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ORIGINAL ARTICLE

Investigation of elongated styloid process prevalence in patients with torus palatinus

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Abstract The aim of the current study was to determine the presence of styloid process elongation (SPE) detected on panoramic radiographs in patients with torus palatinus (TP). Between December 2005 and November 2007, a total of 149 patients with TP are investigated for routine dental examination in the outpatient clinic. Any patient who had disorders related to calcium and phosphorus metabolism was excluded. All medical data were obtained from the files. Twenty (15%) subjects demonstrated SPE at least one side. These patients consisted of 15 women (14.3% of all women) and five men (17.8% of all men). In our previous report performed in normal population at the same region, the prevalence had been found to be 7.7% in 698 dental patients. Although the number of the patients is different in both studies, there is a marked difference in terms of the SPE prevalence between the two reports. This prevalence difference might be related to concomitant disorder.

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Introduction

Torus palatinus (TP) is a bony prominence that occurs in the middle third of the midline of the hard palate. This oral exostosis is not a disease or a sign of disease. However, if TP is large, it may be a problem in the construction and wearing of dentures [2, 3, 19, 20]. TP is asymptomatic, grows slowly during the second and third decades of life, and often goes unnoticed until middle age [3, 10, 19]. TP occurs in about 20% of the population [20]. Although a large number of researches have tried to clarify the influence of genetic, environmental, nutritional, and climatologic factors, there is still no consensus on the etiology of TP [3, 10, 20].

The styloid process (SP) is a cylindrical, long cartilaginous bone located on the temporal bone. There are many nerves and vessels such as carotid arteries adjacent to the SP [3, 5]. The normal SP length is approximately 20–30 mm [9, 15, 18]. The styloid process elongation (SPE) can be assumed if either the SP or the adjacent stylohyoid ligament ossification shows an overall length in excess of 30 mm [5, 9, 12–14, 16, 18]. The reported radiographic prevalence of the SPE varies in the literature [12, 14, 22]. In a study performed in the same region and normal population, the prevalence was detected as 7.7% [9]. Elongated SP is known as Eagle's syndrome when it causes clinical symptoms as neck and cervicofacial pain [3, 7, 12, 15, 20]. It is supposed that this symptoms and signs are due to the compression of the SP on some neural and vascular structures. The exact cause of the elongated SP is not clear [16, 18]. In a study, it was shown that there was a

significant correlation between the serum calcium (Ca) concentration, heel bone density, and the SP length among 80-year-old subjects [17].

In the present study, our aim was to investigate SPE prevalence in patients with TP. To our knowledge, this is the first study investigating the relationship between two disorders in the literature.

Materials and methods

Between December 2005 and November 2007, a total of 149 patients with TP are investigated for routine dental examination in the outpatient clinic. The examination of the TP was assessed by clinical inspection and palpation, performed by YS. The patients who have questionable TP were not enrolled. These patients are investigated for SPE by panoramic radiography (PR). The PRs of these patients had originally been taken for routine examination. Any questionable PR was not included. It was not necessary to seek ethical approval, as the PRs were essential for the routine clinical evaluation. Any patient who had disorders related to Ca and phosphorus (P) metabolism was excluded. All medical data were obtained from the files.

All PRs were obtained with an Orthopantomograph® OP100 (Instrumentarium Corp. Imaging Division, Tuusula, Finland). They were processed according to the manufacturer's recommendations in an automatic film processor and were evaluated by the same author (YS). For mineralized stylohyoid, complexes and lengths of bilateral SPs were evaluated using the measurement method of the study of Jung et al. [13]. In brief, the measurements were taken on the temporal bone's frontal side. A thin transparent line is usually imagined between the SP shadows and the tympanic bone in this area on the PRs. This transparent line corresponds to the cleft between the SP and the temporal bone's tympanic plate [13, 17] (Fig. 1a–c). The tip of the SP is its bony end including calcified parts of the ligament. All the PRs were viewed in subdued ambient light using transmitted light from a standard viewbox. The lengths of the SPE variants were measured using a true-to-scale radiometric ruler (magnification factor, 1.4). The radiographs were investigated and the measurements performed by the same author (YS). To check the intra-observer variations, measurements were repeated after some weeks on a subset of 50 PRs. Deviations of the mean length of the SP between first and second measurements were <1.5%. The length of SP and/or stylohyoid ligament which are longer than 30 mm were considered to be SPE [5, 9, 12–14, 16, 18].

Statistical analysis

Data are presented as mean±SD. Statistical evaluation of the data was carried out using the Statistical Package for Social Sciences (SPSS® version 15.0; SPSS, Chicago, IL, USA). The Student's *t* test was used for statistical analysis. Values of *P* less than 0.05 were accepted as statistically significant.

Results

A total of 149 patients with TP were enrolled in the current study. The TP of nine patients who have co-disorders related to Ca and P metabolism and seven patients who have questionable PRs were not included. The PRs were excluded whether radiograph quality is not good enough,

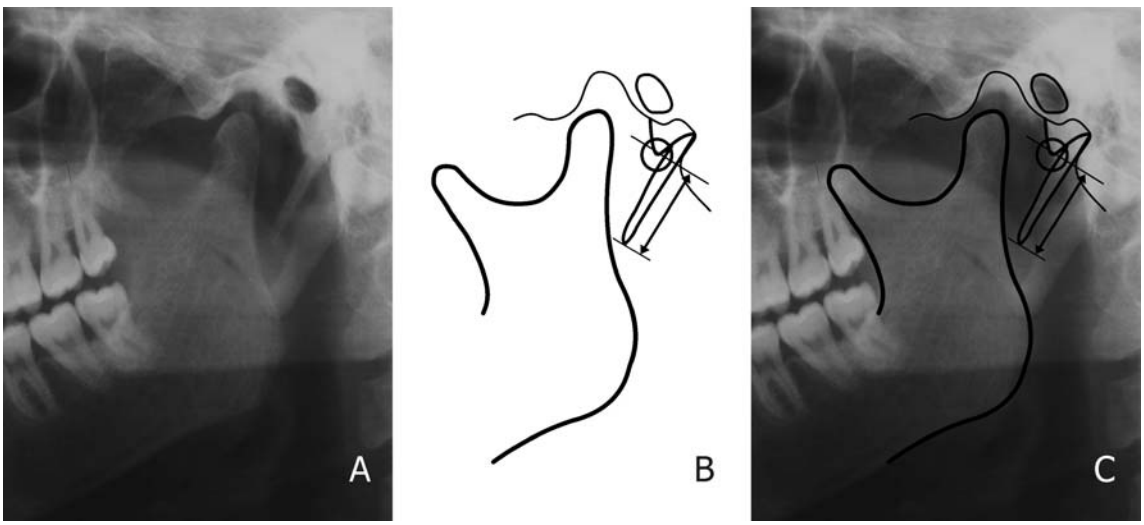

Fig. 1 **a–c** The styloid process length was measured using anatomical landmarks on the panoramic radiographs in subjects with torus palatinus (based on Jung et al. [13])

stylohyoid complex was not clearly identified and superimposed on the temporal bone. Therefore, 133 patients with TP were included. This population consisted of 105 women and 28 men, with a mean overall age of 44.2±14.3 years (range 18–87 years).

The mean age and SP length of the patients with SPE were 43.8±16.6 years (range 19–80 years) and 33.2± 1.9 mm, respectively. No significant difference in mean age between the patients with SPE (43.8±16.6 years) and the patients without SPE (45.1±14.1 years) was detected (P= 0.7). Twenty (15%) subjects demonstrated SPE at least one side. These patients consisted of 15 women (14.3% of all women) and five men (17.8% of all men). The majority of these abnormalities (16, 12%) were unilateral, with six (4.5%) occurring on the right and ten (7.5%) on the left side. The remainder (n=4, 3%) were bilateral.

Discussion

Torus palatinus is an exostosis of the hard palate localized along the median palatine suture, involving both the processi palatini and the os palatinum [3, 20]. TP occurs in about 20% of the population. However, some studies have shown marked differences in racial groups [20]. It was reported between 20.9% to 30.9% in Turkish populations [4, 21]. It was also found that females have a higher prevalence of TP [3, 4, 10, 19–21].

The elongated SP and structural changes in stylohyoid ligament with its clinical symptoms were first described by Eagle. Therefore, it is also known as the Eagle's syndrome [7, 12, 15, 16]. The symptoms and signs with this syndrome are due to the anatomic relationship between the SP and its surrounding structures. More uncommonly, symptoms such as dysphagia, tinnitus, and otalgia may occur in patients with this syndrome [3, 5]. It may also cause reversible cerebral ischemia due to the compression of carotid arteries [6].

Bone mineral density (BMD) determinations are generally used for diagnosing and following up the patients with osteoporosis. There is a low bone mass and increased risk for bone fracture in this disorder [2]. Dual X-ray absorptiometry is the gold standard for the diagnosis of osteoporosis. Inheritance has a major role for peak adult bone mass [1, 2]. Hjertstedt et al. [11] evaluated the relationship of torus mandibularis and palatinus in relation to BMD in 101 women and 129 men over 70 years of age in 2001. There was a significant relationship between the presence of torus mandibularis and BMD at the femoral neck and trochanter. Belsky et al. [2] investigated the correlation between the presence and especially the size of palatal tori and increased BMD. It was shown that there is a significant relation for postmenopausal females between BMD and torus palatinus size after controlling various factors effecting bone density. They recommended that the hard palate examination should be considered a routine part of the physical examination in postmenopausal females.

In another study, Okabe et al. [17] investigated clinical significance and variation of calcified stylohyoid complex (SPE) on PRs among 80-year-old individuals. It was found that there are correlations between the length of the calcified SPE and serum calcium concentration and heel bone density. It was suggested that SPE may be a predictor of BMD and high serum Ca level. In the present report, we found the SPE prevalence as 15% in 133 subjects with TP. However, in our previous report performed in normal population at the same region, the prevalence was found to be 7.7% in 698 dental patients [9]. Although the number of patients is different in both studies, there is a marked difference in terms of the SPE prevalence between the two reports. This prevalence difference might be related to concomitant disorder.

Conclusion

Most of the subjects have dental problems and a PR is noninvasive, cheap and routine for the evaluation of dental problems. SPE can be easily diagnosed on these radiographs. Elongated SP may cause many disorders such as Eagle's syndrome and reversible cerebral ischemia. In the previous reports, there was a significant correlation between the serum Ca concentration, heel bone density, and SP elongation [8, 17]. Therefore, SPE might be a predictor of peak bone mass. However, further studies and large and homogeneous (postmenopausal females) samples are needed to clarify this correlation. To our knowledge, this is the first study investigating the relationship between two disorders in the literature.

Conflict of interest I/We have no conflicts of interest to declare in relation to this article.

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