



Prevalence of Type I Elongated Styloid Process among Dental Patients of A Tertiary Care Centre

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ABSTRACT

Background

Styloid process is a pointed bony projection extending downward from the temporal bone. The normal length of styloid process is approximately 20-30 mm. Keur JJ considered the length of styloid process longer than 30 mm to be styloid process elongation. The study was aimed to measure and observe the different types of elongated styloid process and find the prevalence of Type I elongated styloid process among dental patients visiting radiology department.

Methods

This was a descriptive cross-sectional study comprising 120 digital panoramic radiographs of dental patients of a teaching hospital. Ethical clearance was taken from Institutional Review Committee of a tertiary dental college. Convenient sampling was done. The length of styloid process measured in millimeters were tabulated and analyzed using Statistical Package for Social Sciences version 20 to calculate the frequency and percentage for each type of styloid process.

Results

Type I elongated styloid process (52.08%) was found to be the most prevalent with 50.00% in right side and 54.16% in left side. Type I was found in 56 (46.66%) of total male and 69 (57.50%) of total female patients. Mean value of length of Type I styloid process was found to be 33.19 ± 1.19 and 32.91 ± 1.04 in total male and female patients respectively.

Conclusions

The prevalence of Type I elongated styloid process was found higher than most of the studies conducted in similar settings.

Keywords: Calcification type; Elongated styloid process; Panoramic radiograph.

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INTRODUCTION

Styloid process is a cylindrical bone that arises from the temporal bone in front of the stylomastoid foramen. It normally measures about 2 to 3 cm in length. It varies among individuals and even in right and left side of the same individual. When it is more than 3 cm it is called as elongated styloid process.¹ Elongated styloid process was first reported by Eagle.² It may produce characteristic facial and neck pain known as Eagle's syndrome and it can cause difficulty in swallowing, foreign body sensation etc.³ Knowledge of this syndrome is important to all health practitioners in the diagnosis and treatment of neck and head pain. Langlais classified the styloid process into three main types based on its radiographic appearances.⁴ The purpose of this study was to measure the length of styloid process and find the prevalence of Type I elongated styloid process by using digital panoramic radiographs.

METHODS

This observational cross-sectional study was conducted on 120 digital panoramic radiographs of dental patients age ranging from 25-65 years visiting Radiology Department of Kantipur Dental College and Teaching Hospital. The study was conducted from July 2024 to December 2024 after an approval from Institutional review committee (Ref. No.-14/024) of Kantipur Dental College.

Only good quality radiographs showing bilateral styloid process were included, while radiographs having positioning and magnification errors were excluded from the study. Convenience (Non-probability) sampling was done and sample size was calculated by using the following formula:

$Z^2 pq/d^2$ (Where, Z =z-score value at 95% CI=1.96, n = sample size, p = prevalence 8.7%,⁵ $q=1-p$, d = desired level of precision, i.e., 5% for this study). The sample size as per this formula was 120. Hence, a total of 120 ortho panoramic radiographs (OPG) of patients aged between 25-65 years were taken from Care Stream 3D (CS 3D) machine. The right and left side styloid processes were measured independently.

The length of styloid process (SP) was measured as the distance from the point where styloid process leaves the tympanic plate of temporal bone to the tip of styloid process. It was measured from the frontal side of styloid process with a measuring ruler on the accompanying application CS 3D software. Radiographs were analyzed for different types of elongated styloid process based on Langlais classification.⁶

Type I: SP showing calcified outline

Type II: Mineralized stylohyoid or stylomandibular ligaments attached to SP by a single pseudoarticulation

Type III: Segmented SP containing multiple pseudoarticulation.

The values in millimeters were tabulated and statistically analysed with SPSS version 20.0 software. Descriptive analysis was done and the prevalence of each type of styloid process was calculated.

RESULTS

The present study was conducted among 120 dental patients of age ranging from 25-65 years. Ortho panoramic radiographs were studied for measuring the length of styloid process in right and left side of 60 male and 60 female patients.

Table 1 showed two different types of elongated styloid process (EPS) observed namely Type I and Type II. Type I elongated styloid process (52.08%) was found to be the most prevalent with 50.00% in right side and 54.16% in left side. Type II was observed in 1.66% of total patients. Prevalence of Type II styloid process in right and left side were 2.50% and 0.83% respectively. Normal (non elongated styloid process) was found in 111(46.25%) patients (Table 1).

Types	n(%) in both sides	n (%) in right side	n (%) in left side
Normal	111 (46.25)	57 (47.50)	54 (45.00)
Type I	125 (52.08)	60 (50.00)	65 (54.16)
Type II	4 (1.66)	3 (2.50)	1 (0.83)

Among the two different types of elongated styloid process observed, Type I was found in right side of 23(38.33%) male and 37 (61.66%) female patients. Prevalence of Type II EPS was 5.00% and 1.66% in right and left side of male patients respectively. None of the female patients showed Type II EPS in their right as well as left side. Normal styloid process was observed in right side of 34(56.66%) male and 23(38.33%) female patients and in left side of 26(43.33%) male and 28(46.66%) female patients (Table 2).

Table 2. Gender wise distribution of different types of styloid process (n=120).

Gender (Side)	Normal n (%)	Type I n (%)	Type II n (%)
Male (Right)	34 (56.66)	23 (38.33)	3 (5.00)
Male (Left)	26 (43.33)	33 (55.00)	1 (1.66)
Male (Total)	60 (50.00)	56 (46.66)	4 (3.33)
Female (Right)	23 (38.33)	37 (61.66)	—
Female (Left)	28 (46.66)	32 (53.33)	—
Female (Total)	51 (42.50)	69 (57.50)	—

Mean value of length of Type I styloid process was found to be 33.19 ± 1.19 and 32.91 ± 1.04 in total male and female patients respectively. Mean length in right side was 33.12 ± 1.20 and 32.93 ± 1.06 in left side (Table 3).

Table 3. Mean length of Type I elongated styloid process in total male and female patients (n=120).

Total male	Total female	Right side of total patients	Left side of total patients
33.19 ± 1.19	32.91 ± 1.04	33.12 ± 1.20	32.93 ± 1.06

DISCUSSION

Elongated styloid process results due to calcification of stylohyoid and stylomandibular ligaments, which can lead to symptoms such as foreign body sensation in the throat, earache, headache, tinnitus and trismus.⁷ Our study showed Type I elongated styloid process (ESP) prevalent in 52.08% of patients with 50.00% on right side and 54.16% on left side. Male and female patients showed the prevalence of Type I styloid process as 46.66% and 57.50% along with their mean length as 33.19 ± 1.19 and 32.91 ± 1.04 in right and left side respectively. Our study showed slightly higher

prevalence of Type I elongated styloid process than the study carried on 1706 panoramic radiographs of Solan people retrieved from the archival records of Department of Oral Medicine and Radiology in which 45.01% patients showed elongation along with 44.79% male individuals and 45.52% female individuals.⁷ This study had prevalence of Type I ESP slightly lower than the study conducted on 517 digital panoramic radiographs consecutively retrieved from the archival records at the Department of Oral Medicine and Radiology, KLE Society's Institute of Dental Sciences Bengaluru with prevalence of 65.85%. The ESP may cause symptoms like dull aching pain present in either or both the sides of the throat. The pain may be referred to the ear or mastoid region of the affected side. It may cause pain on swallowing or an abnormal sensation of foreign body in the pharynx. More uncommon symptoms such as tinnitus or otalgia may occur. It is thought to be due to compression of styloid process on any neural and vascular structures. In rare cases, it may cause compression of carotid arteries leading to stroke.⁸ In our study EPS had length in right side greater than left side which was in contrast with the study carried out in the College of Dentistry, AlJouf University in which the length of the elongated styloid process on the right side was less than that on the left side (35.92 ± 7.55). Our study had also higher prevalence of Type I EPS in right (50.00%) and left side (54.16%) than the above study with prevalence of 27.27% in right side and 22.22% in left side.⁹ Higher prevalence of EPS was observed in our study in right (50.00%) and left side (54.16%) than the study performed on panoramic radiographs of outpatients of the Department of stomatology, Taichung Veterans General Hospital in which the prevalence was 41.50% on the right side and 36.20% on the left side. The mean length of ESP in right and left side of our study were also measured to be slightly higher than this study where it measured to be 30 ± 0.7 mm in right side and 29 ± 0.7 mm left side. The exact cause of elongation is not understood but calcification and

ossification of cartilage might occur due to local chronic irritations, mechanical stress, aging or might be related to endocrine disorders.¹⁰

Another research conducted on South Indian patients showed 81.16% prevalence of Type I elongated styloid process which was higher than our study.¹¹ This study showed a very high prevalence of ESP when compared to the study carried on 489 digital panoramic radiographs of Lebanese adults (218 males and 271 females) taken for oral and dental diagnostic purposes in the Oral Medicine and Dentomaxillofacial Radiology Department in which only 15.54% individuals presented with Type I ESP. Our study was similar with this study in having the females (59.21%) Type I ESP more than males (40.78%) and right side affected more than left but still the prevalence of our study was higher than this study.¹² This study showed Type I ESP prevalent with a greater percentage than the study conducted on 860 panoramic radiographs of dental patients in which only 3.72% patients had Type I ESP. Elongated styloid process can irritate and stimulate the nerves in the walls of the external or internal carotid arteries. In such cases, pain will be felt over the entire head from the ophthalmic region to the occiput. Patients may refer to this pain as a headache which can often lead to misdiagnosis so for a corrected differential diagnosis it is important to distinguish Eagle's syndrome from other pathologies.¹³ Prevalence was higher in our study compared to the study carried on 300 patients above 14 years of age in Dar Al Uloom University Hospital, Riyadh, Saudi Arabia which presented with only 27.33% of Type I ESP.¹⁴ This study had a higher prevalence of elongated styloid process than the study conducted in the south Indian population in the Chengalpet region with 6.20% prevalence of elongated styloid process. Although the actual cause of SP elongation is not known but mineralization and calcification of the tip of the SP are suspected to cause elongation or it could be due to bony tissue growth at the site of insertion of stylohyoid ligament. The abnormal elongation may irritate and exert pressure over adjacent neurovascular structures and cause clinical

symptoms of Eagle Syndrome. The symptoms can be confused with some other conditions, including a wide variety of facial neuralgias, nasopharyngeal diseases, ENT, dental and temporomandibular diseases. Thus, a detailed differential diagnosis for SP elongation should be performed. The ligaments are also found to undergo ossification in the population having the the habit of chewing gutka and doing strenuous work.¹⁵ Our study showed higher percentage of prevalence of ESP than the study conducted in the Department of Oral Medicine and Radiology of Bapuji Dental College and Hospital, Davangere, Karnataka in which the incidence of elongation is 24.8% of which 46.5% showed unilateral elongations and 52.5% showed bilateral elongation. Our study also presented with longer styloid in both sexes as compared to this study where the mean length of styloid in males was 22.6 ± 8.98 mm and that of females was 23.7 ± 11.08 mm.¹⁶ This study revealed higher prevalence of ESP Type I than the study carried on Turkish population in which only 7.01% of the population presented with ESP Type I. The exact cause for ESP is not known but endocrine disorders in menopausal women, surgical trauma and mechanical stress could result in calcification of SP. Cervical myofascial pain syndrome, migraine, trigeminal neuralgia should be considered on differential diagnosis.¹⁷ Our study showed a lower prevalence of ESP as compared to the research conducted on digital panoramic radiographs of Bareilly population in which 68.80% of styloid process had Type I elongation pattern on the right side whereas on left side 65.70% of styloid process showed Type I elongation pattern. But our study had the length of styloid process longer than this study in which the average length of the right and left styloid process in males was 26.96 ± 8.74 and 26.76 ± 8.33 , respectively whereas in females right and left average length was 26.02 ± 5.86 and 26.59 ± 7.00 respectively Our study showed similarity with this study in having the length of styloid process in males more than in females. It is suggested that some part of the cartilage gets retained within the stylohyoid ligament during ossification that results

in varying degrees or patterns of ossification and elongation of stylohyoid chain.¹⁸ This study showed lower prevalence of elongated styloid process than the study conducted on the archived panoramic images in the University of Barcelona dental Hospital in which 72.75% of ESP was prevalent. Our study was in contrast to this study in having ESP more prevalent in females than in males. Elongated styloid process should be considered an asymptomatic entity and is detected coincidentally during routine dental examination.¹⁹

CONCLUSIONS

It is very important for the dental and ENT surgeons to know about the elongated styloid process as atypical facial pain and pain from impacted third molars, oropharyngeal region could be the cause of elongated styloid process. Early diagnosis is important as an elongated styloid process can cause pressure on the carotid artery.

Limitations

This was a single center study so does not represent the wider population. Further studies with larger sample among different populations of different ethnic groups should be conducted for better results. Association of elongated styloid process with age and gender can also be studied. There are different types of variations of the styloid process regarding its thickness, angle and direction of deviation and degree of calcification which requires further stud-

ies. Panoramic radiograph being two dimensional can cause image distortions so advanced diagnostic methods can be used to measure the accurate length of styloid process.

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Authors' contributions

Conceptualization: Bipana Manandhar.

Data curation: Bipana Manandhar.

Formal analysis: Bipana Manandhar.

Investigation: Bipana Manandhar.

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