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REVIEW ARTICLE

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Clinical implications of the styloid process elongation: What the dental practitioner should know

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ABSTRACT

The styloid process (SP) is a subtle osseous projection that arises from the undersurface of the temporal bone. It forms, with the styloid ligament and the lesser cornu of the hyoid bone, the stylohyoid chain. SP offers attachment to different muscles and ligaments and is surrounded by major nerves and vessels. Elongation of the SP is an uncommon condition. Some patients with elongated SP may experience a set of symptoms referred to as Eagle syndrome. The latter symptoms develop as a consequence of an aberrant SP irritating nearby anatomic structures. Eagle syndrome diagnosis is challenging; various imaging techniques are helpful in identifying the SP elongation, among them panoramic radiographs and three-dimensional images like computed tomography and cone beam computed tomography scans, which allow for better visualization. Depending on the severity, surgical or conservative treatment options are available for Eagle syndrome. However, it is advised to start out conservatively.

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Introduction

The styloid process (SP) is a slender cylindrical osseous structure that projects anteroinferiorly from the undersurface of the temporal bone, just in front of the stylomastoid foramen. It gives attachments to the stylohyoid, styloglossus, and stylopharyngeus muscles and to the stylohyoid and stylomandibular ligaments. Major nerves and vessels surround the SP. The glossopharyngeal nerve (CN IX), the vagus nerve (CN X), the accessory nerve (CN XI), the internal jugular vein, and the internal carotid artery are all medial to it. The occipital artery and the hypoglossal nerve (CN XII) run next to its lateral side [1,2].

The SP develops from Reichert's cartilage, which derives from the second pharyngeal arch, through endochondral ossification in late pregnancy and during the first 10 years of life [1,3]. It reveals individual variations in length, angulations, and other morphological features. Even though these differences are frequently discovered by chance, some patients may experience a set of symptoms referred to as Eagle syndrome. The latter symptoms develop as a consequence of an aberrant SP irritating or compressing nearby structures [1].

Anatomical Description of the SP

The SP is needle-like, cylindrical, and gradually tapering in thickness. Its root is enclosed inside the vaginal process, which is located on the lower surface of the petrous segment of the temporal bone. It constitutes, together with the styloid ligament and the lesser cornu of the hyoid bone, the stylohyoid chain [1,4].

Possible Anatomical Changes of the SP

The length of the SP varies between individuals and often between the two sides of the same individual [5]. It is typically between 20 and 30 mm, and a longer SP is considered elongated [5–7]. Other studies, such as the one conducted by Omami [4], have

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suggested that the SP's size is normal as long as it does not extend below the mandibular foramen (Fig. 1).

A number of theories have been brought up to elucidate the etiology and mechanism of SP elongation [5]. Many researchers suggested a congenital cause; others, though, claimed that calcification or ossification of the stylohyoid ligament for imprecise reasons is behind this elongation; moreover, it has been proposed that the growth of bony tissue at the insertion site of the stylohyoid ligament might be the cause [1,4,7].

Epidemiological Characteristics of the Elongated SP

The incidence of elongated SP has been assessed in many populations using diverse techniques [4,8–11]. Custodio et al. [2], Natsis et al. [6], Vadgaonkar et al. [12], and Sakaew et al. [13] evaluated the SP elongation on dry skulls in Brazilian, Greek, Indian, and Thai populations, respectively. On the other hand, panoramic radiographs were used in several studies, including those by Kursoglu et al. [14] on the Turkish population, More and Asrani [15] on the Indian population, Shaik et al. [16] on the Saudi population, and Al-Khateeb et al. [17] on the Jordanian population. In addition, some researchers used advanced imaging techniques: Cullu et al. [18], Gözil et al. [19], and Basekim et al. [20] assessed SP elongation in samples of the Turkish population using computed tomography (CT), while Andrei et al. [21] and Oztunç et al. [22] used cone beam computed tomography (CBCT) in samples from Romania and Turkey, respectively.

SP elongation is slightly more frequent in women than in men [4,10,23,24]. Its prevalence is globally estimated to range from 4% to 30% [1]. However, differences between populations exist. For instance, it was reported to be 15.5% by Aoun et al. in a Lebanese sample [10], 17.2% by Omami in a sample of Libyans [4], 8.6% in a Hong Kong Chinese sample, and 7.8% in an English sample by MacDonald and Jankowski [11]. Elongated SP may occur unilaterally or bilaterally [10,15,24,25].

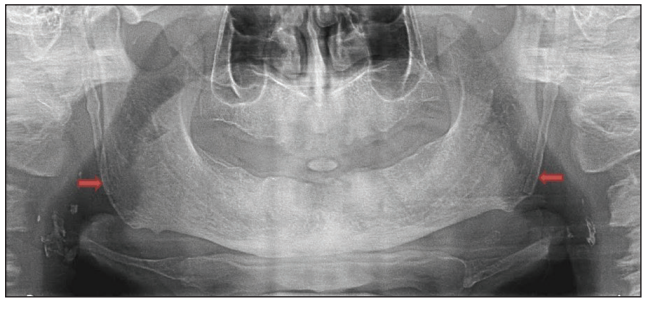

Figure 1. A digital panoramic radiograph showing a bilaterally elongated SP (arrows).

Elongated SP and Related Pathologies

Eagle syndrome

Generally, elongated SPs do not produce any symptoms. Only 4%–10.3% of the cases present with clinical symptoms defining the Eagle syndrome, also known as styloid or stylohyoid syndrome [5]. When symptomatic, elongated SPs are described as showing a mild-to-no correlation with pain intensity and clinical complications [26]. For Camarda et al. [27], there is no connection between calcification or ossification degree and clinical symptoms.

Eagle syndrome's most frequent symptoms (Table 1) are dysphagia and cervicofacial pain, possibly caused by the compression of nearby nerves [12]. Furthermore, tinnitus, neuralgia (usually of the trigeminal or glossopharyngeal nerves), and radiating pain in the ear, orbit, and maxilla are uncommon symptoms that may be present [12,28–30]. When Eagle syndrome is suspected, reproducing the patient's reported pain is of essential clinical significance. Actually, it may be highly beneficial to lightly press the SP with the index finger across the tonsillar fossa intra-orally; if the result of the palpation is positive, this is in favor of a clinical diagnosis of Eagle syndrome [29,31,32].

Eagle syndrome differential diagnosis comprises tonsillitis, dysphagia, and/or odynophagia for other reasons; trigeminal and/or glossopharyngeal neuralgia; giant cell arteritis; migraine; temporomandibular disorders; myofascial pain affecting the neck and masticatory muscles; and cervical arthritis [33–35].

Table 1. Signs and symptoms of elongated SP.

Signs and symptoms of Eagle syndrome
Common
– Dysphagia
– Cervicofacial pain
Less common
– Tinnitus
– Radiating pain in the ear, orbit, and maxilla
– Neuralgia (usually of the trigeminal or glossopharyngeal nerves)
Exceptional
– Mini-strokes and carotid dissection (stylocarotid syndrome)
– Decreased cerebral perfusion, higher intracranial pressure, and higher risk of cerebral hemorrhage (Eagle-jugular syndrome)

Stylocarotid and Eagle-jugular syndromes

Elongated SP can compress the carotid arterial system, resulting in mini-strokes and, in exceptional circumstances, carotid dissection [36]. This condition, known as stylocarotid syndrome, is habitually distinguished by pain and recurrent syncope provoked by cervical movements, particularly rotational [36]. On the other hand, compressions of the internal jugular vein and the dural spaces, reported as the Eagle-jugular syndrome, may eventually lead to decreased cerebral perfusion, higher intracranial pressure, and a higher risk of cerebral hemorrhage [33,37]. For that reason, patients are asked to refrain from adopting positions that further compress any of these vital structures to reduce the danger of the aforementioned issues [38,39].

Radiological Identification of Elongated SP

Various imaging techniques can be used to identify the SP elongation. Panoramic radiographs, lateral skull view radiographs, and nonangled and angled posteroanterior skull radiographs are among these techniques. Besides, three-dimensional images such as CT and CBCT scans permit complete, detailed visualization (length, angulation, and relation to neighboring structures) [15,18,20,40].

Management of Symptomatic Elongated SP

Depending on the severity, surgical or conservative treatment options are available for Eagle syndrome. However, it is advised to start out conservatively. Conservative therapy entails injecting steroids or long-lasting anesthesia in the lesser section of the tonsillar fossa [3,23]. Surgical treatment can be performed via an extra-oral or intraoral approach. The extra-oral approach permits better visualization but is more complex and time-consuming and leaves a visible scar. The intraoral approach reduces the operative time and allows for the use of a local anesthetic; nevertheless, poorer visibility puts the neck's major vessels in danger and raises the possibility of bacterial contamination [1,41].

Conclusion

In routine dental practice, digital panoramic radiographs used for diagnostic purposes may fortuitously reveal elongated SP. Dental professionals need to be aware of this disorder to prevent misinterpreting the symptoms associated with Eagle syndrome.

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