

Received: 2020.08.18

Accepted: 2021.04.13

Available online: 2021.04.26

Published: 2021.05.29

Ossification of Pterygospinous Ligament: An Incidental Finding in Cone Beam Computed Tomography

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Conflict of interest: None declared

Patient: Female, 35-year-old
Final Diagnosis: Ossification of the pterygospinous ligament
Symptoms: No symptoms
Medication: —
Clinical Procedure: —
Specialty: Anatomy • Dentistry • Neurology • Neurosurgery • Radiology

Objective: Rare disease**Background:** Ossification of the pterygospinous ligament (PSL) is an osseous variation occasionally observed in the extra-cranial region of the foramen ovale. It occurs in 1% to 31.2% of the population. The etiology of this condition remains unclear. However, its presence in the skulls of children suggests a hereditary nature. PSL ossification has not been reported in studies on incidental findings in cone beam computed tomography of the maxillofacial region, probably owing to the unfamiliarity with this rare finding. The correct radiographic identification of PSL ossification is crucial as it may produce various neurological disturbances or interfere with surgical procedures involving the infratemporal fossa.**Case Report:** Herein, we present a case of PSL ossification in an asymptomatic 35-year-old woman that was detected as an incidental finding in a cone beam computed tomography for implant treatment planning and discuss the clinical significance of this condition.**Conclusions:** Although this osseous variant is well known in the anatomical literature, we believe it is rarely discussed among dentists. Healthcare providers, especially dentists, should rule out PSL ossification when a patient presents with a neurological disturbance of unknown causes.**Keywords:** Cone-Beam Computed Tomography • Ligaments • Ossification, HeterotopicFull-text PDF: <https://www.amjcaserep.com/abstract/index/idArt/928061>

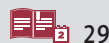
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Background

The cranial base contains several ligaments that connect parts of the sphenoid bone, such as the interclinoid, petroclinoid, pterygospinous (PSL), and pterygoalar ligaments [1]. The PSL, described by Civinini in 1829, is a ligament formed by fascial thickening between the medial and lateral pterygoid muscles. The PSL originates from the pterygospinous process in the superior aspect of the posterior border of the lateral pterygoid plate and courses inferiorly to the spine of the greater wing of the sphenoid bone in the infratemporal fossa.

The PSL may undergo complete or partial ossification. PSL ossification is a normal osseous variant, and its etiology is unclear. It occurs in children and adults; therefore, a genetic factor may contribute to its formation [1-3]. Partial ossification forms an osseous bar medial to the foramen ovale, known as a pterygospinous bar or a Civinini bar, named after the Italian anatomist Civinini. When completely ossified, the PSL forms a Civinini foramen or a pterygospinous foramen located medially or inferiorly to the foramen ovale. Neural and vascular innervations, such as the medial pterygoid vessels, the lingual nerve, and the motor branches of the mandibular nerve, pass through this foramen [1-5]. Studies on the prevalence of this anatomic variant have been conducted on dry skulls of people of different ethnic backgrounds [2,3,6-11]. One study found that PSL ossification is more common in male predominance and the prevalence of complete ossification and partial ossification is widely variable, at 1% to 31.2% [2].

PSL ossification is of clinical and surgical importance. It can contribute to several clinical symptoms due to the compression of neurovascular structures [12-14]. An ossified PSL can entrap the lingual nerve and chorda tympani, resulting in altered taste in the anterior two-thirds of the tongue, numbness of the lingual gingiva, and pain during jaw movement [14-17]. With the contraction of the pterygoid muscles, entrapment of the motor branches of the mandibular nerve between the ossified ligament and the muscles can lead to mandibular neuralgia during chewing in the region supplied by the nerve, paresthesia, and weakness of the supplied muscles [18,19]. Compression of the neurovascular structures in the region of the foramen ovale may cause trigeminal neuralgia [19,20]. Shaw [20] speculated that PSL ossification might alter the course of the accessory meningeal artery as it angles underneath the foramen ovale. As a result, blood flow disturbance and ischemia of some trigeminal ganglion neurons may occur. In addition, an ossified PSL can be an obstacle in different anesthetic and surgical procedures [5,12,21].

Cone beam computed tomography (CBCT) is extensively used for various dental applications because of its advantages of dose reduction, compared with that of multidetector computed

tomography, elimination of superimposition, short scan time, and high spatial resolution [22]. The cranial base is commonly captured in CBCT imaging for various dental indications. Although several researchers have described pterygospinous bars and foramina in anatomical literature [1-21], studies on incidental findings in the CBCT of the head and neck region make no mention of this anatomical variation, probably owing to the unfamiliarity with this rare structure [23-27]. In a study on incidental findings in CBCT that included 1000 CBCT examinations, Allareddy et al [27] found that only 57 scans had no osseous abnormalities or incidental findings. They visualized 77 different incidental findings in 943 scans, and no mention was made of the PSL ossification. We speculate that the lack of reporting of PSL ossification in dental literature is due to a lack of knowledge and awareness among dentists about this normal variant. Additionally, such a cranial base finding can be easily overlooked owing to the complexity of the cranial base anatomy and its location outside the region of interest and expertise of dental professionals. In this study, we describe a case of PSL ossification detected incidentally in CBCT imaging of the maxillofacial region. We report this case to highlight the importance of examining the entire CBCT volume, regardless of its clinical indication, and to discuss the clinical significance of this osseous variant so that clinicians consider it in the differential diagnosis when patients present with facial neuralgia.

Case Report

An asymptomatic 35-year-old woman visited our oral and maxillofacial surgery clinic at an academic-based dental hospital and requested a dental implant for a missing right mandibular first premolar (Figure 1). The patient's medical history was not significant. A CBCT examination was performed using an i-CAT Classic® scanner (Imaging Sciences International, Hatfield, PA, USA). The imaging parameters were as follows: 8×16 cm field of view (FOV) and 0.4 mm voxel size.

The axial sections of the CBCT images demonstrated a unilateral linear, uneven, high-density structure extending posteriorly from the right lateral pterygoid plate (Figure 2). Unfortunately, whether the ligament was completely or incompletely ossified could not be determined. Because the FOV was centered over the mandible for mandibular implant treatment planning, only the inferior aspect of the ossified PSL was captured at the superior margin of the CBCT volume. Following the concept of as low as reasonably achievable (ALARA), performing another CBCT scan to visualize the entirety of the ossified PSL was not justified since the patient was asymptomatic.

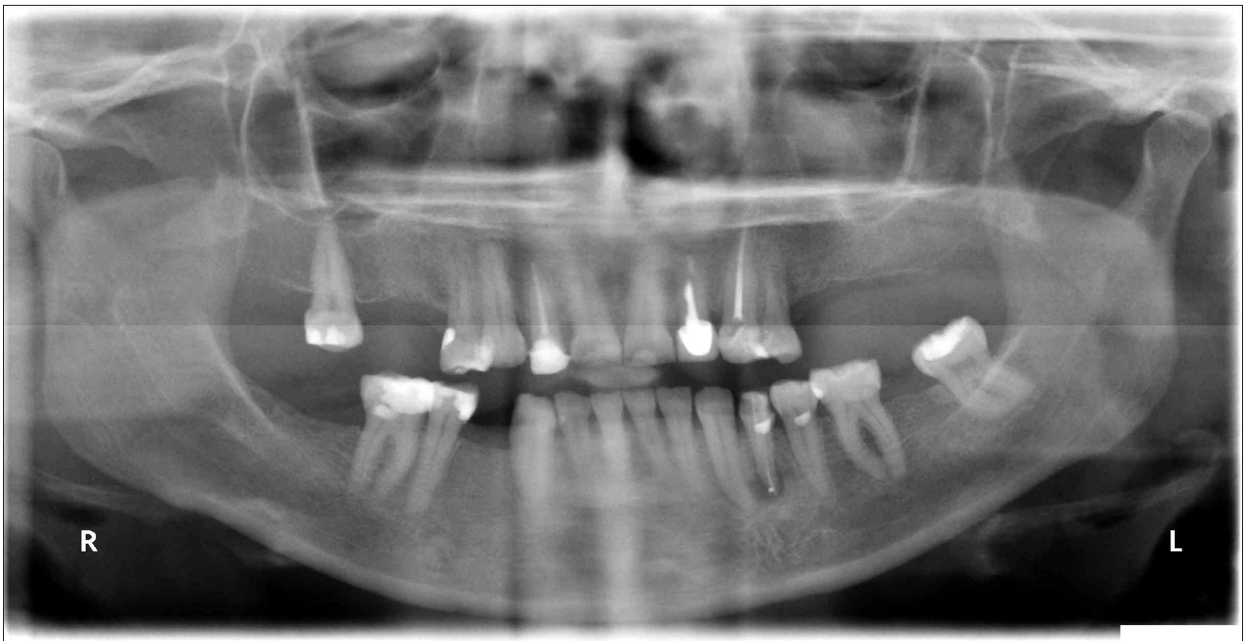


Figure 1. Panoramic image acquired for the initial assessment of implant sites.



Figure 2. (A) Axial and (B) 3D rendering inferior view of CBCT images demonstrating the presence of pterygospinous ligament ossification extending from the right lateral pterygoid plate (white arrows). (C) 3D rendering superior view CBCT image showing the most superior aspect of the CBCT volume acquired.

Discussion

PSL ossification is an anatomical variant of the skull base described thoroughly in anatomical studies involving dry skulls. PSL ossification is hereditary and has shown variable distribution in populations of different ethnic groups. In a meta-analysis of 14 000 skulls, it was found that the prevalence of partial and complete PSL ossification was 11.6% and 4.4%, respectively [3]. Tebo first described the ossification of the PSL in panoramic radiographs in 1968 and demonstrated PSL ossification in panoramic radiographs of a dried skull and a 28-year old patient [28]. The PSL ossification appeared on the panoramic radiograph as an extension from the posterior border of the lateral pterygoid plate.

Despite the widespread use of CBCT in the dental field, no studies have reported the prevalence of PSL ossification in CBCT examinations of the maxillofacial region. Many studies have discussed incidental findings on the large-FOV CBCT imaging of the maxillofacial region [23-27]. Barghan et al [23] examined 400 scans for incidental findings in and around the skull base area. The authors identified 653 incidental findings, of which soft-tissue calcifications (29.71%) and intracranial calcifications (27.1%) were the most common. In a recent systematic review by Monsarrat et al [29], the authors identified 70 retrospective studies discussing incidental findings in CBCT. PSL ossification was not identified in any of the retrospective studies on incidental findings in CBCT [23-27,29]. To the best of our knowledge, Kabak et al [13] were the first to

identify PSL ossification in vivo using CBCT, reporting 3 cases of PSL ossification: 1 patient had neurological symptoms due to lingual nerve entrapment and 2 patients were asymptomatic. Similar to our finding, the PSL ossification was identified as a linear bone-like structure of uneven thickness connecting the posterior edge of the lateral pterygoid plate to the spine of the sphenoid in the axial sections [13].

Although PSL ossification is described in several anatomic studies, its prevalence, possible symptoms, and complications are rarely described in the dental literature. When completely ossified, the PSL forms a pterygospinous foramen on the medial aspect of the infratemporal fossa. Lingual nerve compression might occur and lead to anesthesia and loss of taste in the anterior two-thirds of the tongue, anesthesia of the lingual gingiva, and pain related to speech articulation [14-17]. In addition, it can compress the mandibular nerve, thus causing pain during mastication [18]. The presence of an ossified PSL may result in the development of trigeminal neuralgia. Identifying PSL ossification in CBCT imaging could be useful in the diagnosis of a potential etiology of trigeminal neuralgia.

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Anatomical knowledge of PSL ossification is beneficial for anesthesiologists and maxillofacial surgeons. The limited space between the lateral pterygoid plate and the spinous process of the sphenoid bone when PSL is partially ossified can interfere with surgical access to the parapharyngeal and retropharyngeal spaces [5]. It can also limit access to the infratemporal fossa, thus impeding needle insertion during the anesthetic procedure in the treatment of trigeminal neuralgia [3,20].

Conclusions

PSL ossification is a normal osseous variant that can be identified incidentally in CBCT of the maxillofacial region. It is rarely discussed among dentists despite its potential clinical significance. All healthcare professionals dealing with the diagnosis and management of facial neuralgias should be alerted to the potential of PSL ossification, especially when the cause of the patient's symptoms is not clear.

Conflicts of Interest

None.

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