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## Bony Anatomic Landmarks to Avoid Injury to the Marginal Mandibular Nerve

Ron Hazani, Saeed Chowdhry, Arian Mowlavi, Bradon J. Wilhelm

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## Abstract

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the nerve is most susceptible to injury in this location because it lies superficial to

the anterior facial artery.

**Objectives:** The authors describe the location of the marginal mandibular nerve based on superficial anatomic landmarks as it crosses the facial artery above the mandibular border, in order to help surgeons avoid injury to this nerve during facelift procedures.

**Methods:** Eighteen cadaveric facial halves were dissected with the aid of loupe magnification. The distance from the facial artery to the palpable masseteric tuberosity at the angle of the mandible was measured. The distance from the masseteric tuberosity to the mental midline was also measured to determine a ratio of the facial nerve from the masseteric tuberosity to the mental midline.

**Results:** The facial artery was found to be an average of  $3.05 \pm 0.13$  cm anterior to the masseteric tuberosity along the mandible. The marginal mandibular nerve crossed the facial artery along the mandibular border approximately 3 cm anterior to the masseteric tuberosity. The distance from the masseteric tuberosity to the mental midline averaged  $11.3 \pm 0.54$  cm. Therefore, the marginal mandibular nerve courses superficial to the facial artery at approximately one-fourth of the distance from the masseteric tuberosity to the mental midline.

**Conclusions:** Knowledge of the masseteric tuberosity and mental midline landmarks of the facial artery can provide a reliable and safe approach to surgery of the lower face.

Keywords

anatomic landmarks | marginal mandibular nerve | safe facelift

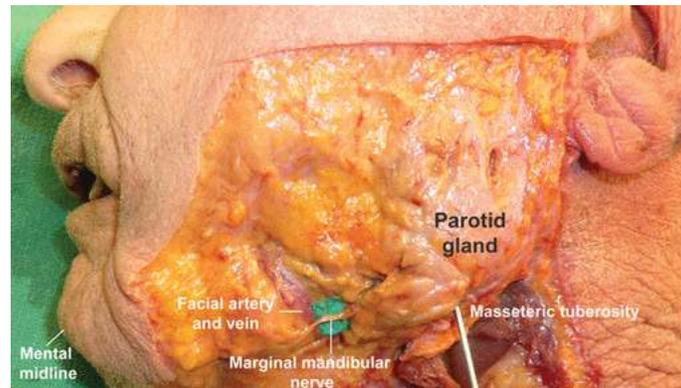
Facial nerve injury during rhytidectomy is a rare but dreaded complication. Of the various divisions of the facial nerve, injury to the marginal mandibular nerve (MMN) is of great concern in planning for a lower face- or necklift. Lack of interconnections between the MMN and other branches may cause a noticeable and permanent deficit. Marginal mandibular palsy can present as a weak smile owing to paresis of the depressors of the lip.<sup>1</sup>

Anatomically, the MMN is protected after it exits the parotid gland by the thick superficial musculoaponeurotic system (SMAS). Elevation of the SMAS-platysma layer anterior to the parotid gland increases the risk of MMN injury, in comparison to a traditional skin-only facelift.<sup>2,3</sup> The most vulnerable point for injury to the MMN is after it exits the deep cervical fascia and courses upward over the anterior mandible in the region of the facial artery.<sup>4</sup>

In a previous study, bony anatomic landmarks were identified to assist surgeons in predicting the anterior edge of the parotid gland, thereby avoiding injury to the facial nerve branches as they exit the parotid gland.<sup>2</sup> The purpose of this study is to identify bony anatomic landmarks that predict the location of the MMN to avoid injury as it crosses over the facial artery.

## Methods

Eighteen fresh cadaveric face halves were dissected with the aid of loupe magnification to determine the location of the MMN as it coursed over the facial artery. The specimen group consisted of 11 women and 7 men. The ages of the cadavers were unknown. Skin, subcutaneous fat, and the SMAS-platysma layer were dissected to facilitate exposure of the masseteric-parotid fascia. Subsequently, the MMN and facial vessels were identified in the buccal space at the lower border of the mandible (**Figure 1**). The distance was measured from the facial artery to the palpable masseteric tuberosity at the angle of the mandible. The distance was also measured from the masseteric tuberosity to the mental midline to determine a ratio of the facial nerve from the masseteric tuberosity to the mental midline. Statistical data were calculated as the average measurement  $\pm$  standard deviation.



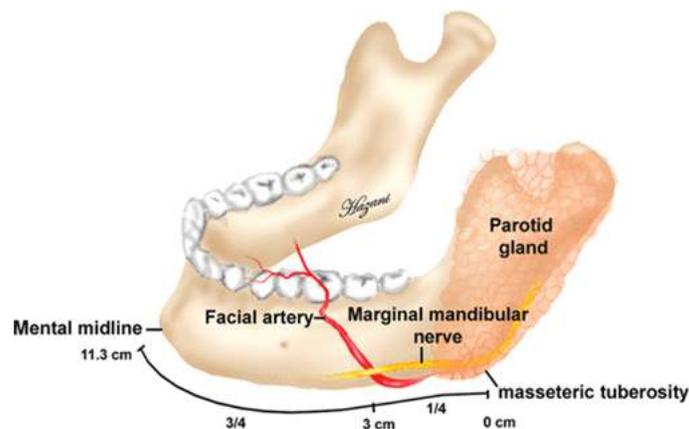
**Figure 1.**

The marginal mandibular nerve is shown as it exits the anterior border of the parotid gland. The nerve courses anteriorly over the facial artery and vein at the inferior border of the mandible. A Kirschner wire is placed at the masseteric tuberosity.

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## Results

In the 18 dissections, the facial artery was found to be an average of  $3.05 \pm 0.13$  cm anterior to the masseteric tuberosity along the mandible. The marginal mandibular nerve crossed the facial artery along the mandibular border approximately 3 cm anterior to the masseteric tuberosity. The distance from the masseteric tuberosity to the mental midline averaged  $11.3 \pm 0.54$  cm. Therefore, the MMN can be predicted to lie about 3 cm from the masseteric tuberosity along the mandible. Given that the distance from the masseteric tuberosity to the mental midline averaged  $11.3 \pm 0.54$  cm, the MMN courses superficial to the facial artery at approximately one-fourth of the distance from the masseteric tuberosity to the mental midline (ie, the ratio of 3.05 cm to 11.3 cm is  $0.27 \pm 0.017$ , which is approximately 0.25, or one-fourth), as depicted in **Figure 2**.



**Figure 2.**

The bony anatomic landmarks that can be used to predict the location of the marginal mandibular nerve as it courses over the facial artery. The nerve can be predicted to cross the facial artery approximately 3 cm anterior to the masseteric tuberosity, or one-fourth of the distance from the masseteric tuberosity to the mental midline.

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## Discussion

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The anatomy of the facial nerve has been extensively investigated. The extratemporal component begins when the facial nerve exits the stylomastoid foramen. The facial nerve trunk is usually identified 1 cm deep and immediately inferior and medial to the tragal pointer.<sup>5</sup> The facial nerve is then encompassed by the parotid gland in the lateral aspect of the face. Medially, it leaves the parotid to traverse along the superficial surface of the masseter muscle.<sup>6</sup>

The MMN exits the anterior caudal margin of the parotid gland anterior to or just below the angle of the mandible at a level deep to the parotid-masseteric and deep cervical investing fascia. In most cases, the nerve continues forward above the inferior border of the mandible deep to the masseteric fascia. In those cases in which the nerve exits the parotid below the inferior mandibular border, it runs anteriorly and crosses the surface of the posterior digastric muscle and the capsule of the submandibular gland.<sup>7</sup> It penetrates the deep cervical fascia near the inferior mandibular border, and running beneath the platysma, it crosses the anterior facial artery to enter the buccal space, where it provides branches to the depressor quadratus labii inferioris and mentalis muscles.<sup>8</sup>

Multiple authors have attempted to accurately delineate the course and location of the MMN in relation to the anterior facial artery and the mandible. On the basis of the dissections of 100 cadaveric facial halves, Dingman and Grabb<sup>9</sup> noted that, posterior to the facial artery, the mandibular nerve passed above the inferior border of the mandible in 81% of the specimens; in the other 19%, this nerve passed in an arc, with its lowest point 1 cm or less below the mandible. Baker and Conley<sup>10</sup> stressed that in their clinical experience, the MMN was 1 to 2 cm below the lower border of the mandible in almost every instance. In one study of 50 specimens, the MMN was above the mandibular border and posterior to the facial artery 74% of the time. Below the inferior border of the mandible and at the crossing point with the facial artery, the MMN was divided into two branches in 22% of the specimens.<sup>11</sup> Potgieter et al<sup>12</sup> reported vertical measurements at certain landmarks along the inferior border of the mandible. On average, they found the MMN to be 2.3 mm inferior to the angle of the mandible, 2.4 mm superior to the facial artery on the mandibular border, and 10.7 mm superior to a point 2 cm anterior to the facial artery.

Previous attempts to identify landmarks for the MMN relied mostly on soft tissue anatomy. Liebman et al<sup>13</sup> demonstrated that at approximately 2 cm from the corner of the mouth, the MMN divides and subdivides, with its branches entering the lip depressors. Blunt dissection lateral to this point and superficial to the platysma muscle was therefore deemed safe and reliable. Seckel<sup>14</sup> described an area close to this point as a "facial danger zone" by drawing a point on the middle of the mandibular body 2 cm posterior to the oral commissure and allowing for a radius of 2 cm around it. He predicted that the platysma-SMAS thins in this circular area, exposing the MMN to injury. He also predicted that the anterior facial artery and vein cross this zone and are susceptible to injury. To our knowledge, we are presenting the first attempt to identify bony anatomic landmarks that can reliably predict the location of the MMN at the point of highest risk of injury—as it crosses over the anterior facial artery.

Techniques to avoid injury of the MMN vary, depending on the plane of dissection. Nahai et al<sup>5</sup> advocated that subplatysmal dissection should begin at least 2 cm below the angle of the mandible. Baker and Conley<sup>10</sup> advised extreme caution during any raising of the SMAS or platysma muscle flap. In their experience, the branches of the MMN were even found 3 to 4 cm below the mandibular border in individuals with lax and atrophic tissues. Daane and Owsley<sup>4</sup> maintained a protective stalk of areolar tissue beneath the platysma muscle that protected the mandibular branch as it passed along the inferior margin of the mandible. Owsley<sup>8</sup> recommended that loosening of the masseteric ligaments be accomplished by blunt stretching with a sponge along the anterior margin of the masseter muscle and below the oral commissure level. Aggressive application of electrocautery in response to bleeding from the facial artery and vein may also explain why the most vulnerable point for injury of the MMN is in the region of the facial artery.

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## Conclusions

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The measurements and bony landmarks identified in this cadaveric study can assist surgeons in avoiding an injury to the marginal mandibular nerve regardless of the technique employed. While identifying the correct plane of dissection is more important in preventing nerve injury than identifying anatomic landmarks, knowledge of them—specifically, the masseteric tuberosity and the mental midline—can provide a more reliable and safe approach to plastic surgery of the neck and lower face.

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