THE LENGTH OF STYLOID TUBEROCITY IN PANORAMIC RADIOGRAPHY OF AN IRANIAN POPULATION: A PRELIMINARY STUDY

Shapour Yaripour¹, Abbas Shokri², Amir Hossein Mohamadi Mofrad³*, Ziba Ghorveii Nosrat⁴, Payam Amini⁵, Farshid Vahdatinia⁶

¹Assistant professor, Department of Oral and Maxillofacial Surgery, Hamadan University of Medical Sciences, Hamadan, IR Iran.
²Associate professor, Dental Research Center and Department of Oral and Maxillofacial Radiology, Hamadan University of Medical Sciences, Hamadan, IR Iran.
³Resident, Department of Oral and Maxillofacial Surgery, Hamadan University of Medical Sciences, Hamadan, IR Iran.
⁴Dentist, Hamadan, IR Iran.
⁵Ph.D. Student of Biostatistics, Department of Biostatistics & Epidemiology, Hamadan University of Medical Sciences, Hamadan, IR Iran.
⁶Dentist, Hamadan, IR Iran.

Email: mohamadimfrad.amir@yahoo.com

Received on 12-07-2016

Abstract

Background: Styloid is a cylindrical oseous appendages which is located anterior to stylomastoid foramen in tympanic part of temporal bone and extended downward and forward.

Objective: the aim of the present study was to assess the length of styloid tuberocity in panoramic radiography of an Iranian population.

Material and methods: The present cross-sectional study was carried out in the department of Oral and Maxillofacial Surgery, School of Dentistry, Hamedan. In this study, a total of 2000 digital panoramic graphs collected from five private radiological centers located in various cities of Iran such as Hamedan, Shiraz, Yazd, Sari, and Tabriz, were assessed. From them, 1138 (531 male and 607 female) had inclusion criteria of the study and others did not satisfied these criteria were excluded from the study.

Results: The length of styloid tuberocity was categorized in three groups of short (shorter than 20 ml), normal (between 20-30 ml), and tall (higher than 30 ml). The results revealed that the prevalence of short styloid type was 11 percent in the left side and 10.9 percent in the right side. Moreover, the prevalence of normal styloid type was 67.7 percent in the left side and 68.1 percent in the other side. Finally, it was observed that the prevalence of tall styloid was 21.4 and 21 percent
in left and right sides, respectively. Furthermore, there was a significant correlation between age and the length of styloid tuberocity so that the length of styloid increased as age raised.

The length of this tuberocity was higher in men than women.

**Conclusion:** It can be concluded from the present study that age and sex has a significant effects on the length of styloid tuberocity.

**Key words:** Styloid tuberocity, Temporal bone, Panoramic view.

**1. Background**

Styloid is a cylinder-shaped hard attachment situated ahead of stylomastoid foramen in tympanic portion of temporal bone. Its projections go descending and frontward. Muscles and ligaments attached to this tuberocity have a crucial part in eating and mastication (1). It is rooted from the the second pharyngeal arch which has four portions including tympanohyale, stylohyale, ceratohyale, and hypohyale. These sections establish the styloid complex (1-3). Styloid complex includes three chief sections; styloid tuberocity, styloid ligament, and little horn of hyoid bone (2). Styloid tuberocity is situated in the parapharyngeal cavity in the purlieu of vascular and neural constructions which could be motivated by lengthened or inappropriate styloid tuberocity and grounds several complications (4). Calcification of the styloid tuberocity begins before birth and continues up to eight years of age (4). The length of this tuberocity varies significantly in various populations and also differs among people of the same population (4-6). Furthermore, the normal length of the tuberocity seems to be in the range from 20 to 30 mm (1-3), while there are also studies that described this range as between 20-25 mm (2). However, Eagle has outlined that the normal length of styloid tuberocity is in a range from 25 to 30 mm (4). In the cases that the length of the tuberocity is higher than 30 mm, it is called an elongated tuberocity (1, 5). Some studies have reported that almost four percent of world population is suffering from an elongated styloid tuberocity (6, 7). Nevertheless, some studies have explained that the prevalence of this type of styloid tuberocity is as high as 28 percent (1). In addition, it is observed that the prevalence of elongated styloid tuberocity is higher on the right side in comparison to its prevalence in the left side which can be attributed to a higher activity of the right hemi mandible in right-hand people during chewing (4). There several methods by which the tuberocity is measurable, panoramic radiography is a popular one (6). Panoramic radiography is normally applied for diagnosing abnormalities related to the facial structure such as mandible or maxilla. It can also be used for assessing the styloid tuberocity, which is
justifiable financially. Elongated styloid tuberocity and mineralization of stylohyoid ligament are detectable using panoramic radiography in two to twenty eight percent of cases (5, 8). In addition to the panoramic radiography, three-dimensional images are another effective way for assessing the length, angle, and shape of this tuberocity (9).

2. Objective

Considering the fact that the length of this tuberocity is different in different populations, the aim of the present study was to measure the length of the tuberocity in Iran based on the panoramic graphs collected from five big cities of Iran (10, 11). It should be emphasized that the present study is a preliminary one and further researches in this area will be conducted in the following studies.

3. Martial’s and methods

This cross-sectional study was carried out in Hamedan, Iran, during 2014 and 2015.

3.1. Data and requirements

In the present study, at first, 2000 digital panoramic graphs were collected from five private centers of radiography located in five big cities of Iran including Hamedan, Shiraz, Yazd, Sari, and Tabriz. Next, a preliminary evaluation was conducted on each of them to assess if they had the inclusion criteria of the study. Measurability of the length of the tuberocity in both left and right sides was the only inclusion criterion taken in to account in the present study. 1138 diagrams showed th criterion which included 399 diagrams from Hamedan, 350 diagrams from Shiraz, 87 diagrams from Sari, 204 diagrams from Yazd, and 607 diagrams from Tabriz.

3.2. Measuring the length of the styloid tuberocity

Two radiologists assessed the graphs and measured the length of the styloid tuberocity separately. The distance between the tympanic part of the temporal bone and the terminal of its bone was regarded as the length of the tuberocity. In the panoramic radiographs a thin radiolucent line is observed between the upper parts of styloid tuberocity and the tympanic part of the temporal bone. The measurement was conducted from the middle of this line. The bony end of the styloid could have the classified part of styloid ligaments. All the diagrams studied using Scanora programmer. The software had millimeter ruler which was utilized for measuring the length of the tuberocity. 20 graphs were arbitrarily designated and measured again by experts and this process was conducted for assessing the inter-observer error with a statistics power of 90 percent and a minimum correlation of 50 percent. SAS software package version 9.1 were used for data analysis.
3.3. Variables of the study

Sex, age, and the length of styloid tuberocity were the variables of the study. From the 1138 digital panoramic graphs assessed in the present study, 46.7 percent (531 ones) were from males and 53.3 percent (607 ones) were from females. In order to assess the association between the length of this tuberocity and age of people from who the graphs were obtained, age was categorized in three main groups; 8-20 years old, 20-40 years old, and 40-80 years old. Moreover, three groups were made for categorizing the length of styloid tuberocity. Styloid with a lower than 20 mm length was considered as short styloid. Length between 20 and 30 mm were considered as regular styloid. Length upper than 30 mm were considered as lengthened styloid.

4. Results

We conducted 1138 digital panoramic graphs for evaluation and measuring the length of styloid. A short type of styloid on the left side was observed among 11 percent of graphs, while the prevalence of this type of styloid in right side was observed to be 10.9 percent. The prevalence of the normal styloid in left and right sides were 67.7 and 68.1 percent, respectively. Furthermore, the elongated styloid in the left and right sides of the graphs were observed to be 21.4 and 21 percent, respectively. The average value of styloid length in the right side was equal to 26.35 ±6.13, while in the left side the average value was 61.7±6.11. The minimum length observed in the left side was 10.2 mm and the maximum was 55.5 mm, while these values for the right side were observed to be 10.2 and 61.7 mm, respectively. These data are represented on Table 1.

Table 1.

<table>
<thead>
<tr>
<th>Styloid side</th>
<th>Number</th>
<th>Average value</th>
<th>Std. deviation</th>
<th>The minimum value</th>
<th>The maximum value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left side</td>
<td>1138</td>
<td>26.3993</td>
<td>6.10632</td>
<td>10.2</td>
<td>61.7</td>
</tr>
<tr>
<td>Right side</td>
<td>1138</td>
<td>26.3529</td>
<td>6.12894</td>
<td>10.2</td>
<td>55.5</td>
</tr>
</tbody>
</table>

The correlation between age and the length of the tuberocity was evaluated using Pearson correlation coefficient. This test revealed that age and the length of styloid tuberocity on both sides had a significant correlation so that the length of styloid tuberocity was increased with increasing age. These results are presented in Table 2.
Table 2. The correlation between age and the length of styloid in both sides.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Age</th>
<th>The length of styloid in left side</th>
<th>The length of styloid in right side</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1</td>
<td>0.307**</td>
<td>0.321**</td>
</tr>
<tr>
<td>The length of styloid in left side</td>
<td>0.307**</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>The length of styloid in right side</td>
<td>0.321**</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

** the correlation is significant at the level of 0.01

The average length of styloid in right and left sides of males were 27.13 and 27.32 mm, respectively. Moreover, these values for females were 25.67 and 25.59 mm, respectively. The difference between males and females in terms of the length of styloid was so significant that the length of styloid was higher among males than females (p-value<0.01).

Pearson's independence test was employed to assess the relationship between the length of styloid and age groups. The results indicated that there was a significant relationship between these two variables (p-value<0.01).

5. Discussion

The present study was set to evaluate the length of the styloid tuberocity in Iran. Investigations were conducted on 1138 digital panoramic graphs collected from five big cities of Iran. The results of the present study revealed that with increasing age the length of styloid also increased. Moreover, the length of this tuberocity was higher in males in comparison with that of females. The average length of the tuberocity in right and left sides of males were 27.13 and 27.32, respectively. Whereas, these values among females were 25.67 and 25.59 mm. In the study carried out by Konstantinos Natsis (4) in a Greek population, 149 adult skulls were examined, but no significant association was found between age, gender, and the length of styloid, which were in contradiction with the results obtained from the present study. Jung et al (12) also conducted a study in this vein, they found that the association between age and gender with the length of this tuberocity was significant, which were in line with the results we obtained in this study. Mirshekar et al (13) also obtained results which were very similar to our findings, they also reported that the length of styloid significantly increased as age increased, and the length of this tuberocity was significantly higher among males than females. In the study carried out by Ardakani et al (14), the reported average length of styloid is higher than that of the present study and, moreover, they did not find any significant association between age or gender and the length of this tuberocity, so the
results were not in an agreement with what we observed in the present study. Based on previous studies, an abnormal length of styloid would be expected among 1.3-28 percent of a specific population, however, what was obtained in the present study is higher than thirty percent (15-17). It should be noted that in the present study styloid was classified as normal if its length was within a range from 20 to 30 mm. In this regard, Eagle described that a normal styloid should have a length between 25 and 30 mm (16), while Kaufman et al (18) regarded those with a length higher than 30 mm as normal. Correll et al (15) in 1979 conducted some investigations on mineralization of styloid complex. In that study, the normal length of styloid was considered to be 25 mm and any sign of mineralization in the styloid ligament was considered to be an abnormality, which differed with what in the present study was regarded as normal steroid. Similar to the present study, Ferrario et al (19) also outlined that there was a positive correlation between age and styloid length. Likewise, Krenmair et al (20) also found a positive correlation between these two variables. As age increases, styloid would undergo calcification, which can be considered as a possible explanation of observing a higher length of styloid in elders. However, Krenmair et al (20) did not observed a significant association between gender and the length of this tuberocity which differed from the findings of the present study. Rizzatti et al (21) also reported that the elongated styloid tended to be more prevalent among old aged persons, which were analogous to our results. The same results also reported by Zangouei et al (22). Moreover, in contrast to the present study, Okebeet al (6), Correll et al (15), and Rizzatti et al (21) reported that the length of styloid was not significantly different between the left and right sides. Accordingly, it seems to be logical that the prevalence of abnormal styloid found in the present study was different from those reported by other studies, because, in addition to the different populations, different criteria have been applied by different studies for distinguishing abnormal styloid from a normal one.

6. Conclusion

It was found from the present study that the length of styloid was higher among males in comparison with females. Moreover, there was found a significant association between age and styloid length, so that the older the age, the higher the length of styloid. As a conclusion, when physicians examine patients suffering from pain in the head or neck should pay a special attention to this abnormality. Finally, considering the high prevalence of this abnormality and its association with Eagle's syndrome, it is recommended that the association between the length of styloid and systemic diseases in which there is an interference with the calcification metabolism can be a subject for further researches in this area.
References


Corresponding Author:
Amir Hossein Mohamadi Mofrad,
Department of Oral and Maxillofacial Surgery,
Hamadan University of Medical Sciences, Hamadan, IR Iran.
Email: mohamadimfrad.amir@yahoo.com