and Type III elongation was more common in males and type II elongation was more common in females. In the left side all the three types of elongation was more common in males [Table 9]. The results shows bilateral elongation was most commonly found (71.4%) than unilateral elongation (28.6%). It was also found that unilateral and bilateral elongation was frequently seen in males compared to females [Table 10].

DISCUSSION

The styloid process and ligament are derived from the first and second branchial arches, in addition to Reichert's cartilage. During foetal development, Reichert's cartilage links the styloid bone to hyoid bone. If these structures solidify, they can cause the pain and suffering present in Eagles

syndrome.^{11,12,13 and 14} Although, the panoramic is the more common projection to detect ESP, Other projections can also be used such as posteroanterior of mandible, oblique lateral of mandible, axial and cephalometric radiographs.¹⁵

It has been previously reported that, the normal radiographic length of styloid process is 20 to 30 mm.⁶ Whereas Scaf et al demonstrated that the mineralization of the styloid process is considered present if its length equals or exceeds 30 mm from the temporal bone on the panoramic radiographs.¹⁵ In the present study, it was observed that there was an increase in the length of the styloid process as age increased which was consistent with previous studies.^{6, 15, 16, 17 and 18.} However these findings differed from others who suggested that age may not have a role in elongation.¹⁹ Gokce et al ²⁰ suggested that age may not have a role in the elongation of styloid process. In the present study it was found that males had elongated styloid process than females. In the study conducted by Roopashri et al ⁶ Ferrario et al ²¹ and Phulambrikar et al ¹⁷ it was found that females had elongated styloid process than males but their data was not statically significant. But study conducted by Scaf et al ¹⁵ found equal distribution of elongated styloid process in males and females. In the present study the mean average length of styloid process was found more in males than females and the data was statistically significant. Balcioglu et al ²² found the mean average length of styloid process in males to be greater than females. Type I elongation was more common than other types of elongation in both right and left side and the data was statically significant. However these findings were similar to the study conducted by Roopashri et al ⁶ and Shah et al. ²³ In the present study the length of elongated styloid process on the left side was significantly more when compared to the right side which was in contrast with the study conducted by More and Asrani ⁹ whose studies reveled that elongated styloid process was more on right side. Study conducted by Roopashri et al ⁶ also revealed that left side elongation was more than right side elongation of styloid process. In the present study it was found that maximum number of patients with all the three types of elongation are found in the range of 31- 40 mm length. In the right side Type I elongation was more common in 31- 50 years age patients, Type II was more common in 50- 70 years

patients and Type III was also more commonly found in 31- 50 years age group patients, and in the left side all the three types of elongation was most commonly found in 31- 50 years age group patients. This was the findings of the present study.

In the present study it was also found that right side Type I elongation was more common in males, Type II elongation was more common in females and Type III elongation was again more common in males and in the left side all the three types of elongation was more common in males. This study shows bilateral elongation was most commonly found (71.4%) than unilateral elongation (28.6%). This is consistent with the study conducted by Roopashri et al ⁶ where they found Unilateral elongation in females was (07) 11.5% and (16) 34.8% in males and bilateral elongation was (54) 88.5% in females and (30) 65.2% in males. Overall (23) 21.5% had unilateral and (84) 78.5% had bilateral elongation and concluded that bilateral elongation was more common than the unilateral elongation.

CONCLUSION

The clinical significance of the natural variation of styloid process is unclear. Styloid process elongation with an asymptomatic radiographic finding may often be a coincidence. An appropriate clinical and radiographic evaluation can detect an elongated styloid process. Correct diagnosis can be of immense help to propose the line of management and the ultimate clinical outcome. In cases with undiagnosed neck and/or intermittent facial pain as well as pain originating from impacted third molars, oropharyngeal region we could suspect an elongated styloid process to be the causative agent. Therefore the patient should be advised for further clinical and radiological investigation. Panoramic radiography is useful for detecting an elongated styloid process and/or ossification of stylohyoid ligaments in symptomatic or asymptomatic patients. This helps to rule out misinterpretation of the symptoms. Hence forth panoramic radiography is an economical and best imaging modality to view the elongation of styloid process. However, to further assess the prevalence of elongated styloid process with the type and pattern of elongation newer studies with larger sample size would be helpful.

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