

# The Comparison of Styloid Processes in the Edentulous and the Posterior Dentate Patients Using Panoramic Radiography

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## Abstract

**Introduction:** The aim of this study was to evaluate the length of styloid processes of edentulous and posterior dentate patients retrospectively using digital panoramic radiography. **Methods:** This study was carried out in southwestern of eastern Anatolia region Turkish population. In this study, 100 styloid processes of each of edentulous and posterior dentate patients were measured on digital panoramic radiographs. Styloid process longer than 30 mm was evaluated as an elongated styloid process. Recording of data was performed based on gender, side and groups, Chi-square and Mann Whitney U test were conducted for statistical analysis. **Results:** Styloid process length was not found to be statistically significant between edentulous (24.9±6.66) and posterior dentate (25.75±5.64) groups (p>0.05). The frequencies of Elongated styloid processes were not statistically different between genders, side or groups (p>0.05). **Conclusion:** Being edentulous was not an important factor for the length of the styloid process and the likelihood of symptoms that might develop.

**Key words:** Styloid Process, Edentulous, Eagle Syndrome

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## Introduction

The styloid process is a protrusion of the temporal bone, it has a cylindrical shape, which is localized in front of the stylomastoid foramen and is attached to the hyoid bone via styloid ligament (1). The styloid process is located in the anterior-inferior direction between the internal and external carotid arteries towards the apex of the tonsillar fossa and the styloid process. The distal end

is attached to three muscles as stylopharyngeus, stylohyoid, and styloglossus and two ligaments as stylohyoid and stylomandibular ligaments (2). Eagle stated in 1937 that the average length of styloid process is between 25 mm and 30 mm, and in case of being longer than 30 mm, he named it an elongated styloid process and stated that this elongation could cause styloid syndrome or eagle syndrome (3). Eagle syndrome may cause earache, throat ache, dysphagia, and foreign body perception in the throat and pain in the mouth, neck, and face area during the mouth opening, swallowing and head movements (4-6). Although there are a large number of theories related to the aetiology of the elongation of the styloid process including reactive hyperplasia, reactive metaplasia, anatomical variation, anomaly due to age, degenerative process, renal transplantation and genetic hypothesis, the exact aetiology is still unknown (7,8). However, the elongated styloid process is common in the population and generally, it does not cause any symptoms or clinical findings (1). In the Eagle syndrome, the main treatment option is surgical intervention, use of non-steroid anti-inflammatory agents, application of anaesthetics through local infiltration can be used (9).

Although CT and CBCT make the correct measurement of anatomic structures, digital panoramic radiography application is easy and also gives sufficient correct information about the diagnosis of elongated styloid process (10).

In edentulous patients, occlusal disagreements might be accepted more than dentate patients. According to Scaf et al. (11) elongated styloid process frequency is affected by muscle tension originated from occlusal disarrangements. The study planned with this opinion. The aim of this study is to evaluate the length styloid processes of edentulous and posterior dentate patients retrospectively by using panoramic radiography images.

## Materials and Methods

Before the study, ethics committee approval was taken from Inonu University Health Sciences Scientific Research and Publication Ethics Committee (2020/1262). The study was conducted by retrospective evaluation of 200 styloid processes (110 female and 90 male) on panoramic radiographs of 121 patients with the age of 51-90 years old referred to Inonu University Faculty of Dentistry Department of Oral and Maxillofacial radiology for various reasons. Of these styloid processes, 100 belonged to posterior dentate patients and 100 belonged to edentulous patients. For this purpose, the files including panoramic radiography and treatment plans of patients were evaluated between 01.01.2019 and 30.10.2020. Digital panoramic radiographic images used in the study were obtained by using PlanmecaProline XC (2009; Helsinki, Finland) device. All panoramic radiographic images were obtained with 66 kVp, 5mA and 18 sec exposure parameters. In case of any systemic disease that can influence bone metabolism, syndrome or drug use, and presence of surgical operation in the study area, the patients were excluded. In addition, if they did not have enough quality for evaluation, the panoramic images were excluded from the study. The styloid process was measured on each panoramic image by a clinician with six years of experience. Planmeca Romexis software program was used for the measurements. In styloid process length measurement, the method by İlğüy et al. (12) was used and the point where the styloid process separated first from the temporal bone and the extreme point were determined as reference points. The magnification factor was accepted as 1.2 for the measured values and the real size was calculated. The distance was recorded according to edentulous and posterior dentate groups. Also the measurements longer than 30 mm were accepted as the elongated styloid process (figure 1). The elongated styloid processes were recorded according to edentulous and posterior dentate groups, right and left sides groups and genders.

The Kolmogorov-Smirnov test was used to check the normal distribution in our data for styloid process length and ages. The results indicated that our data do not show normal distribution. Mann Whitney U test was used for the comparison of styloid process length, while the chi-square test for the frequency of elongated styloid processes according to groups. To define intraobserver

error rate, measurements were repeated on randomly selected 30% of all images intraclass correlation coefficients (ICC). Statistical analysis of data was conducted by using Statistical Package for Social Sciences (SPSS) program. The significance level was set at  $P < 0.05$ .

## Results

ICC scores were 0.85-0.90 for all measurements. In our study, a total of 121 panoramic radiographs (58 male, 63 female) of edentulous and posterior dentate patients were evaluated. In the edentulous patients, the minimum age was 52, the maximum age was 88, and the average age was found as  $70.96 \pm 7.18$ . However, in the posterior dentate patients the minimum age was 51, the maximum age was 90, and the average age was found as  $70.6 (\pm 7.15)$ . No statistically significant difference was found between age of posterior dentate patients and edentulous patients ( $P=0.44$ ) (Table I). Of the styloid processes evaluated in edentulous patients, 44 belonged to male patients, 56 belonged to female patients; of the styloid processes in posterior dentate patients, 46 belonged to male patients and 54 belonged to female patients and there were no statistically significant differences ( $P=0.77$ ). A total of 200 styloid processes were measured (100 edentulous, 100 posterior dentate). Length measurements of 200 styloid processes according to the dental status shown in Table I. According to this, the mean length of styloid processes was found as  $24.9 \pm 6.66$  mm (9.2-50.5 mm) in edentulous patients and as  $25.75 \pm 5.64$  mm (16.6-48 mm) mm in posterior dentate patients. No statistically significant difference was found between the styloid process length of posterior dentate patients and edentulous patients ( $P=0.39$ ). Elongated styloid process frequency between posterior dentate patients and edentulous patients were shown in Table I. In the edentulous patients, the frequency of elongated styloid processes was 19 (19%). Nonetheless, the frequency of elongated styloid processes was 14 (14%) in the posterior dentate patients. The frequency of total elongated styloid processes was found as 33 (16.5%). No statistically significant difference was found between posterior dentate and edentulous patients in terms of elongated styloid process frequency ( $P=0.341$ ). Table II shows the patients' elongated styloid process in terms of gender. Table III shows the right and left side elongated styloid process distributions.

**Table I:** Compare of styloid process length and age mean between edentulous and dentate patient groups with mann whitney U test and compare of frequencies of elongated styloid process with chi-square test.

Patient group	Styloid process length mean,std deviation(min-max)	Median index	Interquartile range	p-value	Age mean,std deviation(min-max)	p-value	Elongated styloid process frequency n(%)	p-value
Edentulous	24.9±6.66 (9.2-50.5)mm	25.65	8.05	0.39	70.96 ±7.18(52-88)	0.44	19(19%)	0.34
Dentate	25.75±5.64(16.6-48)mm	27.4	5.55		70.6 ±7.15 (51-9)		14(14%)	

**Table II:** Compare of elongated styloid process frequent between female and male gender groups with chi-square test.

Edentulous				Dentate			
gender	Elongated styloid n(%)	Without Elongated styloid n(%)	P-value	gender	Elongated styloid n(%)	Without Elongated styloid n(%)	P-value
Female	10 (7.9)	46 (82.1)	0.74	Female	8 (14.8)	46 (85.2)	0.79
Male	9 (20.5)	35 (79.5)		Male	6 (13)	46 (87)	

**Table III:** Compare of elongated styloid process frequent between right and left side groups with chi-square test.

Edentulous				Dentate			
Side	Elongated styloid n(%)	without Elongated styloid n(%)	P-value	Side	Elongated styloid n(%)	without Elongated styloid n(%)	P-value
Right	7(14)	43(86)	0.20	Right	7(12.5)	48(87.5)	0.63
Left	12(24)	38(76)		Left	7(15.9)	38(84.1)	



Figure 1: Measuring the length of the styloid process.

## Discussion

There are published studies in which styloid process is measured and the prevalence of the elongated styloid process is evaluated by using panoramic radiograph on various populations (1, 10,13-15).

In a study conducted on a population between 6 and 87 years of age in Italy, Gracco et al. found the prevalence of the elongated styloid process as 33%. In the same study, the prevalence of elongated styloid process was found to be higher in the older population (10). In the study on patients between 20 and 30 years of age in Sri Lanka population, Hettiarachchi et al. (13) found the prevalence of elongated styloid process as 34.9% in men and as 24.6% in women and there were no statistical differences between genders. In the study conducted on patients between 5 and 90 years of age, Bruno et al. found the prevalence of elongated styloid process as 33.4% and there were no statistical differences between genders (1). Also in Shakibaei et al (16) study there were no statistical differences between genders. In their study, they evaluated patients between the ages of 55 and 84 and with an average age of 61.8, Nalçacı and Mısırlıoğlu found styloid process length as  $28,60 \pm 12,69$  mm in panoramic radiograph and found the prevalence of elongated styloid process as 27%. They found that there was no association between right-left styloid process length and gender (14). In a study conducted on Turkish population older than 50 who consisted of edentulous patients, the rate of

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elongated styloid process was found as 4% (15). In our study, edentulous patients were between 52 and 88 years old and the average age was found as 70,96. Moreover, the posterior dentate patients were between 51 and 90 years old and the average age was found as 70,6. In our population, the elongated styloid process was found as 16.5%, and it was found as 19% in edentulous patients and as 14% in posterior dentate and there were no statistical differences between these groups ( $P > 0.05$ ). There were also no statistically significant differences between genders and right and left sides in terms of the prevalence of elongated styloid process in our study ( $P > 0.05$ ).

Okabe et al. found the length of styloid process than 80 as minimum 0 and maximum 153 mm and as 36.7 mm on the average. Furthermore, they found an association between elongated calcified styloid process and serum calcification concentration (17). In their study conducted on edentulous patients, Scaf et al. found the prevalence of elongated styloid process as 11% in men and as 13,2% in women, and 12.6% in all groups. They recommended the investigation of elongated styloid process in patients with syndrome and occlusal disorder (11). In our study, considering that occlusal forces would be more irregular in edentulism when compared with the patients with posterior tooth contact, the elongated styloid process was compared in these two groups. In our study, no statistical difference was found although the elongation rate was high in edentulous patients. The average lengths of

styloid processes were found to be close in both groups and there were no statistical differences between them. Similar to the results of our study, Magat et al. also found that there was no association between the dental status resulting from edentulism and elongated styloid process (18).

## Conclusion

It was found that edentulism had no effect on the length of the styloid process. In addition, it was found that elongated styloid process rates were not different between males and females and right and left sides in individuals between 51 and 90 years of age.

## Conflict of interest

The authors report no conflict of interest.

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