



Evaluation of Elongated Styloid Process on Digital Panoramic Radiographs

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ABSTRACT

Background and objective: The elongated styloid process may produce characteristic head and neck pain syndromes, commonly known as Eagle's syndrome. An awareness of this syndrome is important to all health practitioners involved in the diagnosis and treatment of neck and head pain. It has been estimated that 2 to 28% of the general adult population has radiographic appearance of elongated styloid process.

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.

Results: Elongated styloid process was seen in 107 subjects out of 300 patients who were aged between 10 and 70 years old. Our study revealed that as age increased elongation of styloid process increased with female predominance. Type 1 elongation was most common than the other types of elongation. We also found that left styloids were elongated than the right with bilateral elongation.

Conclusion: Panoramic radiographs can show a correct picture of elongated styloid process which can confirm the diagnosis and can thus help avoid misinterpretation of the symptoms as tonsillar pain or pain of dental, pharyngeal or muscular origin and hence panoramic radiography is economical and the best imaging modality to view the elongation of styloid process.

Keywords: Styloid process, Elongation, Panoramic radiographs.

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INTRODUCTION

Variation is the law of nature. Every human is unique anatomically to such an extent that even identical twins are not alike. Styloid process is derived from the Greek word 'Stylos' meaning a pillar. The styloid process is normally a cylindrical bone which arises from the temporal bone in front of the stylomastoid foramen. The length of the styloid

process is usually 2 to 3 cm. When it is more than 3 cm it is called as elongated styloid process, and it can cause pain in throat, difficulty in swallowing, foreign body sensation, carotid artery compression syndrome, etc. This elongation was first described in 1652 by Italian surgeon Pietro Marchetti. In 1937, Watt W Eagle coined the term stylalgia to describe the pain associated with elongation of styloid process. In 4% the general population styloid process is grossly enlarged. Although 4% of the population is thought to have an elongated styloid, only 4 to 10% of this group is symptomatic.¹⁻⁵ Langlais proposed three radiographic appearances of the styloid process.⁶ The purpose of this study was to evaluate the elongation of styloid process by using digital panoramic radiographs.

AIMS AND OBJECTIVES

- To measure and assess the length of elongated styloid process on panoramic radiographs.
- To determine the variation in age, sex, type and sides of elongated styloid process.
- To determine the usefulness of panoramic radiographs in undiagnosed neck and/or intermittent facial pain.

MATERIALS AND METHODS

This study was conducted in the Department of Oral Medicine and Radiology, MR Ambedkar Dental College and Hospital, Bengaluru, India. The purpose of this study was to evaluate the elongation of the styloid process and/or ligament ossification by using panoramic radiographs, according to age, sex and the types. A total of 300 digital panoramic radiographs, which were available as soft copies in the hard drive of the computer in radiology department, were selected for the study. Radiographs having positioning and magnification errors were excluded during this selection process. These radiographs were taken with a digital panoramic system (Kodak 8000C, Bengaluru, India) under

standard exposure factors, as recommended by the manufacturer.

The selected radiographs were of patients above 10 years of age with the maximum age limit of 70 years. Out of 300 panoramic radiographs, 107 radiographs showed elongated styloid process. To obtain percentiles for different age groups, the radiographs were categorized into three groups of approximately equal sample size, the age group of 10 to 30 years, 31 to 50 years and 51 to 70 years. Styloid processes measuring more than 30 mm were considered as elongated (Fig. 1). Further the elongated styloid processes were categorized according to classification by Langlais as Type I, elongated, which appears as an uninterrupted integrity of the styloid process (Fig. 2A). Type II, pseudoarticulated, which is apparently joined to the mineralized styloid mandibular or styloid ligament by a single pseudoarticulation (Fig. 2B). Type III, segmented, consists of either short or long noncontinuous portions of the styloid process or interrupted segments of mineralized ligament (Fig. 2C).⁶ Both unilateral and bilateral measurements were made and the prevalence of the same was recorded.

The apparent lengths of the styloid process were measured with the help of the measurement tools on the accompanying software (Kodak, version 6.7, India).

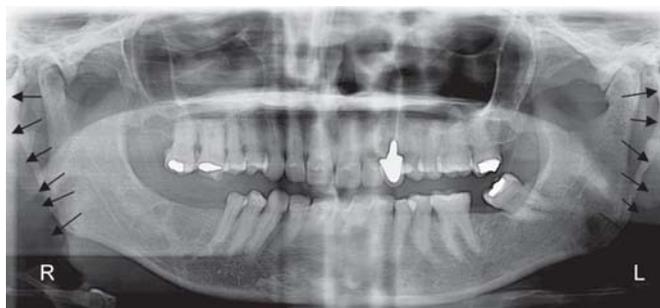
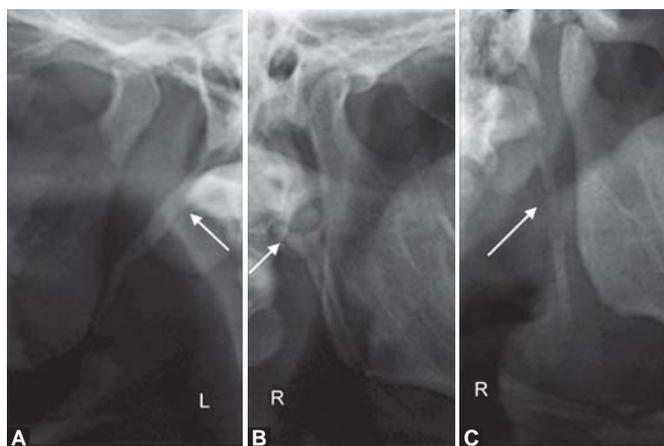


Fig. 1: Elongated styloid process



Figs 2A to C: The orthopantomogram shows a langlais styloid process (A) Type I (B) Type II (C) Type III

The magnification factor used for the machine was 1.29. The lengths of the styloid process were measured on the frontal side of the styloid process, from the point of emergence of the process to their tips, regardless of whether or not the styloid process was segmented.

STATISTICAL METHODS

The data was analyzed using SPSS version 15.0 (statistical package for social sciences), the quantitative values were expressed as mean and standard deviation and qualitative values in percentages. Chi-square and contingency coefficient was used to detect difference in distribution of percentages and the Student t-test and ANOVA were used to test the difference between mean elongation for the gender, age and the side affected. The statistical significance level was fixed at 0.05 and at 95% confidence interval.

RESULTS

Panoramic radiographs of 300 patients who were aged between 10 and 70 years old were studied. In the present study, elongated styloid processes were found in 107 subjects.

- Age (Table 1)
 - Age group (10-30 years)
 - Left side: 33.34 ± 3.75
 - Right side: 31.31 ± 3.38
 - Age group (31-50 years)
 - Left side: 37.90 ± 8.04
 - Right side: 34.53 ± 7.97
 - Age group (51-70 years)
 - Left side: 42.72 ± 10.83
 - Right side: 38.94 ± 9.81 ($p < 0.05$)

It was observed that as age increased, elongation increased.

- Sex (Table 2): It was observed that (46) 43% of the patients were males and (61) 57% were females.
 - Males
 - Left side: 37.13 ± 9.17
 - Right side: 34.47 ± 8.47
 - Females
 - Left side: 38.57 ± 8.71 and
 - Right side: 35.24 ± 7.86

Females showed more elongated styloid process than males.

- Types (Table 3)
 - Left side
 - Type I elongation (36) 33.6%
 - Type II elongation (36) 33.6% and
 - Type III elongation (36) 33.6%

- Right side
 - Type I elongation (38) 32.7%
 - Type II elongation (33) 30.8% and
 - Type III elongation (36) 33.6%

These difference was not statistically significant ($p > 0.05$). Type I elongation was more common than the other types

- Sides (Table 4): The average length of the elongated styloid process on the left side was significantly more 37.95 ± 8.90 (mean \pm SD), compared to right side 34.91 ± 8.10 ($p < 0.05$).

Left side elongation was more common than the right side.

- Bilateral/unilateral (Table 5): 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.

Bilateral elongation was more common than the unilateral elongation.

DISCUSSION

The stylohyoid process and ligament are derived from the first and second branchial arches, in addition to Reichert’s cartilage. It has been demonstrated that during fetal

development, Reichert’s cartilage links the styloid bone to the hyoid bone. If these structures solidify, they can cause the pain and suffering present in Eagle’s syndrome.⁷⁻¹⁰ Radiographic diagnosis should include plain radiography, orthopantomogram, anterioposterior; lateral skull films and CT scan.¹¹

There has always been a natural variation in the length of styloid process as debated by various researchers.^{12,13} It has been previously reported that the normal radiographic length of styloid process is 20 to 30 mm⁹ (see Fig. 1). Whereas, Kaufman et al reported 30 mm as the upper limit for the normal styloid process.¹⁴

In the present study, we observed that there was an increase in the length of the styloid process as age increased which was in consistent with the studies done by various researchers.¹⁷⁻¹⁹ In a study, Okabe et al found a significant correlation between serum calcium concentration and the length of styloid process among 80 years old subjects. They noticed that longer the styloid process, higher was the serum calcium concentration. It was also found that the longer the styloid process was, the heel bone density was higher.²¹ However, these findings differed from others who suggested that age may not have a role in elongation.²⁰

Table 1: Difference between the mean elongation of styloid process according to age of the study subjects

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Age group in years						
<i>Left</i>						
10-30	38	33.34	3.75	0.60	$p < 0.05^*$	
31-50	32	37.90	8.04	1.42		
51-70	37	42.72	10.83	1.78		
<i>Right</i>						
10-30	38	31.31	3.38	0.54	$p < 0.05^*$	
31-50	32	34.53	7.97	1.40		
51-70	37	38.94	9.81	1.61		

*ANOVA at 95% confidence interval

Table 2: Difference between the mean elongation of styloid process according to sex of the study subject

Table 2: Difference between the mean elongation of styloid process according to sex of the study subject						
Gender						
<i>Left</i>						
Males	46	37.13	9.17	1.35	$p = 0.409$	
Females	61	38.57	8.71	1.11		
<i>Right</i>						
Males	46	34.47	8.47	1.24	$p = 0.603$	
Females	61	35.24	7.86	1.00		

Table 3: The percentage distribution of the types of the elongated styloid process

	Type I		Type II		Type III		Total
	N	%	N	%	N	%	N
Left side	35	32.7	36	33.6	36	33.6	107
Right side	38	35.5	33	30.8	36	33.6	107
F = 0.126	p-value = 0.419						

Table 4: The percentage distribution of the sides of the elongated styloid process

	<i>N</i>	<i>Mean</i>	<i>Std. deviation</i>	<i>Std. error of mean</i>	<i>p-value</i>
Left side	107	37.95	8.90	0.86	<0.05 [#]
Right side	107	34.91	8.10	0.78	

[#]Student t-test at 95% confidence interval

Table 5: The percentage distribution of unilateral and bilateral elongation of styloid process

<i>Gender</i>	<i>Unilateral</i>		<i>Bilateral</i>		<i>Total</i>
	<i>N</i>	<i>%</i>	<i>N</i>	<i>%</i>	
Male	16	34.8	30	65.2	46
Female	07	11.5	54	88.5	61
Total	23	21.5	84	78.5	107

In the present study we found that females had elongated styloids than males. Although these findings were not statistically significant, these findings were similar to studies conducted by Ferrario et al. This is related to endocrine disorders of women during menopause.¹⁵ This can also be the reason for elongation in elderly women.

In our study, percentage distribution of types on the left side showed that 32.7% of cases were Type I and 33.6% of the cases were Type II and 33.6% of cases was Type III. Similarly, distribution on the right side showed that 35.5% of the cases had Type I, 30.8% had Type II and 33.6% had Type III. We found that Type I elongation was most common among all the types and this difference was not statistically significant, however these findings were similar to the study conducted by Vajendra Joshi et al.¹⁸ This difference in the results of our study may be due to differences in the sample sizes.

In the present study the length of the 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 B More and Asrani¹⁷ whose studies revealed that elongated styloid process was more on the right side. This difference in the results of our study may be due to differences in the sample sizes.

Our study showed unilateral elongation in 21.5% and bilateral elongation in 78.5%, irrespective of age, gender and type. It was also found that bilateral elongation was frequently seen in females (88.5%) compared to males (65.2%). This is consistent with the study conducted by Bozkir et al who noted that bilateral elongation was more common in females than unilateral.¹⁶

CONCLUSION

It is important for the dentists be aware of the natural variations of styloid process whose clinical importance is not well understood. Styloid process elongation may often be a coincidental asymptomatic radiological finding. Proper clinical and radiographic evaluation can detect an elongated

styloid process. Proper diagnosis can definitely be of immense help to rationalize the line of management and the ultimate clinical outcome.

In patients with undiagnosed neck and/or intermittent facial pain as well as pain originating from impacted third molars, oropharyngeal region an elongated styloid process could be suspected. So further clinical and radiological investigation is advisable. Panoramic radiography is useful for detection of an elongated styloid process and/or ossification of stylohyoid ligaments in patients with or without symptoms and can thus help avoid misinterpretation of the symptoms and hence panoramic radiography is an economical and best imaging modality to view the elongation of styloid process. However, studies with larger sample size would further help to assess the prevalence of elongated styloid process with the type and pattern of elongation.

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