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The “sand watch” mandible

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The lingual surface of the mandible’s body is commonly indicated as presenting the submandibular and sublingual fossae, which are separated by the mylohyoid line. The mylohyoid line attaches to the mylohyoid muscle (MM). Less attention has been paid to the ‘mylohyoid boutonnières’, which allow the ‘sublingual buttons’ to pass through the mylohyoid muscle in the submandibular space. The cone-beam computed tomography files of patients were routinely examined for anatomical studies. Two cases were found with unexpected morphologies of the mandible’s body — the mylohyoid lines were incomplete anteriorly, and herniated sublingual tissue determined an additional fossa inferior to that line in the premolar region. That fossa was termed the ‘accessory submandibular fossa’. It determined on coronal slices a ‘sand watch’ contour of the mandible’s body. With such a peculiar morphology, the mandible is more prone to fracture. Moreover, when inserting endosseous implants, the procedure should be carefully personalised in such rare cases. (Folia Morphol 2023; 82, 2: 424–428)

Key words: mandible, cone-beam computed tomography, mental foramen, premolar teeth, sublingual fossa, endosseous implants

INTRODUCTION

On the internal surface of the mandible’s body is the mylohyoid line, which separates the submandibular and sublingual fossae and normally courses toward the digastric fossa (Fig. 1). The lingual tuberosity (LT) appears as a bony shelf located lingual to the mandibular molars in some individuals, at the posterior extremity of the mylohyoid line [8]. Greatly enlarged LTs prevent the proper denture base extension [8]. Commonly, the LT does not extend on the lingual side of the mandibular premolars. The two fossae are occupied, respectively, by the submandibular and sublingual glands. The mylohyoid line is the origin of the mylohyoid muscle (MM), which is an anterior suprahyoid muscle separating the submandibular and sublingual spaces [14]. A deficiency or hiatus on the part of the MM could lead to the penetration of the sublingual glands [10]. This was found in up to 42% of 150 cadavers [10, 13].

We hereby report an unexpected morphology for the mandible’s body in which the mylohyoid line was incomplete anteriorly and the herniated sublingual tissue determined an additional fossa inferior to that line, in the premolar region.

MATERIALS AND METHODS

The archived cone-beam computed tomography (CBCT) files of 2 patients, a 56-year-old male and

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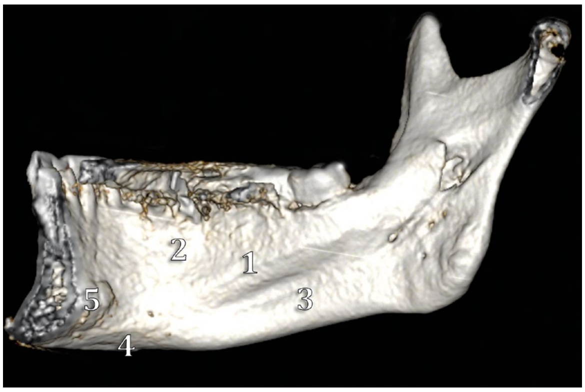

Figure 1. Internal view of a normal right hemimandible. Three--dimensional computed tomography volume rendering; 1 — mylohyoid line; 2 — sublingual fossa; 3 — submandibular fossa; 4 — digastric fossa; 5 — mental spine.

a 61-year-old female were documented for a peculiar morphology of the mandible. The subjects were routinely scanned, according to the manufacturer instructions using an iCat CBCT machine (Imaging Sciences International [Hatfield, PA, USA]) with the settings: resolution 0.250, field of view 130, and image matrix size 640 × 640. The CBCT files were exported as single uncompressed DICOM files, which were analysed with the Planmeca Romexis Viewer 3.5.0.R software, as in other previous studies [17–19]. There were evaluated the 2-dimensional planar cuts as well as 3-dimensional volume renderings. Relevant results were exported as image files (*.tif). The patients have given written informed consents for use of medical data if anonymised. The responsible authorities (2nd affiliation of the 2nd author) approved the study (approval no. 372/18.03.2020).

RESULTS

In the first case, the male (Fig. 2), the mandible was completely dentate. On the inner aspect of each hemimandible, left and right, LTs were found at the level of all molars. The posterior segments of the mylohyoid lines were applied on the LTs. At the level of the molars, the submandibular fossae were identified. However, on each side, the mylohyoid line continued toward the mental spine, not descending toward the digastric fossa. Beneath that line and anterior to the submandibular fossa accessory submandibular fossae, left and right, were identified in the premolar regions. Both mylohyoid lines were indented correspondingly. On each side, the mental foramen was located at the level of the second mandibular premolar. On coronal cuts through the mental foramina, on each side, a "sand watch" contour of the mandible was identified due to the lingual cortical plate of the accessory submandibular fossa, which reached extremely close to the respective mental foramen.

In the second case, the female (Fig. 3), the mandible was partly edentulous. On the right side, the 1st mandibular premolar and all the molars were missing. On the left side, the 2nd premolar and the 3rd molar were missing. The inner side of each hemimandible had an evident mylohyoid line just in the posterior regions, at the level of the molars. At the level of the premolars, on each side, accessory submandibular fossae were found. As in the other case, the coronal cuts revealed a "sand watch" aspect of the mandible's body. In this case, as in the previous one, the coronal cuts revealed incomplete mandibular attachments of the MMs, allowing protrusions of the sublingual tissues (sublingual buttons) to descend and occupy the accessory submandibular fossae.

DISCUSSION AND CONCLUSIONS

Gaughran (1963) [6] observed, in dissections of the submandibular space, a 'mass of tissue lying between the mandible laterally and the MM medially', which was seen 'to continue through the MM, passing into the paralingual compartment'. He documented the standard gross anatomy textbooks at that time and observed that this anatomical condition was described by Henle (1871), Poirier (1900), Eisler (1912), Quain (1923), Morris (1942), Testut and Latarjet (1948), Pernkopf (1952), Lanz and Wachsmuth (1955), and Meyer (1958) (all quoted in [6]). Gaughran [6] also studied previous reports and found that the first hint regarding a hiatus on the part of the MM belongs to Forget (1870) (quoted in [6]). The following observation on the part of Gaughran, in 1963, is still valid: 'Looking at the clinical literature concerned with anatomical studies of the submandibular and paralingual regions one obtains the overwhelming impression of a complete mylohyoid barrier between the two compartments.' When Gaughran studied 162 cadavers (324 half-heads), he found, in 36.1%, 'distinct masses of tissue resting on the inferior surface of the mylohyoid muscle', which he termed sublingual buttons located either in the anterior half or in the anterior two thirds of the MM, in the cleft between that muscle and mandible's body [6]. Therefore, such sublingual buttons can *bona fide* determine the bone accessory submandibular fossae, such as those report-

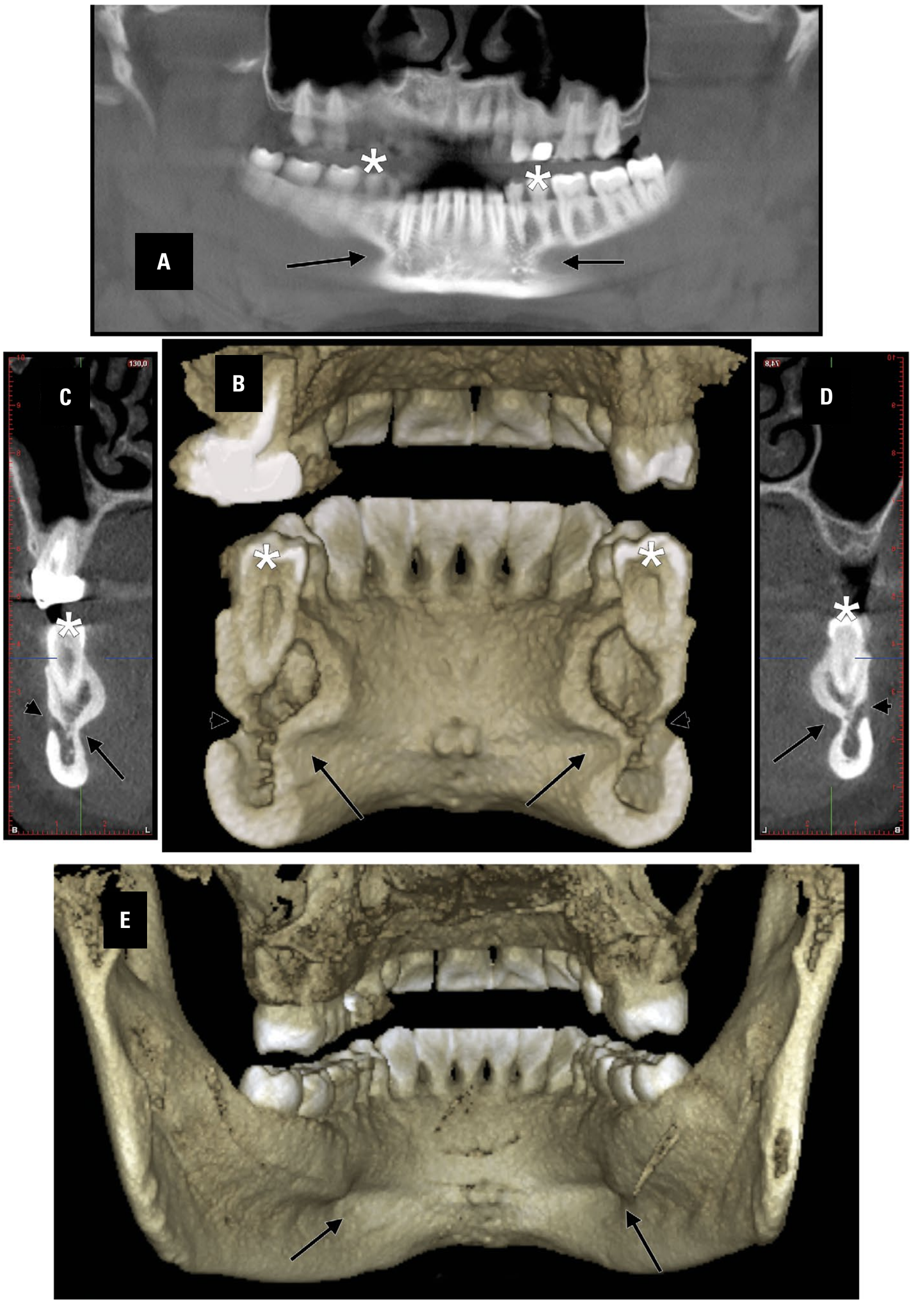

Figure 2. Case 1. The bilateral anomalous morphology of the "sand watch" mandible is documented on digital orthopantomogram (**A**), coronal cuts, 3-dimensional rendering (**B**, posterior view) and orthogonal (**C**, left side; **D**, right side), and complete 3-dimensional rendering (**E**, posterior view). The arrowheads indicate the mental foramen, the arrows indicate the deep accessory submandibular fossae beneath the premolar alveoli. The 2nd mandibular premolar is indicated (*).

ed here. Most of these buttons were processes of the sublingual gland, which penetrated the MM through a "mylohyoid boutonnière" and occurred bilaterally in just 19% of cases [6]. Through that boutonnière were also found, exclusively, fat herniations [6]. Branches of the submental vessels were also found within the boutonnière [6, 13, 22]. In just 0.9% of cases, neither glandular tissue nor fat was found within the boutonnière of the MM [6]. Double sublingual buttons were found, with one being fatty and the other being glandular [5].

The prevalence of the mylohyoid boutonnière was reviewed by Ahmed et al. (2009) [1] and ranged from 30% to 80%. However, Windisch et al. (2004) [21] found herniations and deficiencies of the MM in just 12.2% of 205 cadavers. To our knowledge, sublingual

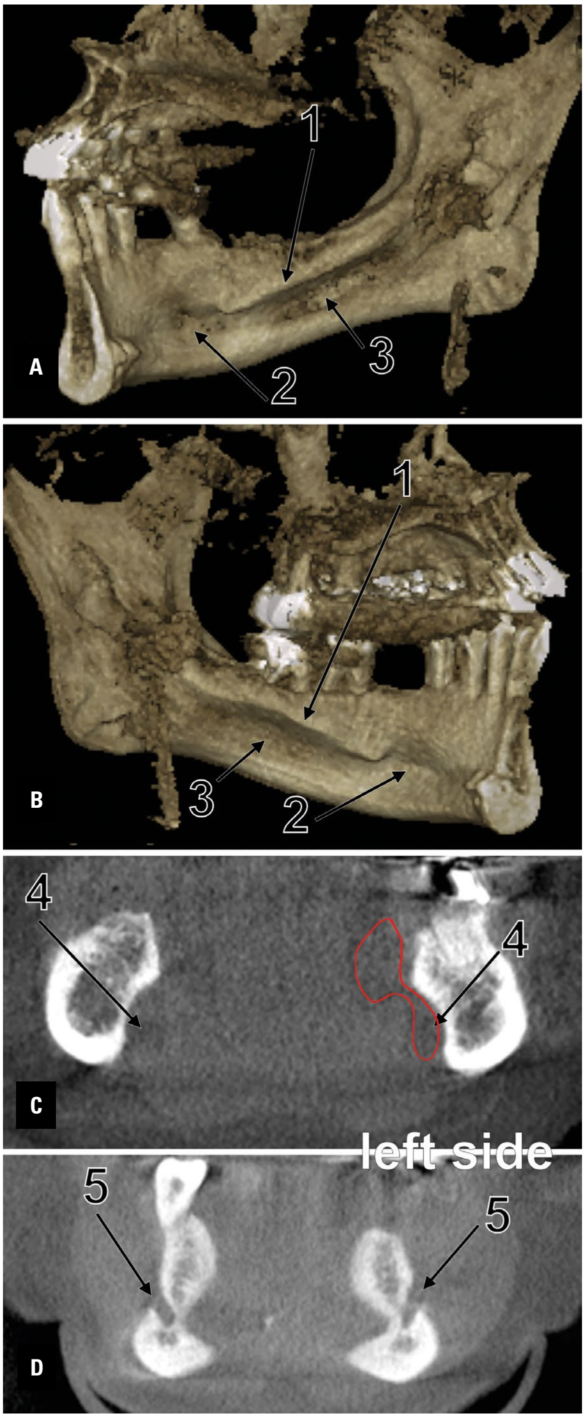

Figure 3. Case 2. Three-dimensional renderings of the right (**A**) and left (**B**) hemimandible. Coronal cut through the accessory submandibular fossa (**C**). Coronal cut at the level of the mental foramina — the "sand watch" aspect of the mandible (**D**); 1 — mylohyoid line; 2 — submandibular fossa; 3 — accessory submandibular fossa; 4 — bilateral sublingual buttons; 5 — mental foramina.

buttons were not previously observed to determine accessory submandibular fossae on the body of the mandible [13, 20, 21].

The accessory submandibular fossae we found occurred bilaterally. This could be suggestive of developmental symmetry on the part of the mylohyoid boutonnières. Such unexpected fossae of the inner cortical plate of the body of mandible, if unidentified, increase the risks of iatrogenic events during the placement of endosseous implants in the mandible; therefore, the pronounced lingual concavity of the bony plate should be taken into account and correlated with the length and inclination of an implant inserted in the premolar region of the mandible.

The region of the sublingual fossa is highly vulnerable to perforation during implant placement procedures [11]. While perforating the lingual plate of the mandible in the molar region may damage the salivary gland, a perforation in the premolar area carries a much higher risk because the osteotomy drill may damage the arterial plexus formed by the sublingual and submental arteries. There are several cases reported in the literature with a potentially serious risk for the patient [4, 7, 12, 15], and this concavity of the mandible in the premolar area may predispose patients to this kind of accident [3].

Moreover, it is well-known that a severe complication related to endosteal implants is the fracture of the edentulous, resorbed mandible [2, 16]. The fragility of the mandible may increase not only in edentulous mandibles but also in "sand watch" mandibles, such as those reported herein. Overloading such a "sand watch" mandible could also lead to an unexpected fracture during mastication or during a traumatic event, such as violence or an accident. Such mandibular fractures more commonly occur in the weaker areas of the mandible [9].

Clinicians, as well as students and teachers, should pay attention to individual anatomical characteristics [23]. Such "sand watch" mandibles can be identified in CBCT, and the treatment plan for such should be personalised.

Conflict of interest: None declared

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