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Prevalence of Elongated Styloid Process in Adults of Cuddalore District (South India) - A Retrospective Cross-Sectional Study.

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Abstract

Introduction: The prevalence of elongation of the styloid has been found to vary from 4 % to 30 %. The prevalence increases as the age progresses and differs with locality. But, in routine radiographic reporting in our department, we came across an increase in the prevalence of Styloid Process Elongation (SPE), so we conducted this study on the prevalence of elongation of styloid process.

Aim: The aim of this study was to assess the elongation of the styloid process on digital panoramic radiographs and to evaluate the prevalence of the elongation and its correlation with age and gender.

Materials and methods: About 235 OPGs of patients from 20-55 years of age in 2020-2021 were retrieved from our Radiology Department for Retrospective analysis of SPE. Each styloid process in the collected images were evaluated bilaterally using Acrobat XL Pro (adobe) software for length and type of elongation. The

Chi-square statistical analysis was done using the data measured.

Result: In 235 OPGs, there was styloid process elongation in 150 OPGs (63.9%). In 150 OPGs, 73 (66. 4%) OPGs were of males and 77(61.6%) OPG's were of females showed elongation. In 70.7% cases were bilaterally elongated and in 29.4% cases were unilaterally elongated. Type I elongation shows more elongation than the other types. The elongation is more 46-55 years of age group.

Conclusion: In our study, the prevalence of SPE was around 63.9%. The panoramic radiograph was used as a reliable tool in estimating the SPE.

Keywords: Styloid process elongation, orofacial pain, Eagles syndrome, Orthopantomograph

Introduction

Orofacial pain is a group of painful condition affecting the oral cavity, face and neck, which can be somatic, neuropathic or psychological [1,2]. The Dentists are the first consulted for the orofacial pain. The Orofacial Pain includes 51% is of odontogenic cause, 25% is of MPDS and TMDs, 9% is of sinusitis, 11% is of neuralgic pain and 4% is of Styloid Process Elongation [1-3]. The elongation of styloid process maybe a less common condition, which is known as Eagle Syndrome. Eagle syndrome, was described by Eagle, an Otorhinolaryngologist in 1937[5]. The clinical symptoms include cervicofacial pain with dysphagia, foreign body sensation in throat, vertigo, tinnitus and otolagia [5].

Embryologically, the styloid process originates as a part of Reichert's cartilage which forms from the second pharyngeal arch. The styloid process is a cylindrical, slender, needle-like projection of varying lengths of 2-3cm. They arise bilaterally from the inferior part of the petrous temporal bone projecting downward and forward. The tip of the styloid process is surrounded by a complex structure includes internal jugular vein, internal carotid artery, cranial nerves V, IX. The tip of the styloid process offers attachment to stylohyoid ligament, stylopharyngeus and styloglossus muscles. The styloid process is considered elongated when it is more than 3cm [9]. The prevalence of styloid process elongation accounts for about 3-30% of the world-wide population which varies according to race and locality. As the prevalence varies widely with the geographic distribution, assessing the prevalence in the Cuddalore district population is needed. Various classification was given by many, Langlais et al classified ~~into~~ the styloid process into three types, Type 1 – Elongation more than 3 cm; Type 2 – Pseudo articulated type; Type 3 – Segmented type [9] [Figure 1].

On our routine radiographic interpretation, incidentally we found that there was asymptomatic elongation of styloid process in some cases. The elongation of styloid process is seen radiographically in Orthopantomograph, Lateral cephalogram, Computed Tomography, Cone Beam Computed Tomography. The main purpose of this study was to evaluate the Prevalence of Styloid Process Elongation (SPE) using orthopantomograph among adults of Cuddalore district. The objectives of the study were, to Assess the prevalence and types of Styloid Process Elongation using Orthopantomograph, to Comparison of prevalence and types between the gender variance, to Comparison of prevalence and types with age group variance, unilateral and bilateral prevalence of Styloid Process Elongation

Materials and methods

The study was conducted in the Department of Oral Medicine and Radiology in our college. The Ethical approval was obtained from the Institutional Ethical and Scientific Committee (IHEC/891/2022). The sample size was calculated to be 235 based on the prevalence rate

from the previous articles using the NMaster Sample Size Software. A total of 235 digital OPG images were retrieved from the database of our radiology department from the year 2020- 2021. The radiographs were taken using the Carestream 8100c digital panoramic X-Ray machine. The radiographs of good quality with the age 15 to 55 years were included. The radiographs of poor quality with distortions and magnifications where styloid process not clearly identified, superimposition of stylohyoid complex over temporal bone and with bone pathologies were excluded. The radiographs were selected by simple random sampling method by calibrated examiners.

The styloid process measurement was done using the Adobe Acrobat XL Pro software. Using the measurement tools, the length of the styloid process was measured from the base of the skull near the temporal bone where the styloid bone emerges from to the tip of the styloid process bilaterally[5] [Figure 2]. The following are determined for each styloid process in the collected data; length, type of elongation of right and left styloid processes are analysed independently.

Inclusion criteria

- Good quality radiographs without distortion and magnification.
- Age – 15-55 years

Exclusion criteria

- Poor quality radiographs with distortions and magnifications where the styloid process not clearly identified.
- Superimposition of the stylohyoid complex over temporal bone.
- Prevalence of bone pathologies in the maxilla and mandible that extends and superimpose over the SP.

Statistical Analysis

The data were tabulated and analysed using SPSS 2.0, the prevalence percentage and chi-square test for prevalence and distribution among the group variance was done.

Results

In the study, the elongation was observed in 150 cases (63.9%) of the 235 OPGs evaluated, the remaining 85 cases (36.1%) were without elongation [Figure 3].

In the 150 OPGs with elongation, type I elongation was found in 93 cases (39.6%), type II elongation in 39 cases (16.6%), type III elongation in 18 cases (7.7%) [Figure 4]

Among the styloid process measured the longest one was about 57.49mm [Figure 5] and the shortest one was measured at about 18.17mm.

Table 1 shows the distribution of study subjects based on age groups and Styloid process elongation. The age was stratified into 4 groups- 15-25 years, 26-35 years, 36-45 years, and 46-55 years for data analyses. Among 150 subjects with elongation, the majority of the subjects (50 subjects) were in the age group of 26-35 years, followed by 46-55 years (39 subjects), 36-45 years (35 subjects) and the least was observed in the age group of 15-25 years (26 cases). The association between age and SPE was found to be statistically significant (p-value of 0.05).

Table 2 shows the distribution of types of SPE based on age groups. Type I elongation was majorly observed in all the age groups which was approximately 93 subjects (39.6%), in which ~~the~~ 26(66.7%) subjects are present in the age group of 46-55 years, 32(64%) subjects are present in the age group of 26-35 years, 21(60%) subjects are of age group 36-45 years, 14(53.8%) are presented in the age group of 15-25 years. Similarly, type II elongation was found in 39 subjects, out of which 13(37.1%) subjects presented in the age group of 36-45years, 10 subjects (25.6%) are presented in age group

of 46-55years, 11 subjects (22%) are of age group 26-35 years, 5 subjects (19.2%) are of age 15-25 years. The type III elongation were presented in 18 subjects of the 150 elongations, out of which 7 subjects (26.9%) were in the age group of 15-25years; 7 subjects (14%) among the age group of 26-35 years, 3 subjects (7.7%) are presented in the age group of 46-55 years, only 1 subject (2.9%) had presented in the age group of 36-45years.

Table 3 shows gender wise distribution of study subjects based on styloid process elongation. Among 150 subjects with SPE, 77 subjects were female and the remaining 73 were male. The association of gender and styloid process elongation was statistically not significant.

Table 4 shows distribution of styloid process elongation gender wise according to types, among the 77 females with SPE, 49 subjects (63.6%) were presented with type I elongation; 20 subjects (26%) were presented with type II elongation; type III elongation were presented in 8 subjects (10.4%). Out the 73 males, 44 subjects (60.3%) had type I elongation; type II elongation were presented in 19subjects (26%); 10 subjects (13.7%) showed type III elongation

Table 5 shows distribution of SPE based on the involve ment of sides, the elongation of SP was more with bilateral involvement (70.7%), followed by left unilateral (18.7%), unilateral right (10.7%) and Type III (7.7%)

Discussion

Orofacial pain is a diagnostic challenge to the dentist. Most of the acute orofacial pain maybe due to the odontogenic cause, whereas chronic orofacial pain may be related to nonodontogenic reason [1]. The styloid process elongation being one among the cause of the orofacial pain with a prevalence of 4%. The elongation of SP may lead to Eagle's Syndrome which is a rare disease. The tip of the styloid process is in proximity to complex structures. The elongation of styloid process can compress the cranial nerves and carotid arteries causing dysphagia, tinnitus, otalgia, restricted neck movement and tenderness, headaches and rarely ischemia due to compression of arteries. Clinically, the diagnosis of symptomatic SPE can be made by palpation in the tonsillar fossae which induces pain. Radiographically elongation of styloid process is diagnosed with various imaging methods using panoramic radiographs, lateral oblique view of the mandible, posterior-anterior view skull, CBCT and CT scan.

The measurement of the elongation of SP can be done using imaging modalities like panoramic radiographs [8-12], CBCT, CT [14,15], on dry skulls or cadavers [20]. The evaluation of SPE in dry skull or cadaver is the most accurate method. CBCT or CT being the accurate imaging technique to assess the SPE but they are high radiation, expensive and not routinely advised for the patients visiting the dental clinic. The panoramic radiographs which is advised routinely in dental OPD was used in the present study. More than 30mm is considered as elongation of styloid process [9]. The panoramic radiograph though it has magnification and superimposition of images, it can indicate the elongation of the SP. The image can be retrieved from the stored data, low dose of radiation, cost-effective and are routinely taken in dental clinics on daily basis, hence panoramic radiographs were used in our study.

During our routine dental OPD, OPG interpretation revealed frequent presence of styloid process elongation though the patients were asymptomatic, which contradicts the evidence mentioned in the literature. Hence, we decided to perform a study on the prevalence

of SPE. Our study results projected, variations in the length, type of elongation with respect to age, gender, involvement of the sides. The presence of elongation of styloid process was found increased.

In our study, out of 235 OPG's that included from the age group of 15-55years, 150 showed SPE with the overall prevalence of 63.9%. In the study by Bagga et al [7], they found the prevalence of SPE to be 45%, where they used 1706 OPG's with no age specification. In a study by Rishi Thukral et al [16], 407 OPG's were studied of age 30-60 years, out of which the prevalence was 15.97%. From the literature, it is evident that there is wide variation in the prevalence of SPE among the Indian population, in our study it is 63.9%, the highest prevalence, indicating an elaborate study in this, to rule out the rise in the prevalence of SPE.

In a study, by Asustay et al [8] increased prevalence was seen in 51-60years of age group and in the study in Greece population by Anastasios [17] also showed the increased SPE in the age group of more than 65 years. In contrast our study showed the prevalence of SPE was more in the age group of 26-35 years (50 cases), followed by 46-55years (39 cases), followed by 36-45years (35 cases) and in 15-25 years of age group (26 cases), but the previous studies had included the age group above 55 years which maybe a reason for variation in the result. However, subsequent studies including the age group above 55 years may give more accurate result.

In our study, the prevalence of type I elongation were about 39.6%, the prevalence of type II elongation were 16.6%, type III were 7.7%. Similar to our study, the study by Hettiarachchi et al [10] shows the prevalence of type I elongation to be 55%, 40% prevalence in Type II elongation, 5% prevalence in type III. In the present study, we found that type I was more in age group of 46-55years with a prevalence of 66.7%, type II was more in 36-45years and type III in 15-25years.

We observed that the SPE was more in males that females where the prevalence was 66.4% for males and 61.6% for females. In accordance with our study, the study by Rishi Thukral et al [16] also showed an increased prevalence in males (55.3%) than in females (44.2%). Similarly in study by Hettiarachchi et al [10], the prevalence of SPE in males was 34.9% when compared to females 24.6%. Whereas Bagga et al [7] showed variation in the results with slight increased prevalence in females (45.5%) than in males (44.8%).

On analysing the elongation of SPE based on sides, we found that 70.7% was bilaterally involved and the 29.4% were of unilateral in nature which matched the results of Bagga et al [7] where the bilateral involvement was in 77.9% of OPG's and unilateral involvement in 22.2%. Rishi Thukral et at [16] showed 53.8% elongation bilaterally and 46.2% elongation in unilaterally.

There were many other studies showed varying prevalence of SPE from 3.7% by Ilguy et al [5], 6.6% in a study by Custodio et al [19] who used dry skull in analysing, Correll et al [18] with 18.2%, etc. which may be due to variation in age, gender, different racial population and method of imaging.

Conclusion

In our study, as we suspected the increased prevalence of SPE through routine radiographical examination, there was increased SPE prevalence in the Cuddalore district population. 63.9% overall prevalence where found, which is the highest, with increased prevalence in the age group of 26-35years. Our study concludes that the elongation of styloid process prevalence has been increasing and should be given more important in diagnostic criteria for orofacial pain.

Limitations and future prospects

Since OPG is a 2-dimensional imaging technique that may have errors like magnification, patient positioning. Studies with more sample size, multicentric study on different population, 3- dimensional imaging modalities like CBCT or CT is more advisable for future studies.

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Legend Figures and Tables

Age (years)	Elongation – NO N (%)	Elongation – Yes N (%)	Chi square	p value
15-25	27(50.9)	26(49.1)	7.33	0.05*
26-35	25(33.3)	50(66.7)		
36-45	19(35.2)	35(64.8)		
46-55	14(26.4)	39(73.8)		

Table 1: shows the distribution of styloid process elongation based on age groups, *p value shows statistical significance

Age	Elongation Types	Chi	P value

	Type I N (%)	Type II N (%)	Type III N (%)	square	
15-25	14(53.8)	5(19.2)	7(26.9)	10.9	0.09(NS)*
26-35	32(64)	11(22)	7(14)		
36-45	21(60)	13(37.1)	1(2.9)		
46-55	26(66.7)	10(25.6)	3(7.7)		

Table 2: Prevalence of distribution of types of styloid process elongation based on AGE groups, *p value shows statistically non-significant.

Gender	Elongation		Chi square	P value
	No n (%)	Yes n (%)	0.575	0.44
Male	37(33.6)	73(66.4)		
Female	48(38.4)	77(61.6)		

Table 3: shows distribution of styloid process elongation based on gender. * p value shows statically non-significant

Gender	Type of elongation			Chi square	P value
	Type i N (%)	Type ii N (%)	Type iii N (%)		
Male	44(60.3)	19(26)	10(13.7)	0.41	0.86 (NS)*
Female	49(63.6)	20(26)	8(10.4)		

Table 4: Prevalence and distribution of types of styloid process elongation based on GENDER. *p value shows statistically not significant

Involvement of elongation	N (%)
Unilateral right	16 (10.7)
Unilateral left	28(18.7)
Bilateral	106(70.7)

Type III	18(7.7)

Table 5: Prevalence of styloid process elongation based on involvement

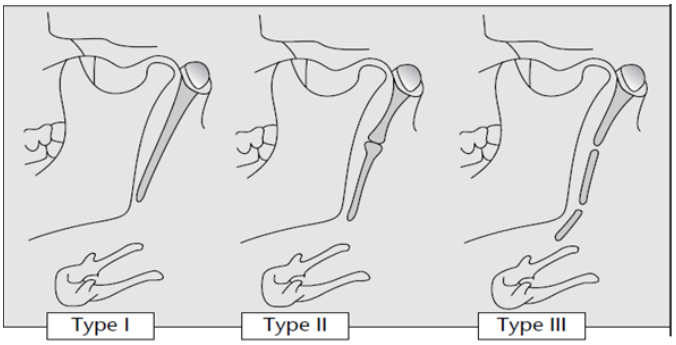

Figure 1: Types of elongation of SP – Radiographic appearance

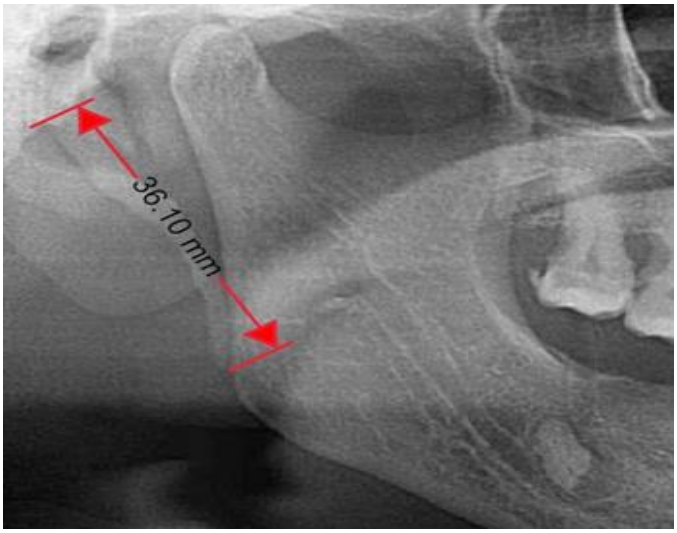

Figure 2: shows the of measurement of length of Styloid Process using Adobe Acrobat XL pro software

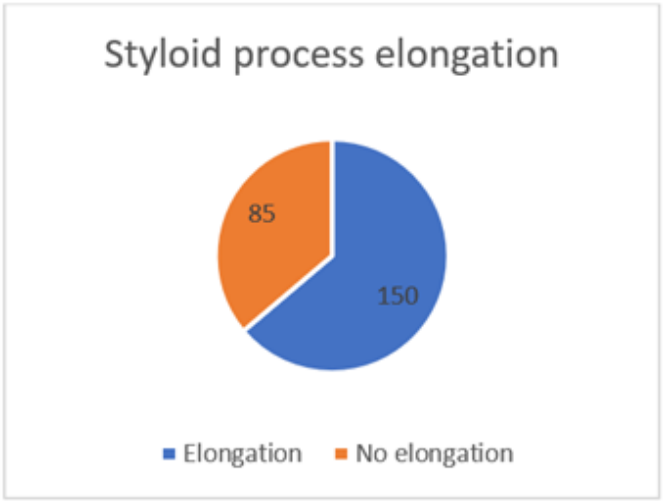

Figure 3: shows the prevalence of styloid process elongation

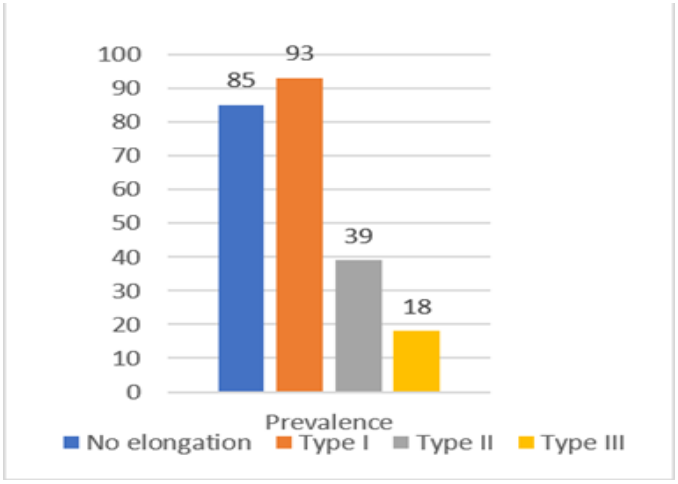

Figure 4: Prevalence of styloid process elongation based on types

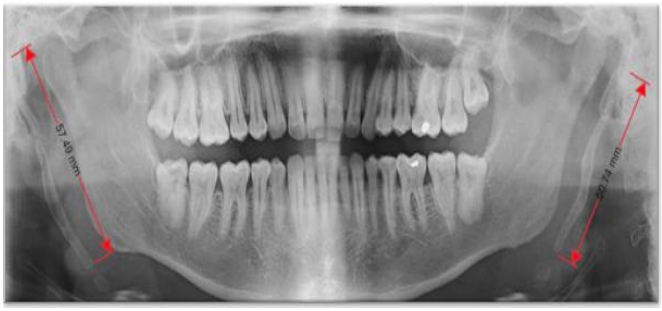

Figure 5: shows the length of styloid process on right side which is (57.49mm) and on left side(50.74mm) which is the longest measured in our study