

Double or Bifid Zygomaticus Major Muscle: Anatomy, Incidence, and Clinical Correlation

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The anatomy of the double or bifid zygomaticus major muscle is investigated in a series of 50 hemifacial cadaver dissections. The double zygomaticus major muscle represents an anatomical variation of this muscle of facial expression. This bifid muscle originates as a single structure from the zygomatic bone. As it travels anteriorly, it then divides at the sub-zygomatic hollow into superior and inferior muscle bundles. The superior bundle inserts at the usual position above the corner of the mouth. The inferior bundle inserts into the modiolus below the corner of the mouth. The incidence of the double zygomaticus major muscle was 34% in the present study, as it was found to be present in 17 of 50 cadaver dissections. This study shows that variation in the individual morphology of the mimetic muscles can be a common finding. Clinically, the double or bifid zygomaticus major muscle may explain the formation of cheek "dimples." The inferior bundle was observed in several specimens to have a dermal attachment along its mid-portion, which tethers the overlying skin. When an individual with this anatomy smiles, traction on the skin may create a dimple due to this dermal tethering effect. Clin. Anat. 11:310–313, 1998. © 1998 Wiley-Liss, Inc.

Key words: bifid zygomaticus major; facial expression; cheek "dimple"; smile

INTRODUCTION

The facial mimetic muscles display a high degree of structural variability. These muscles, which differ histochemically from skeletal muscle of the lower extremity (Happak et al., 1988), also exhibit variability among themselves. For example, the buccinator muscle contains the highest percentage of Type 1 fibers (Freilinger et al., 1990), in keeping with its capacity for endurance (Stal et al., 1990).

The frequency of appearance of certain facial muscles is also known to vary. Some facial muscles, such as the levator labii superioris and the zygomaticus major, are almost always present, whereas the risorius muscle is relatively uncommon (Sato, 1968). Even when these muscles of facial expression are present, there is a striking degree of variability in their size and shape from individual to individual (Pessa et al., unpublished data). Variability may also exist in the shape of certain mimetic muscles. The zygomaticus major appears to be an important muscle for facial expression as it has been noted to be present in 97–100% of individuals (Sato, 1968). This muscle originates at the lateral zygoma and inserts into the corner of the mouth (Fig. 1), and is responsible for pulling the lips upward and laterally to create a smile during facial animation. This

muscle is usually depicted as being a single unit or muscular bundle (Netter, 1989).

A previous study by Zufferey (1992) reported finding a case of a double zygomaticus major muscle in one out of ten dissections, and felt that this was a rare finding since previous to this there had been little documentation in the literature. The following study was performed to identify the anatomy and the incidence of the double or bifid zygomaticus major muscle.

MATERIALS AND METHODS

A series of 50 cadaver dissections was performed. A hemifacial dissection was performed on each cadaver by making a lateral face incision from the corner of the eye to the angle of the mandible. Dissection was carried down to the level of the facial muscles includ-

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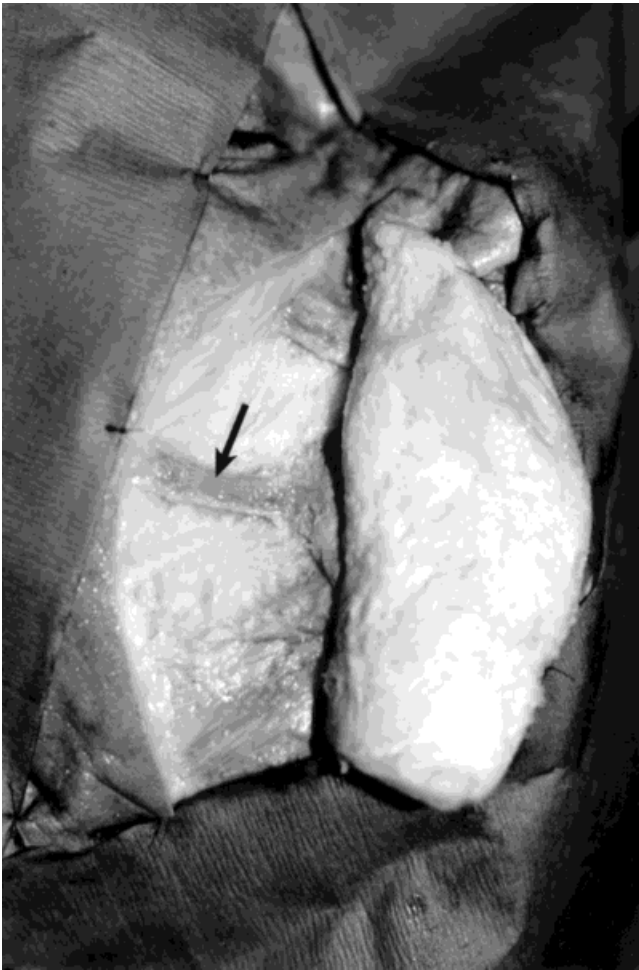


Fig. 1. The single zygomaticus major muscle (arrow) originates from the zygoma and inserts into the modiolus at the corner of the mouth.

ing the lip elevators, the zygomaticus major, and the platysma. The skin flap was dissected medially to the corner of the mouth in order to identify the insertion of the zygomaticus muscle. The width and morphology of the zygomaticus major was noted in each cadaver dissected. The cadavers were derived from a predominantly Caucasian population (90%).

RESULTS

A double zygomaticus major muscle was found in 17 of the 50 cadavers dissected, and had an incidence of 34%. A single zygomaticus major muscle was identified in the other 33 cadaver specimens (66%). Since the zygomaticus major and minor have different origins, lateral zygoma and malar eminence deep to orbicularis oculi respectively, fusion of the proximal portions of the zygomaticus major with the minor was excluded. In addition, in 14% it was noted that a bifid



Fig. 2. The double or bifid zygomaticus major muscle has superior (large arrow) and inferior (small arrow) bundles which have separate insertions.

zygomaticus major appeared simultaneously with a zygomaticus minor.

The origin of this variant muscle was the zygomatic bone anterior to the zygomatico-temporal suture. In the sub-zygomatic fossa, the main muscle bundle bifurcated into two trunks. The superior bundle inserted *at or above* the corner of the mouth in every cadaver specimen (Fig. 2). The inferior belly inserted at the confluence of muscles *below* the corner of the mouth into the modiolus. The average width of the main muscle belly prior to its division was 12 mm, with a range of 6–20 mm. The average width of the superior bundle was 8.5 mm, and the average width of the inferior bundle was 3.6 mm. In only one specimen were the upper and lower bundles of equal width, 4

and 4 mm respectively. In all other specimens, the superior bundle was wider than the inferior bundle.

DISCUSSION

The anatomy of the zygomaticus major muscle has been well described in previous publications (Patrinely et al. 1988; Netter, 1989). Although the muscle is usually represented as a single unit, some texts have shown that this muscle can have a broad decussation at the corner of the mouth (Ferner and Staubesand, 1983; Anderson, 1983). This apparently represents a minor variation in the terminal anatomy of this muscle.

On the other hand, the double or bifid zygomaticus major muscle appears to represent a true anatomical variation. The anatomy of the origin is as described for the single muscle, anterior to the zygomatico-temporal suture. The double variant bifurcated at the sub-zygomatic fossa, and in each instance superior and inferior bundles were clearly identified. The superior bundle was the wider of the two and inserted at or above the corner of the mouth. The inferior bundle inserted below the corner of the mouth.

The double zygomaticus probably does not represent some sort of aberrant fusion with another facial muscle. For example, the inferior slip of the double zygomaticus can be easily differentiated from the risorius, which lies in a more horizontal plane. Additionally, it is unlikely that the superior bundle of the bifid zygomaticus major represents a fusion of the zygomaticus minor, as the zygomaticus minor is located more medial and follows a more superior-inferior vector.

There are two reports in the literature which describe the true double zygomaticus major muscle having an insertion above and below the corner of the mouth. The earliest report of this anatomical variation was in 1775 by Domenici Santorini. In his book *Anatomici Summi*, Santorini illustrated a double zygomaticus muscle with an insertion at the corner of the mouth, and an inferior insertion beneath the depressor anguli oris muscle (Fig. 3). Santorini stated that this muscle rarely divides, but that he had observed this double insertion in two individuals ("nos bis observavimus").

A second report of this variation is from the plastic surgery literature, in which Zufferey (1992) found one case of a double zygomaticus major during cadaver dissection. From these two reports, and from the paucity of any other documentation, this anatomical variation would seem to be rare. In fact, from the present study, the double or bifid zygomaticus major muscle represents a relatively common variation. In this series, this variation was noted in 34% of the cadaver specimens.



Fig. 3. Drawing from *Anatomici Summa* which shows the double zygomaticus major muscle described initially by Santorini (reproduced with permission of P.I. Nixon Library).

The clinical correlate of this anatomy may be inferred by one further observation made during these dissections. In several cadavers, the inferior slip of the double zygomaticus was noted to insert into the dermis of the cheek skin. This anatomy may correlate with the occurrence of the cheek dimple seen during facial animation in certain individuals (Fig. 4). As the double zygomaticus contracts, a dimple is formed by the dermal tethering of the inferior muscle bundle. Currently in facial re-animation surgery attempts have been made to reconstruct the paralyzed face with the assumption that all individuals possess the same number and position of facial muscles. The present study demonstrates that a certain degree of variability exists in the facial musculature, specifically the zygomaticus major. The presence of a facial dimple suggests the existence of an underlying bifid zygomaticus major muscle. Based on this study, in individuals with a prominent cheek dimple it is recommended that to achieve greater facial symmetry the reconstructed zygomaticus major should possess two distal insertions thereby mimicking the bifid form.



Fig. 4. The cheek dimple, an anatomic correlate of the bifid zygomaticus major, results from a dermal insertion arising from the inferior muscle bundle.

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