Received: 18th June 2015 Accepted: 17th September 2015 Conflicts of Interest: None

Source of Support: Nil

Original Research

Length, Types and Patterns of Calcification of Stylohyoid Complex: A Retrospective Radiographic Study

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How to cite the article:

Raviraj J, Satish G, Divya KT, Reddy V, Shetty SB. Length, types and patterns of calcification of stylohyoid complex: A retrospective radiographic study. J Int Oral Health 2015;7(11):67-70.

Abstract:

Background: (1) To determine the prevalence of elongated styloid process in Tirupati population, (2) to determine the distribution of types/patterns of calcification of stylohyoid complex, (3) to determine the influence of age, sex, and elongation of styloid process on types/patterns of stylohyoid complex calcification.

Methods: A 430 digital panoramic radiographs (860 measurements) were assessed retrospectively for length, types/patterns of calcification of stylohyoid complex. Age and sex correlation with elongation of the styloid process and types/patterns of stylohyoid complex calcification were assessed and subjected to statistical analyses.

Results: The 148 (17.3%) had elongated styloid process in Tirupati population. Mean length of stylohyoid complex of the total sample and mean length of the elongated styloid process were 21.59 mm and 38.13 mm respectively in Tirupati population. Amongst the elongated styloid processes the "uninterrupted" type; "partially calcified" pattern of Langlais and "E" pattern of MacDonald-Jankowski's were the most prevalent in the present study population.

Conclusions: (1) Age had a statistically significant positive correlation with elongation of styloid process, (2) the difference in length of stylohyoid complex, elongated styloid process, types/patterns of calcification were statistically insignificant between males and females, (3) calcification of ceratohyal region of stylohyoid complex could contribute to elongated styloid process.

Key Words: Age, panoramic radiograph, stylohyoid complex, styloid process

Introduction

Styloid process is a thin, bony projection that arises from lower surface of temporal bone and projects in an antero-inferior direction bilaterally. Stylohyoid complex consists of styloid process, the stylohyoid ligament, and the lesser cornu of the hyoid bone.[1]

Calcification/ossification of stylohyoid ligament can contribute to elongated styloid process, which in turn can lead to eagle's syndrome.[2,3] However, studies have reported that elongated styloid process need not always produce symptoms resembling Eagle's syndrome.[4,5] Hence, this study was done to assess the prevalence of type of elongation and pattern of calcification according to Langlais *et al*.[6] and MacDonald-Jankowski's[7] criteria in asymptomatic individuals of Tirupati population. Further, the influence of age, sex, elongation of styloid process on the type and patterns of calcification of stylohyoid complex were assessed. No such studies were reported from this geographic region of India.

Methods

Ethical Clearance and patient's informed consent were obtained for the present study. 430 digital panoramic radiographs of oral radiology department obtained from patients with routine dental complaints except for orofacial pain were included in the present study. Radiographs of patients with orofacial pain complaint were excluded since the present study was designed to evaluate the status of stylohyoid ligament complex in asymptomatic patients and it is a well-known fact that symptoms related to Eagle's syndrome, caused due to elongated styloid process, can mimic dental/orofacial pain. These radiographs were obtained from Newtom Giano (Italy) radiographic machine which uses charged coupled device detectors, with standard exposure parameters. 860 (right and left of 430 patients) measurements were done using the software provided by the manufacturer with measuring tools (Figure 1). We adopted the methodology used by Ilgüy *et al*.[8] in measuring the length of the stylohyoid complex. Measurements exceeding 30 mm were considered as an elongated styloid process. The Langlais type, Langlais pattern and MacDonald-Jankowski's patterns of calcification of stylohyoid complex were noted down for each patient in a Microsoft Excel 2007 and subjected to statistical analysis using SPSS 16.01 software. An additional group of "others" were included in the present study and any type/pattern of calcification that did not belong to the original description

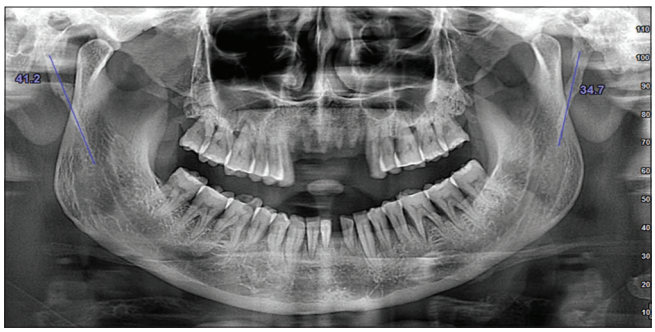

Figure 1: Photograph of panoramic radiograph showing measurement of the length of stylohyoid complex using the software.

by Langlais and MacDonald-Jankowski types/patterns were included in this category.

Results

Since the difference between mean values of right and left measurements of the stylohyoid complex were statistically insignificant, 860 stylohyoid complex measurements were obtained. However, out of these 860 measurements, four measurements and type/patterns of calcifications could not be assessed due to poor visibility of stylohyoid complex in the panoramic radiographs. Hence, 856 measurements were considered for statistical analysis. The results of the present study are presented in Tables 1-6. The mean length of stylohyoid complex in Tirupati population was 21.59 mm. The most prevalent was "uninterrupted" type amongst Langlais type of calcification; "completely calcified" amongst Langlais pattern of calcification and "D" pattern amongst the MacDonald-Jankowski's pattern of calcification of stylohyoid ligament in Tirupati population. No statistical significance was observed between males and females length, type and pattern of calcification of stylohyoid complex. However, a definite positive correlation was observed between age and length of stylohyoid complex.

Table 1: Comparison of mean age between elongated styloid and normal styloid length groups.

Age of the Individual	Length				*P* value*
	≤30 mm		>30 mm		
	Mean	SD	Mean	SD	
Age	30.92	15.25	38.13	14.06	<0.001* Significant

*Based on independent sample '*t*' test, SD: Standard deviation

Table 2: Correlation of age with length of stylohyoid complex.

Stylohyoid complex – side	Statistical values
Right	
Pearson correlation	0.358**
P value	<0.001
Left	
Pearson correlation	0.395**
P value	<0.001
Total	
Pearson correlation	0.355**
P value	<0.001

**Correlation was considered significant at the 0.01 level (two-tailed)

Table 3: Comparison of elongated styloid process between males and females.

Length of the stylohyoid complex	Sex (*N* (%))		*P* value*
	Male	Female	
Length			
≤30 mm	388 (84.2)	320 (81.0)	0.224
>30 mm	73 (15.8)	75 (19.0)	

*Based on Chi-square test

Table 4: Comparison of mean length of a stylohyoid complex between males and females.

Stylohyoid complex –side	Sex				*P* value*
	Male		Female		
	Mean	SD	Mean	SD	
Side					
Right	22.26	9.71	21.08	11.22	0.246
Left	21.99	10.15	20.84	10.67	0.259
Total	22.13	9.92	20.96	10.94	0.103

*Based on independent sample '*t*' test, SD: Standard deviation

Discussion

The length of stylohyoid complex varies from individual to individual. The normal length varies usually between 2.5 and 3.0 cm. The mean length of stylohyoid complex in the present study was 21.59 mm, which was comparable to values obtained by Patil *et al.*[9] Out of 856 measurements, 148 (17.3%) had elongated styloid processes with mean length of 38.1 mm. This was comparable with prevalence rate of 19.4% in a study by More and Asrani, 2010.[10] However, other studies had reported different prevalence rates of 24.8%[11] and 52.1%.[5]

The prevalence of elongated styloid process in more with the progressing age; the mean age of the individuals with the elongated styloid process was significantly higher compared to the group with normal stylohyoid length. Moreover, a positive correlation between age and length of stylohyoid complex was found (Tables 1 and 2). The calcification of stylohyoid ligament could be considered as an important contribution toward an increase in the length of the stylohyoid complex.

There was no significant difference between male and female mean stylohyoid complex length and elongated stylohyoid processes in our study (Tables 3 and 4). Such similar observations were also made by Bagga *et al.*[5] Prevalence of type/patterns of calcifications of the stylohyoid complex was also statistically insignificant between males and females.

The most prevalent type of calcification in our study was uninterrupted type, which consisted of 59.8% and was comparable to results in the previous studies.[4,5] Amongst the Langlais patterns, "partially calcified" variety and amongst the MacDonald-Jankowski's patterns, "D" pattern was the

Table 5: Prevalence of types/patterns of calcification of stylohyoid complex and their distribution between females and males.

Types and patterns of stylohyoid complex	Total sample *N* (%)	Sex (*N* (%))	
		Female	Male
Langlais types			
No data	4 (0.5)	1 (0.3)	3 (0.6)
Others	210 (24.4)	117 (29.5)	93 (20.0)
Pseudo articulated	35 (4.1)	12 (3.0)	23 (5.0)
Segmented	97 (11.3)	42 (10.6)	55 (11.9)
Uninterrupted	514 (59.8)	224 (56.6)	290 (62.5)
Langlais patterns			
No data	4 (0.5)	1 (0.3)	3 (0.6)
Calcified outline	72 (8.4)	24 (6.1)	48 (10.3)
Completely calcified	146 (17.0)	80 (20.2)	66 (14.2)
Nodular	4 (0.5)	4 (1.0)	0 (0.0)
Others	83 (9.7)	47 (11.9)	36 (7.8)
Partially calcified	551 (64.1)	240 (60.6)	311 (67.0)
MacDonald Jankowski's patterns			
No data	4 (0.5)	1 (0.3)	3 (0.6)
A	22 (2.6)	14 (3.5)	8 (1.7)
B	134 (15.6)	64 (16.2)	70 (15.1)
C	82 (9.5)	28 (7.1)	54 (11.6)
D	415 (48.3)	170 (42.9)	245 (52.8)
E	68 (7.9)	41 (10.4)	27 (5.8)
F	8 (0.9)	7 (1.8)	1 (0.2)
G	9 (1.0)	5 (1.3)	4 (0.9)
H	8 (0.9)	4 (1.0)	4 (0.9)
I	12 (1.4)	7 (1.8)	5 (1.1)
J	4 (0.5)	1 (0.3)	3 (0.6)
L	81 (9.4)	45 (11.4)	36 (7.8)
Others	13 (1.5)	9 (2.3)	4 (0.9)

Table 6: Distribution of types/patterns of stylohyoid complex based on length.

Types and patterns of stylohyoid complex	Length (*N* (%))	
	≤30 mm	>30 mm
Langlais types		
Others	206 (29.1)	4 (2.7)
Pseudo articulated	21 (3.0)	14 (9.5)
Segmented	71 (10.0)	26 (17.6)
Uninterrupted	410 (57.9)	104 (70.3)
Langlais patterns		
Calcified outline	59 (8.3)	13 (8.8)
Completely calcified	129 (18.2)	17 (11.5)
Nodular	2 (0.3)	2 (1.4)
Others	83 (11.7)	0 (0.0)
Partially calcified	435 (61.4)	116 (78.4)
MacDonald-Jankowski's patterns		
A	22 (3.1)	0 (0.0)
B	133 (18.8)	1 (0.7)
C	64 (9.0)	18 (12.2)
D	370 (52.3)	45 (30.4)
E	2 (0.3)	66 (44.6)
F	4 (0.6)	4 (2.7)
G	6 (0.8)	3 (2.0)
H	7 (1.0)	1 (0.7)
I	4 (0.6)	8 (5.4)
J	4 (0.6)	0 (0.0)
L	81 (11.4)	0 (0.0)
Others	11 (1.6)	2 (1.4)

most prevalent (Table 5) which was comparable to previous reports.[4,11,12]

A new and interesting observation was obtained in the present study which included the increased prevalence of "E" pattern (44.6%) in individuals with elongated styloid process compared to normal styloid length group which had a predominance of "D" pattern of calcification (52.3%) (Table 6). "E" pattern of calcification indicates "Regions 1, 2 and 3 continuous" according to MacDonald-Jankowski's patterns of calcification of stylohyoid complex,[7] "Region 1" is tympanohyal alone, "Region 2" is stylohyal alone and "Region 3" is ceratohyal alone. This means that when the ceratohyal region of stylohyoid complex undergoes calcification, as in pattern E, it contributes to greater prevalence of elongated styloid process, as observed in the present study. Okabe *et al.*[11] had reported similar observation of highest prevalence of E pattern of calcification in their study. However, no specific mention regarding the prevalence of pattern of calcification amongst the elongated styloid process group was made in their study.

Conclusion

Few important observations could be made from the present study.

A. Mean length of stylohyoid complex in the present study was 21.59 mm and the mean length of elongated styloid processes was 38.13 mm.

B. Age had significant positive role in the elongation of styloid process.

C. The difference in length of stylohyoid complex, elongated styloid process, types and patterns of calcification were statistically insignificant between males and females.

D. Amongst the elongated styloid processes the "uninterrupted" type; "partially calcified" pattern of Langlais and "E" pattern of MacDonald-Jankowski's were the most prevalent in the present study population.

E. Calcification of "ceratohyal" region of the stylohyoid complex could be an important contributing factor toward elongation of the styloid process.

Acknowledgments

We sincerely thank Dr. Kiranmai, Post-graduate Student, Department of Oral Medicine and Radiology, CKS Theja Institute of Dental Sciences and Research, Tirupati for her contribution in performing the measurements. We would also like to thank Dr. Kalyan Chakravarthy, Associate Professor, Department of Community Dentistry, Manipal Dental College, Manipal for performing statistical analysis for this study.

References

1. Murtagh RD, Caracciolo JT, Fernandez G. CT findings associated with Eagle syndrome. AJNR Am J Neuroradiol 2001;22(7):1401-2.
2. Taheri A, Firouzi-Marani S, Khoshbin M. Nonsurgical treatment of stylohyoid (Eagle) syndrome: A case report. J Korean Assoc Oral Maxillofac Surg 2014;40(5):246-9.
3. Thoenissen P, Bittermann G, Schmelzeisen R, Oshima T, Fretwurst T. Eagle's syndrome-A non-perceived differential diagnosis of temporomandibular disorder. Int J Surg Case Rep 2015;15:123-126.
4. Sudhakara Reddy R, Sai Kiran CH, Sai Madhavi N, Raghavendra MN, Satish A. Prevalence of elongation and calcification patterns of elongated styloid process in south India. J Clin Exp Dent 2013;5(1):e30-5.
5. Bagga MB, Kumar CA, Yeluri G. Clinicoradiologic evaluation of styloid process calcification. Imaging Sci Dent 2012;42(3):155-61.
6. Langlais RP, Miles DA, Van Dis ML. Elongated and mineralized stylohyoid ligament complex: A proposed classification and report of a case of Eagle's syndrome. Oral Surg Oral Med Oral Pathol 1986;61(5):527-32.
7. MacDonald-Jankowski DS. Calcification of the stylohyoid complex in Londoners and Hong Kong Chinese. Dentomaxillofac Radiol 2001;30(1):35-9.
8. Ilgüy D, Ilgüy M, Fisekçioglu E, Dölekoglu S. Assessment of the stylohyoid complex with cone beam computed tomography. Iran J Radiol 2012;10(1):21-6.
9. Patil S, Ghosh S, Vasudeva N. Morphometric study of the styloid process of temporal bone. J Clin Diagn Res 2014;8(9):AC04-6.
10. More CB, Asrani MK. Evaluation of the styloid process on digital panoramic radiographs. Indian J Radiol Imaging 2010;20(4):261-5.
11. Okabe S, Morimoto Y, Ansai T, Yamada K, Tanaka T, Awano S, *et al*. Clinical significance and variation of the advanced calcified stylohyoid complex detected by panoramic radiographs among 80-year-old subjects. Dentomaxillofac Radiol 2006;35:191-9.
12. Lins CC, Tavares RM, da Silva CC. Use of digital panoramic radiographs in the study of styloid process elongation. Anat Res Int 2015;2015:474615.