Case report

Anatomical variation of the anterior belly of the digastric muscle: case report and clinical implications

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Abstract

The digastric muscle is a suprahyoid muscle composed of two bellies connected by an intermediate tendon. This muscle participates in deglutition and mandibular movements. The anterior belly of the digastric muscle is localized superficially to the mylohyoid and deeply to the platysma muscle. During dissection of this region of an embedded cadaver, an accessory anterior belly of digastric muscle was observed bilaterally. The accessory bellies were similar but not symmetrical. They were composed of two segments, one long and one short, on both sides, and when observed together these appeared to form the letter "X". The accessory fibers, on both sides, originated from the anterior digastric muscle and inserted medially to the digastric fossa. Anatomic variations of the digastric muscle may influence mastication and deglutition. Moreover, the accessory digastric muscle affects diagnostic imaging and therapeutic procedures in head and neck surgery and must be considered in procedures involving this area.

Keywords: digastric muscle, accessory belly, anatomical variation.

1 Introduction

The digastric muscle is located in the suprahyoid region and frequently has two bellies. These bellies (anterior and posterior) are linked by an intermediate rounded tendon, which crosses the stylohyoid ligament and attaches to the hyoid bone. The anterior belly is attached to the internal surface of the mandible, in the digastric fossa. The posterior belly originates from the medial surface of the mastoid process of the temporal bone, in a deep groove between the mastoid process and the styloid process, called the digastric groove (WILLIANS, WARWICK, DYSON et al., 1989).

The geniohyoid and mylohyoid muscles, together with the anterior belly of the digastric muscle make up the floor of the mouth. The paired digastric muscles act together either depressing the mandible or elevating the hyoid bone (WIDMALM, LILLIE and ASH, 1988). They participate in deglutition by elevating the hyoid bone and in mastication by depressing the mandible, in addition to which they are involved in anterior or posterior neck flexion (WILLIANS, WARWICK, DYSON et al., 1989). Moreover, nowadays, the digastric muscle can be made use of in plastic surgery, where the digastric anterior belly transfer technique is employed to restore the depressor function of the lower lip in lesions of the facial nerve after tumor resection (TAN, 2002; TERZIS and TZAFETTA, 2009)

The anterior belly of the digastric muscle and the mylohyoid muscle develop from the first branchial arch and appear by the fourth week of intrauterine development, whereas the posterior belly originates from the second arch (ZIOLKOWSKI, MAREK and KLAK, 1984). The two bellies are innervated by different nerves, because they are derived from the mesenchyme of two different branchial arches. Thus, the anterior belly is innervated by the trigeminal nerve and the posterior by the facial nerve. The motoneurons that control the digastric anterior belly are located in the trigeminal motor nucleus which is found in the lateral pontine reticular formation surrounded by a ring of premotor neurons. It has been divided in two cytoarchitectonic regions according to jaw muscle innervation. The dorsolateral subdivision houses motoneurons innervating jaw closer muscles, and the ventromedial contains motoneurons innervating jaw opener muscles including the digastric anterior belly. This compartmentalization has been proposed based on the results of retrograde tracer injections in the masticatory muscles of various species (MIZUNO, KONISHI and SATO, 1975; MATSUDA, UEMURA, KUME et al., 1978; MIZUNO, MATSUDA, IWAHORI et al., 1981; UEMURA-SUMI, TAKAHASHI, MATSUSHIMA et al., 1982).

The anterior bellies of the digastric muscle divide the region between the hyoid bone and mandible into two triangles: the submandibular and the submental (HOLLINSHEAD, 1982). Laterally to the digastric muscle up to the mandibular base is located the submandibular space. The submental triangle consists of varying amounts of adipose tissue and submental lymph nodes. The anterior bellies of the digastric muscles form the lateral margins of this triangle. Anatomic variations in digastric muscles may affect diagnostic and therapeutic procedures in head and neck surgery; such abnormalities commonly occur in the submental triangle and have to be considered in imaging procedures of soft tissue masses and in operations involving this region (SARGON and CELIK, 1994; UZUN, ALUCLU and KAVAKLI, 2001; CELIK, ALDUR, OZDEMIR et al., 2002; AKTEKIN, KURTOGLU and OZTURK, 2003; SAKAMOTO and AKITA, 2004; OZGUR, GOVSA and OZGUR, 2007).

2 Case report

During dissection of the submental region of an approximately 40-year-old Brazilian male, indigent, embedded cadaver, an accessory anterior belly of the digastric muscle was observed.

The accessory bellies were observed bilaterally medially to the anterior digastric muscles. The bellies consisted of two segments: a long, anterior and a short, posterior, on both sides. Interestingly, when the muscle accessory bundles were observed together they appeared to form the letter "X" (Figure 1b, d). The accessory fibers, on both sides, originated from the anterior digastric muscle (Figure 1b, d) and were inserted medially to the digastric fossa. On the left side the long segment was 20 mm in length and 6 mm in width and the short was 10 mm in length and 9 mm in width. On the right side the long segment was 20 by 9 mm, while the short was 12 by 7 mm (length versus width, respectively). In the midline the accessory bellies were linked to each other by dense connective tissue that also connected these bellies to the mylohyoid muscle superiorly. The anterior belly of the digastric muscle on the left side measured 33 by 13 mm and on the right side 36 by 15 mm (length versus width, respectively).

3 Discussion

Variations in the digastric muscle have been reported in the posterior belly, intermediate tendon and in the anterior belly. Moreover, the complete absence of the anterior belly has already been described (LARSSON and LUFKIN, 1987; DE-ARY-PIRES, ARY-PIRES and PIRES-NETO, 2003; OZGURSOY and KUCUK, 2006).

The anterior belly of the digastric muscle develops from the first branchial (or pharyngeal) arch, while the posterior belly originates from the second arch (ZIOLKOWSKI, MAREK and KLAK, 1984). It is possible that during embryological development some of the neural crest cells composing the first pharyngeal arch undergo an aberrant migration leading to the development of an accessory anterior belly (LOUKAS, LOUIS, KAPOS et al., 2005).

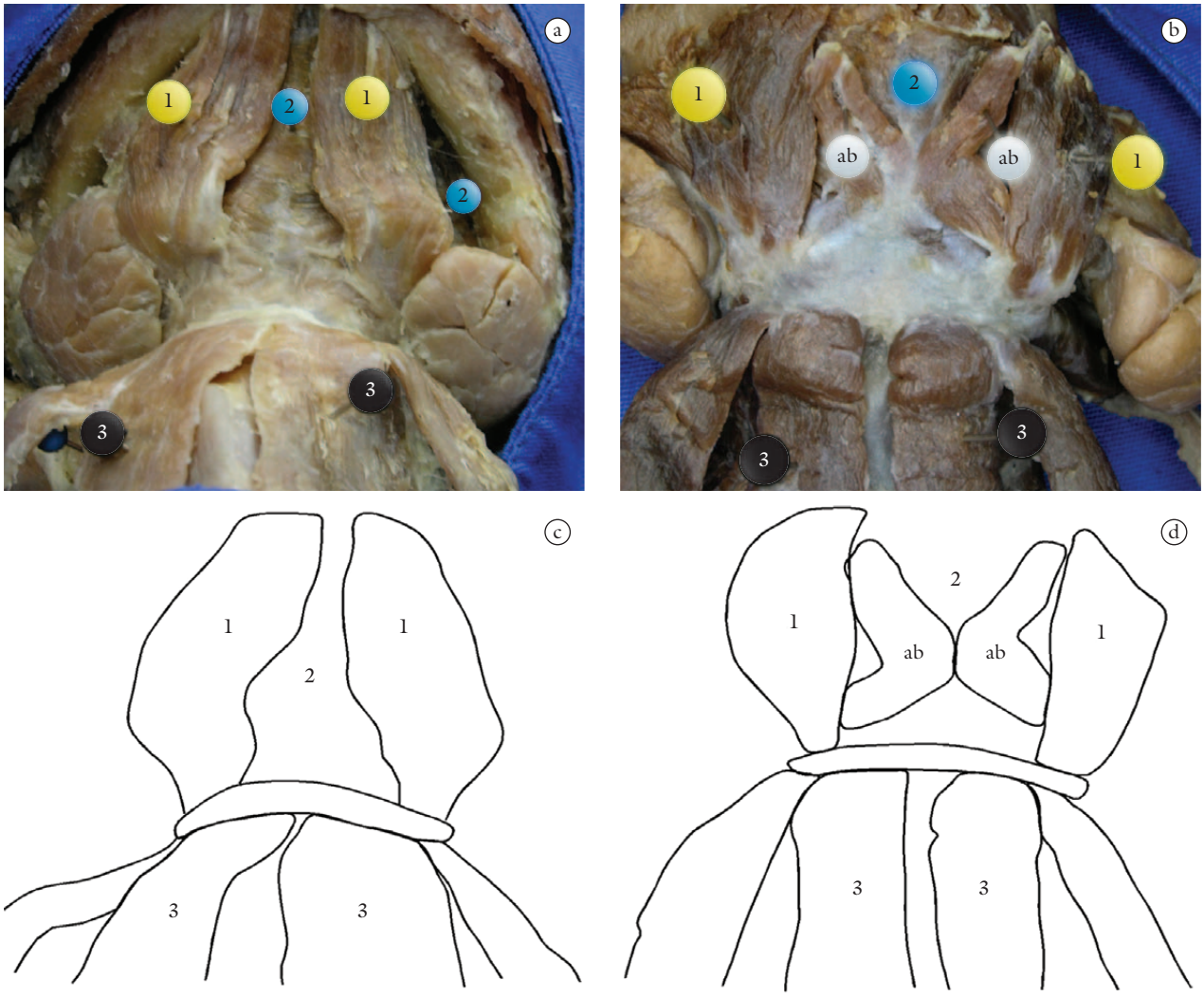

Figure 1. Comparison of the normal aspect and the anatomical variation of the digastric muscle. a) Normal aspecto f the submental region and the anterior área of the neck. b) Accessory anterior bellies of digastric muscle (ab). c-d) Diagrammatic representations of photographs a and b, respectively. Labeled structures: 1 – anterior belly of the digastric muscle; 2 – mylohyoid muscle; 3 – sternohyoid muscle.

The digastric muscle is involved in deglutition, where it elevates the hyoid bone, as well as the process of mastication, where it depresses the mandible. Variation in the anterior digastric belly could influence these movements (STOCKSTILL, HARN and UNDERHILL, 1991). For example, alterations in the intensity or symmetry of the movements could occur depending on the origin, insertion, and innervation of the accessory bellies. Moreover, the type of variation, whether unilateral or bilateral, must also be considered. According to Sargon and Celik (1984) and Peker, Turgut and Anil (2000), the unilateral variation of the anterior digastric belly is more common. In these cases the imbalance in the morphology of the anterior region of the neck, as well as functional alterations in mandibular depression or elevation of the larynx might be more explicit (USLU, ATILLA, CELIK et al., 1995). On the other hand, many studies have described a bilateral variation (PEKER, TURGUT and ANIL, 2000; TURAN-OZDEMIR, OYGUCU and KAFA, 2004; LIQUIDATO, BARROS, ALVES et al., 2007), similar to what was observed in this study. Here we found that the accessory anterior bellies were composed of two segments linked by connective tissue in the midline, an arrangement that is different from other descriptions but is similar to a case reported by Andreo, Caldas-Navarro and Toledo Filho (1997) where two accessory bellies crossed the midline in an X-shaped pattern.

Awareness of these alterations in arrangement and number of the anterior belly is important for the evaluation of the submental region using imaging techniques such as computerized tomography or magnetic resonance. The submental triangle is bounded by the digastric anterior bellies, and normally contains adipose tissue, submental lymph nodes and the anterior jugular veins. Anatomical variation can be confused with pathologic conditions, and is particularly important since the digastric anterior belly is used by surgeons as a landmark to identify the lingual nerve or the duct of the submandibular gland (GUELFGUAT, NURBHAI and SOLOUNIAS, 2001); consequently, the presence of accessory anterior bellies could induce mistakes in surgical procedures. In conclusion, anatomical variations of the anterior digastric belly muscle can influence clinical evaluation, imaging interpretation and surgical references in the anterior neck and submental area; therefore, consideration of this variation could help to prevent clinical errors.

References

AKTEKIN, M., KURTOGLU, Z. and OZTURK, AH. A bilateral and symmetrical variation of the anterior belly of the digastric muscle. *Acta Medica Okayama*, 2003, vol. 57, no. 4, p. 205-7.

ANDREO, JC., CALDAS-NAVARRO, JA. and TOLEDO FILHO, JL. Anatomical study on the variations of the anterior belly of the digastric muscle. *Revista Chilena de Anatomia*, 1997, vol. 15, no. 2, p. 111-4.

CELIK, HH., ALDUR, MM., OZDEMIR, B. and AKSIT, MD. Abnormal digastric muscle with unilateral quadrification of the anterior belly. *Clinical Anatomy*, 2002, vol. 15, no. 1, p. 32-4.

DE-ARY-PIRES, B., ARY-PIRES, R. and PIRES-NETO, MA. The human digastric muscle: patterns and variations with clinical and surgical correlations. *Annals of Anatomy*, 2003, vol. 185, no. 5, p. 471-9.

GUELFGUAT, M., NURBHAI, N. and SOLOUNIAS, N. Median accessory digastric muscle: radiological and surgical correlation. *Clinical Anatomy*, 2001, vol. 14, no. 1, p. 42-6.

HOLLINSHEAD, WH. *Anatomy for surgeons.* 2 ed. Philadelphia: Harper and Row, 1982. vol. 1, p. 364-6.

LARSSON, SG. and LUFKIN, RB. Anomalies of digastric muscles: CT and MR demonstration. *Journal of Computer Assisted Tomography*, 1987, vol. 11, no. 3, p. 422-5.

LIQUIDATO, BM., BARROS, MD., ALVES, AL. and PEREIRA, CSB. Anatomical study of the digastric muscle: variations in the anterior belly. *International Journal of Morphology*, 2007, vol. 25, no. 4, p. 797-800.

LOUKAS, M., LOUIS, RG., KAPOS, T. and KWIATKOWSKA, M. A case of a bilateral accessory digastric muscle. *Folia Morphologica* (Warsz), 2005, vol. 64, no. 3, p. 233-6.

MATSUDA, K., UEMURA, M., KUME, M., MATSUSHIMA, R. and MIZUNO, N. Topographical representation of masticatory muscles in the motor trigeminal nucleus in the rabbit: a HRP study. *Neuroscience Letters*, 1978, vol. 8, no. 1, p. 1-4.

MIZUNO, N., KONISHI, A. and SATO, M. Localization of masticatory motoneurons in the cat and rat by means of retrograde axonal transport of horseradish peroxidase. *Journal of Comparative Neurology*, 1975, vol. 164, no. 1, p. 105-15.

MIZUNO, N., MATSUDA, K., IWAHORI, N., UEMURA-SUMI, M., KUME, M. and MATSUSHIMA, R. Representation of the masticatory muscles in the motor trigeminal nucleus of the macaque monkey. *Neuroscience Letters*, 1981, vol. 21, no. 1, p. 19-22.

OZGUR, Z., GOVSA, F. and OZGUR, T. Bilateral quadrification of the anterior digastric muscles with variations of the median accessory digastric muscles. *Journal of Craniofacial Surgery*, 2007, vol. 18, no. 4, p. 773-5.

OZGURSOY, OB. and KUCUK, B. Unique variation of digastric muscle: a confusing landmark for head and neck surgeons. *Acta oto-laryngologica*, 2006, vol. 126, no. 8, p. 881-3.

PEKER, T., TURGUT, HB. and ANIL, A. Bilateral anomaly of anterior bellies of digastric muscles. *Surgical and Radiologic Anatomy*, 2000, vol. 22, no. 2, p. 119-21.

SAKAMOTO, Y. and AKITA, K. Supernumerary muscle bundles in the submental triangle: their positional relationships according to innervation. *Surgical and Radiologic Anatomy*, 2004, vol. 26, no. 3, p. 245-53.

SARGON, MF. and CELIK, HH. An abnormal digastric muscle with three bellies. *Surgical and Radiologic Anatomy*, 1994, vol. 16, no. 2, p. 215-6.

STOCKSTILL, JW., HARN, SD. and UNDERHILL, TE. Clinical implications of anomalous muscle insertion relative to jaw movement and mandibular dysfunction: the anterior belly of the digastric muscle in a cadaver. *Journal of Craniomandibular Disorders: facial & oral pain*, 1991, vol. 5, no. 1, p. 64-70.

TAN, ST. Anterior belly of digastric muscle transfer: a useful technique in head and neck surgery. *New York Head and Neck Society*, 2002, vol. 24, no. 10, p. 947-54.

TERZIS, JK. and TZAFETTA, K. "Babysitter" procedure with concomitant muscle transfer in facial paralysis. *Plastic and Reconstructive Surgery*, 2009, vol. 124, no. 4, p. 1142-56.

TURAN-OZDEMIR, S., OYGUCU, IH. and KAFA, IM. Bilateral abnormal anterior bellies of digastric muscles. *Anatomical Science International*, 2004, vol. 79, no. 2, p. 95-7.

UEMURA-SUMI, M., TAKAHASHI, O., MATSUSHIMA, R., TAKATA, M., YASUI, Y. and MIZUNO, N. Localization of masticatory motoneurons in the trigeminal motor nucleus of the guinea pig. *Neuroscience Letters*, 1982, vol. 29, no. 3, p. 219-24.

USLU, SS., ATILLA, S., CELIK, HH. and INAL, E. An important anatomic variation in head and neck region: anomaly of the anterior belly of the digastric muscle. *Bulletin de l'Association des Anatomistes (Nancy)*, 1995, vol. 79, no. 244, p. 39-41.

UZUN, A., ALUCLU, A. and KAVAKLI, A. Bilateral accessory anterior bellies of the digastric muscle and review of the literature. *Auris, nasus, larynx*, 2001, vol. 28, no. 2, p. 181-3.

WIDMALM, SE., LILLIE, JH. and ASH, MM. Anatomical and electromyographic studies of the digastric muscle. *Journal of Oral Rehabilitation*, 1988, vol. 15, no. 1, p. 3-21.

WILLIANS, PL., WARWICK, R., DYSON, M. and BANNISTER, LH. *Gray's anatomy*. 37th ed. London: Churchill Livingstone, 1989. p. 584-5.

ZIOLKOWSKI, M., MAREK, J. and KLAK, A. The human digastric muscle in the fetal period. *Folia Morphologica*, 1984, vol. 43, no. 3, p. 243-9.

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