

# Exclusion of Musculature from the Submental Flap: A Contingency Plan for Facial Nerve Palsy

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**Summary:** Submental flap surgery is a useful and versatile reconstructive procedure. Currently, disagreement exists regarding the need to include the anterior belly of the digastric muscle or mylohyoid in the submental flap. The report outlines the value of excluding normal and variant anterior digastric and mylohyoid musculature from the submental flap as a contingency plan for marginal mandibular branch of facial nerve palsy. Also, the article addresses variant anterior digastric musculature, a common anatomical finding, as it relates to the submental flap. The question of whether or not to include the anterior digastric musculature does not necessitate an all-or-none decision. In the case of multiple anterior digastric bellies, some bellies may be included in the flap, whereas others are not. The location of the submental vessels and the desired bulk or contour of the flap should guide the decision of which anterior digastric bellies, if any, are included in the flap. (*Plast Reconstr Surg Glob Open* 2014;2:e266; doi: 10.1097/GOX.0000000000000181; Published online 9 December 2014.)

## THE SUBMENTAL FLAP

Submental flap surgery was first described by Martin et al<sup>1</sup> in 1993. Since its inception, the procedure has been successfully used in the reconstruction of the lower and mid face,<sup>2-6</sup> pharynx,<sup>7</sup> palate,<sup>8,9</sup> oral cavity,<sup>10,11</sup> and eye socket,<sup>12</sup> as well as the nose and columella.<sup>4,13</sup> Additionally, the flap has been used to reconstruct the prevertebral space during spine surgery by being inserted between pharyngeal sutures and hardware to minimize wound dehiscence.<sup>14</sup>

The versatility of the flap is also evidenced by its use in conjunction with other flaps and its capacity

to incorporate diverse tissues. The submental flap has been used in combination with a prefabricated superficial temporal fascia flap for the restoration of the total cheek defects caused by noma.<sup>15</sup> Similarly, it has been used in conjunction with a dorsalis pedis flap and first toe web for the reconstruction of the lip.<sup>16</sup> The submental flap has also been integrated with cartilage, harvested from the eighth rib, for columellar reconstruction, and bone, to create a submental artery mandibular osteomuscular flap.<sup>13,17</sup>

In addition to its broad versatility, the submental flap has numerous other benefits including its close match for facial skin tone and thickness, well-hidden donor-site scarring under the mandibular arch, relatively constant and safe pedicle, and wide pivotal movement.<sup>12,13</sup> The flap surgery also has the added cosmetic benefit of eliminating submental and neck rhytides.<sup>12</sup> Additionally, the presence of hair lends itself to reconstruction of the mustache and beard of the male face.<sup>5</sup>

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Although the procedure has numerous benefits, it is not without its risks and complications. Negative outcomes associated with submental flap surgery include marginal mandibular branch of facial nerve (MMBFN) palsy, venous congestion, and complete flap loss.<sup>11,12,18,19</sup> Additionally, the anterior belly of the digastric muscle and, less frequently, the mylohyoid muscle may be incorporated into the flap, which may be unwarranted.

### **CONTROVERSIAL USE OF THE ANTERIOR DIGASTRIC AND MYLOHYOID MUSCLES IN THE SUBMENTAL FLAP**

Controversy exists regarding the inclusion of the anterior digastric and mylohyoid muscles within the submental flap. The argument to include the muscles in the flap has primarily focused on anatomical variability of the submental artery and the need to ensure adequate perfusion to the skin island. Faltous and Yetman<sup>20</sup> documented that submental vessels travel deep to the anterior belly of the digastric muscle in 70% of cases and superficial in the remaining 30% of cases. Likewise, Magden et al<sup>21</sup> noted the submental vessels to travel deep to the muscle belly in 81% of cases. Alternatively, Atamaz Pinar et al<sup>22</sup> reported the submental vessels to travel deep to the anterior belly of the digastric in 56% of cases and superficial in 44% of cases. Therefore, one could easily argue that removal of the anterior belly of the digastric muscle would seem prudent to ensure adequate blood supply to the skin island, by protecting those vessels traveling superficial to the digastric belly. Indeed, Karaçal et al<sup>12</sup> noted that the ipsilateral anterior belly of the digastric must be included in the reverse-flow flap for the prevention of venous congestion. Likewise, the potential for damage to the submental vessels traveling between the anterior digastric muscle and the mylohyoid spurred Patel et al<sup>23</sup> to include the mylohyoid with the anterior digastric musculature in the submental flap.

Although inclusion of the anterior digastric and mylohyoid appears prudent to adequately perfuse the flap island, the aforementioned reports are not congruent with reports of positive clinical outcomes from flap surgery despite noninclusion of the digastric or mylohyoid muscles. Both Yilmaz et al<sup>3</sup> and Kim et al<sup>4</sup> demonstrated an absence of flap loss despite omission of the digastric or mylohyoid muscles from the flap. Also, Matsui et al<sup>24</sup> were able to assess vasculature and perfusion of submental flaps via near-infrared fluorescence imaging with indocyanine green as the fluorescent agent, and Ishihara et al<sup>25</sup> documented that preoperative Doppler examina-

tions could confirm the location of submental vasculature, suggesting that digastric and mylohyoid muscle removal is not necessary if vessels are identified before dissection.

### **MARGINAL MANDIBULAR BRANCH OF FACIAL NERVE PALSY**

A potential pitfall to submental flap surgery is the chance of MMBFN palsy occurring either unilaterally or bilaterally. Pistre et al<sup>19</sup> documented one case of MMBFN palsy in 31 patients (3%). Alternatively, Sterne et al<sup>18</sup> reported MMBFN palsy in 2 of 12 patients (16%).

The MMBFN supplies depressor muscles of the inferior lip including mentalis, depressor anguli oris, and depressor labii inferioris.<sup>26</sup> Palsy of the MMBFN results in an inability to move the lower lip inferiorly and laterally and evert the vermillion border.<sup>27</sup> As a consequence of palsy, there is conspicuous deformity when opening the mouth or smiling. MMBFN palsy management strategies have included minihypoglossal nerve transfer to the cervicofacial branch of the facial nerve,<sup>28</sup> direct neurotization of the depressor muscle,<sup>29</sup> chemodenervation with botulinum toxin injections to normal contralateral musculature,<sup>30</sup> or resection of the normal contralateral depressor labii inferioris.<sup>30,31</sup> Additionally, muscle transfer procedures may be used in the management of MMBFN palsy, which include transfer of the free extensor digitorum brevis,<sup>32,33</sup> transfer of the posterior portion of the mylohyoid muscle with a tensor fasciae latae graft,<sup>34</sup> transfer of the anterior belly of the digastric muscle,<sup>34-36</sup> and transfer of variant anterior digastric musculature.<sup>37</sup>

### **VARIANT ANTERIOR DIGASTRIC MUSCULATURE AND THE SUBMENTAL FLAP**

A peculiar oversight among reports of submental flap procedures is the scarce mention of variant anterior digastric musculature. Variant anterior bellies have been reported to occur at a frequency ranging from 2.7% to 69.6%.<sup>38,39</sup> Anatomical variety in the anterior belly of the digastric muscle has been documented to occur unilaterally, bilaterally, symmetrically, and asymmetrically.<sup>40,41</sup> Oftentimes, individual anterior bellies traverse the midline and insert contralaterally, which could disorient the surgeon during a submental flap procedure. Similarly, variant anterior digastric bellies often attach directly to the mylohyoid raphe, which could also cause surgical confusion during submental flap procedures. Variant anterior digastric musculature has been identified via computed tomography and magnetic

resonance imaging.<sup>38,42</sup> Accordingly, presurgical screening and identification of variant digastric musculature may prevent unforeseen surgical scenarios.

### A NOVEL PERSPECTIVE WITH REGARD TO EXCLUSION OF NORMAL AND VARIANT ANTERIOR DIGASTRIC OR MYLOHYOID MUSCULATURE IN THE SUBMENTAL FLAP

MMBFN palsy has been reported to occur in as many as 16% of submental flap cases.<sup>18</sup> Therefore, the surgeon should be cognizant of surgical options for the management of MMBFN palsy during preoperative planning in the event that MMBFN palsy occurs. Likewise, the surgeon should recognize that, in the case of lower, midfacial, and oral damage, there may already be significant damage to the neuromuscular anatomy responsible for the balance of the mouth. In the case of parotidectomy, for example, MMBFN damage occurs in 26.08% of superficial parotidectomy cases and 71.42% of total conservative parotidectomy cases, respectively.<sup>43,44</sup> Therefore, MMBFN palsy may result from either the primary procedure (eg, parotidectomy) or as a result of the submental flap procedure (eg, reconstruction of the preauricular region post-parotidectomy).

If MMBFN palsy exists, either as a preexisting problem or as a result of surgery, and the anterior digastric muscle is included in the submental flap, then the future surgical treatment options to reconstruct the deformity of the mouth would be limited to those excluding anterior belly of digastric muscle transfer. Likewise, if variant digastric musculature is included in the flap, again, future surgical options would be further limited. Similarly, if the mylohyoid is included en bloc with overlying anterior belly of the digastric musculature (including possible variant anterior digastric musculature), future surgical options would be limited to those excluding mylohyoid transfer, normal anterior belly of digastric transfer, and variant anterior digastric muscle transfer.

When digastric or mylohyoid muscles are included in the submental flap, and are consequently unavailable for later muscle transfer, options for the management of mouth deformities occurring as the result of MMBFN palsy, such as nerve transfer of direct neurotization, may be unrealistic due to preexisting damage to neural structures necessary for the procedure. Also, chemodenervation or resection of normal contralateral lip depressor musculature could further limit facial expression in a patient who may already have extensive damage to the muscles of facial expression. Therefore, muscle transfer may be the best option available for an individual undergo-

ing a submental flap procedure. Exclusion of anterior digastric and mylohyoid musculature from the submental flap could serve as a valuable preparation for possible MMBFN palsy.

Also, anterior digastric muscle belly variants have existed as bilateral duplications and triplications of the bellies which present as 4 or 6 total muscle bellies rather than 2.<sup>41</sup> The question of whether or not to include the anterior digastric musculature does not necessitate an all-or-none decision. Some anterior digastric bellies may be included in the flap, whereas others are not. The location of the submental vessels and the desired bulk or contour of the flap should guide the decision of which anterior digastric bellies, if any, are included in the submental flap.

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