Submandibular Gland Reduction in Aesthetic Surgery of the Neck: Review of 112 Consecutive Cases

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Background: The indications for reduction of excessive submandibular gland volume in aesthetic rejuvenation of the neck have been well described, as has the surgical anatomy and the surgical technique. Despite this, submandibular gland reduction does not appear to be widely adopted, nor have significant case series been reported in the literature. This review of a consecutive series of aesthetic submandibular gland reductions was undertaken to provide a perspective about its place in neck contouring.

Methods: A retrospective chart review was conducted of all patients on whom the senior author (B.C.M.) had performed submandibular gland reduction for aesthetic reasons. Complications and reoperations were specifically analyzed.

Results: Submandibular gland reduction was performed in 112 of 736 consecutive face lifts between 2002 and 2013, an incidence of 13 percent in primary face lifts and 25 percent in secondary face lifts. The median patient age was 57 years, and 87 percent were women. Major complications were those requiring early reoperation (1.8 percent) to manage significant hematomas; one was potentially fatal. Minor complications (10.8 percent) were managed nonoperatively. Submandibular sialoceles (4.5 percent) and marginal mandibular branch neurapraxia (4.5 percent) were the most frequent, and all resolved fully by 3 months. Significantly, no patient reported a permanent dry mouth.

Conclusions: The complication rate with submandibular gland reduction is comparable to that of a neck lift with platysma plication alone, with some additional specific risks: (1) catastrophic airway compression from bleeding deep in the neck, (2) significant increase of neurapraxias in secondary neck lifts, and (3) a moderate incidence of benign submandibular sialoceles. (*Plast. Reconstr. Surg.* 136: 463, 2015.)

CLINICAL QUESTION/LEVEL OF EVIDENCE: Therapeutic, IV.

The mandibular and cervicomandibular angles are important in the appearance of a youthful face and, accordingly, in aesthetic neck rejuvenation.¹ Although it is generally accepted that the neck contour of people having prominent glands can be improved with submandibular gland reduction, it remains a

controversial topic in aesthetic facial surgery, with few surgeons including it in their practice²⁻⁶ (Fig. 1). This is understandable, as the procedure is neither easy to learn nor easy to perform because of the combination of the gland's location beneath the investing deep fascia in the neck and limited visibility from the compromised surgical exposure. Unresolved concerns about the functional consequences of a permanent dry mouth and about additional complications add to this reluctance. This clinical review was undertaken to better define the place of submandibular gland reduction in aesthetic neck surgery.

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Fig. 1. (Left) Frontal and lateral views of a 63-year-old woman shown preoperatively. (Right) One year postoperatively, after face lift with small reduction of subplatysmal fat and major reduction of submandibular glands. In addition, the patient underwent prejowl sulcus augmentation (1.0 cc of hydroxyapatite granules subperiosteally) and lower lid blepharoplasty with hydroxyapatite augmentation of the inferior orbital rim and maxilla, and small-volume lipofilling of the upper lids and lips.

PATIENTS AND METHODS

A retrospective chart review was performed of all patients who underwent submandibular gland reduction, between 2002 and 2013, in the senior surgeon's (B.C.M.) practice. Patient demographics and all complications and reoperations were analyzed.

All patients had the superficial lobe of their submandibular glands reduced through a submental

incision using the following surgical technique, which is not dissimilar to that described by Singer and Sullivan in 2003.² Through the incision, the skin flap was elevated off the platysma surface, allowing the medial platysma edges to be defined. Then, the dissection was continued on the undersurface of each platysma, mobilizing the muscle sufficient to allow its lateral retraction. Following removal of excess subplatysmal fat, the anterior belly of each

digastric muscle was defined, and at the lateral border of each muscle posteriorly, the thin layer of deep fascia was incised to gain access to the submandibular gland. Each gland was mobilized from its surrounding capsule by the spreading of blunt-tip scissors in the submandibular space, aided with diathermy as required. The intracapsular dissection was facilitated by traction on the gland, using an atraumatic clamp, with countertraction provided by a retractor inside the capsule. Finally, using gentle, blunt digital dissection, the posterior extent of the gland was mobilized as well as deeper toward the deep lobe.

Local anaesthetic (containing epinephrine) was injected into the gland to reduce the hypertensive response to traction on the gland and bleeding. The parenchymal reduction was performed using a diathermy blade on a moderately high setting for meticulous hemostasis.

The central artery in the gland was specifically looked for, and then clamped and securely ligated. A suction drain was routinely placed in the cavity in the earlier cases, but subsequently only for specific indications, as partial closure of the residual cavity was then being performed.

RESULTS

Of the 736 consecutive patients who underwent face and neck-lift surgery between 2002 and 2013, 112 (15.2 percent) had submandibular gland reduction. This included 13 percent of the 610 primary face lifts (81 patients) and 25 percent of the 126 secondary/tertiary face lifts (31 patients). The average patient age was 57 years (range, 38 to 80 years). Ninety-seven patients were women and 15 were men. Twelve patients were smokers. The average follow-up was 25 months (range, 11 days to 7 years). Complications occurred in 14 patients (12.5 percent) (Table 1). The complication rate was not different between the primary and secondary/tertiary face lifts, 14 percent and 13 percent, respectively.

Of the minor, nonoperative complications, the most frequent was submandibular sialoceles in five patients (4.5 percent). These patients underwent an average of two needle aspirations, and every case resolved by 4 weeks. Three of the

patients had a single injection of botulinum toxin (20 units) into the gland remnant.

Neurapraxia of the marginal mandibular branch occurred in five patients (4.5 percent). The incidence was 2.5 percent of those having primary neck lifts and 10 percent of the secondary neck-lift patients (three of 31). All neurapraxias resolved completely within 3 months. Unrelated to the submandibular surgery, two patients had a parotid sialocele (1.8 percent), which resolved quickly with conservative management. There were not any lingual or hypoglossal nerve injuries. There were no long-term complications in the series—specifically, no cases of permanent dry mouth—although in one patient, early postoperative dry mouth persisted for almost 6 months.

Early reoperation for control of bleeding occurred in two patients and was life threatening in one of them. Because of their significance, these cases are reported in detail.

CASE REPORTS

Case 1

The patient in case 1 was a 38-year-old normotensive man, the eighth case in the series. Following uneventful surgical reduction of exceptionally large glands, and just before discharge from the day-surgery unit, the patient was ambulatory in the bathroom and had a brief emesis. This was immediately following the sensation of a “click” in the side of his neck followed by the sudden onset of respiratory stridor. This progressed rapidly to severe airway obstruction associated with a rock-hard, tight, swollen neck. Removal of the submental dermal sutures was performed immediately, with no effect in decompressing the hematoma. Precious minutes were spent blindly removing enough of the interrupted midline platysma closure sutures until sufficient opening had been made for arterial blood to spurt out under pressure and relieve the airway obstruction. With the airway crisis over, major arterial bleeding continued through the submental incision despite effort to apply deep digital pressure onto the gland remnant. Intravenous fluid replacement was given, and eventually the bleeding stopped spontaneously. With the situation stabilized, the patient was returned to the operating room and successfully intubated using a rapid sequence induction, in the presence of laryngeal edema. Surgical exploration revealed the source of pulsatile bleeding to be from the central artery of the gland, adjacent to a previously placed ligature. For airway security, the patient was kept intubated and transferred to an intensive care unit for overnight care before satisfactory extubation the next morning. There were no long-term sequelae.

Case 2

The patient in case 2 was a 56-year-old hypertensive woman, the 82nd case. Intraoperatively, dissection of the gland from the capsule was difficult, because of unusual fibrosis, presumably postinflammatory. Accordingly, a submental drain was placed and a moderate drainage of venous blood persisted undiminished into the evening. Although not urgent, as a precaution, the surgical site was reexplored and the bleeding site attended to, to ensure definitive hemostasis.

Table 1. Complications in 112 Submandibular Gland Reduction Cases

Complication	No. of Patients (%)
Submandibular sialocele	5 (4.5)
Marginal mandibular branch palsy	5 (4.5)
Hematoma requiring reoperation	2 (1.8)
Permanent dry mouth	0 (0)

DISCUSSION

The reduction of excess submandibular gland volume is a major advance in aesthetic contouring of the neck.⁵ Given its aesthetic importance, it is noteworthy that the procedure does not appear to be widely performed. This may be attributable to the paucity of published information from case series about the outcomes, complications, and safety. Although the safety of complete excision of the submandibular gland for a benign pathologic condition is accepted in the head and neck literature,⁶⁻⁹ this cannot be compared to aesthetic, subtotal excision performed through an indirect approach.

The only patient series available when this study commenced was an early report based on limited experience with eight patients that did not detail outcomes and complications.⁴ The excisions were performed through the rhytidectomy or a direct approach at the lower edge of the mandible; this is no longer considered acceptable in aesthetic surgery, because of the visual location of the incision and increased risk to the marginal mandibular branch. As this article was being finalized for submission, a significant decade-long series of 129 cases has been published in this *Journal*, allowing for useful comparisons.¹⁰

This review includes the entire consecutive experience of one plastic surgeon, who commenced performing aesthetic submandibular gland reduction surgery with trepidation and some reluctance despite having significant face-lift surgery experience. Accordingly, the lessons learned and presented here may be of value to surgeons who find themselves in a similar position. It is notable that the rate of performing submandibular gland surgery is less than that of the few renowned surgeons in the United States who have a particular reputation for their neck rejuvenation surgery as teachers and practitioners.¹¹⁻¹⁴ The routine use of direct submental surgery in their face lift/neck rejuvenations allows for glandular adjustments, even small, to be readily performed in passing. In contrast, during this experience, the submental approach was not routinely used, being undertaken only for specific indications, including reduction of prominent glands. The significance is that all of the submandibular operations reported here were performed for major reductions.

Although the pathogenesis of submandibular gland prominence has not been defined

conclusively, resection for glandular enlargement is regarded as more definitive than the alternatives of direct glandular suspension for correction of ptosis from lax deep cervical fascia and plication of the platysma over the gland.^{4,9,10,15,16} Prominence of the glands is readily determined by palpation, even with the masking effect of excessive soft-tissue fullness in the neck. The surgical indication was not the presence of prominent submandibular glands per se; rather, it was the patient's expectation for a degree of improvement of neck contour beyond that obtainable without removal of the excess gland volume, taking into consideration the additional operating time, cost, morbidity, and attendant risks.

Prominent submandibular glands present an aesthetic concern in two patient categories.^{4,10,14} Primary face-lift patients with detectable prominence of the glands contributing to their neck fullness, and secondary patients dissatisfied with their neck contour following a previous face/neck lift, because the glandular prominence had either been overlooked or not fully appreciated until further revealed by correction of their neck laxity (Figs. 2 and 3). The 25 percent incidence of submandibular gland surgery in our secondary/tertiary face-lift patients was twice that of the primary cases. Presumably, this represents patients whose underlying glandular pathologic condition had not been addressed, and the prominence increasing over subsequent years (Fig. 4).

The basic surgical anatomy of the region has been well described, based on an excellent cadaver dissection study.² There are also some recent descriptions to which is added some perspective developed during this experience.^{9,17,18} The capsule of the submandibular gland is the key to surgical control and, related to that, the minimization of complications. The "capsule" is not part of the gland structure itself, as its name would imply. Rather, it is a capsule of the surrounding soft tissue, formed by the investing deep fascia of the neck, which here splits into two layers to enclose the submandibular space in which the gland is located.

From a surgical perspective, it is important to appreciate the vessels around the gland and the vascular supply to the gland. The vessels on the capsule immediately lateral to the gland, although not always seen, are relevant. These include a significant tributary of the facial vein and the facial artery on the deeper aspect, which is important, as it courses immediately outside the lateral capsule

and gives a short and potentially troublesome branch into the gland.

The few small arteries that penetrate the medial capsule (average, two) have a very short course through to the gland and do not constitute a surgical difficulty. The real difficulty is posed by the deep perforator artery, which continues through the substance of the gland from the deep lobe into the superficial lobe. Because of its location, this vessel is not seen until after the superficial part of the gland has been excised, during the course of which the vessel is transected. The artery has a tendency to brisk bleeding and to retract into the cut surface of the remaining gland. It also has a tendency to go into a deceptive, temporary spasm. Considerable technical expertise is required to control this intraglandular vessel given its deep and posterior location with the limited surgical access, while bleeding rapidly fills the cavity from the depth, concealing the bleeding source.^{10,17,18}

Specific attention should be given to the central intraglandular artery other than with superficial “shaving” reductions of the gland. Exercising good surgical planning is beneficial here. This involves preparation, consisting of first freely mobilizing the gland within its capsule, especially on the lateral side, where the facial vein, artery, and mandibular nerve are located, before commencing the glandular reduction. It is recommended to have the resources of two surgical assistants during the glandular resection phase; the first provides optimal exposure using two retractors, and the second controls the suction to quickly evacuate diathermy smoke and blood, as required, so the bleeding source can be localized immediately.

Major hematoma in a standard neck lift, without submandibular gland reduction, has a generally accepted incidence of not less than 1 percent.^{19,20} However, bleeding from submandibular gland surgery is in an entirely different category of risk because of the deep location within the visceral part of the neck, which is effectively a closed space. The high-pressure expansion here from an arterial hematoma readily causes airway compression, precipitating a surgical emergency, similar to postthyroidectomy bleeding. Although this danger has been described, possibly sufficient emphasis not been given, as this has not been the subject of a case report until now.^{10,17,18}

The minimization of bleeding risk is essential. Control of systematic factors, such as the preoperative cessation of all medications that may interfere with normal coagulation and the assiduous

management of hypertension, is fundamental. This must include not only preoperative and intraoperative but also early postoperative control, including the transient hypertensive increase associated with pain, vomiting, and activity. A lesson from our experience with a catastrophic postoperative bleed is the need for absolute local control of hemostasis, because of the possibility of an unexpected, significant rise of the patient's blood pressure. For this reason, ligation, not just cauterization of the perforating artery, is preferred. At times, better visualization of the bleeding artery may be required for precision in clamping, for which the removal of additional parenchyma is helpful. Absolute hemostasis before closing the submandibular space is mandatory. Although suction drainage of the space has been recommended, it would be unhelpful in the presence of major arterial bleeding. A further precaution against potentially catastrophic bleeding is to require our submandibular gland reduction patients to remain under overnight observation with monitoring and pharmacologic control of the blood pressure as required. As for thyroidectomy patients, a suture removal set should be at the bedside.

Other than the major bleeding exception, the complications, which occurred in 11.6 percent of patients, were not serious, with a reduced frequency with ongoing surgical experience. This is because all the significant nerves are external to the capsule of the gland with the marginal mandibular branch reported to be approximately 3.7 cm cephalad to the inferior margin of the gland. Because the hypoglossal and lingual nerves are deep within the visceral layers of the neck, they are not seen and are protected using the intracapsular surgical technique described. Neurapraxia of the marginal mandibular branch is a well-recognized complication of standard face and neck lift alone, and the incidence would be expected to increase from the additional surgical manipulation involved in submandibular gland excision, especially because many of these patients have heavier necks. However, temporary marginal mandibular branch palsy occurred in only two of the primary patients (2.5 percent), with the incidence increasing fourfold, to 10 percent, in the secondary cases, presumably associated with fibrosis from the previous neck lift. The management of neurapraxias consisted of patient reassurance, aided in three patients by botulinum toxin A to temporarily weaken the contralateral lip hyperactivity. That all palsies had resolved within 3 months suggests they were simple compression neurapraxias.

Fig. 2. Patient series showing the results of three procedures over 13 years. These show the difference between neck fullness attributable to fat excess and submandibular gland prominence. (Left) A 39-year-old female patient shown preoperatively. (Right) At age 45, 6 years after primary face lift, with midline platysmaplasty, and no defatting submental or subplatysmal and no submandibular gland surgery. Also, placement of prejowl silicone jawline implant (medium size), coronal brow lift, upper and lower blepharoplasties were performed.

Given that the strong wound retraction required in the control of brisk glandular bleeding deep in the neck causes compression of the capsule and adjacent soft tissues, it became appreciated how the improved surgical control by preliminary subcapsular mobilization may have contributed to keeping the incidence relatively low.

This incidence of sialoceles occurring with aesthetic submandibular gland reduction had not previously been reported.^{10,18} The aspiration of clear saliva-appearing content helps differentiate a sialocel from a seroma and is confirmed by

amylase content analysis. The treatment of sialoceles is nonsurgical, requiring the passage of time. The five sialoceles in this series presented between the first and second postoperative weeks, and all had resolved by 4 weeks. All were unilateral and managed expectantly. Needle aspirations were performed for diagnosis and temporary relief of discomfort. The injection of botulinum toxin type A into the residual gland was most effective and has replaced the traditional pharmacologic treatment of scopolamine, thereby avoiding the unpleasant anticholinergic side effects. The introduction of

Fig. 3. Patient series showing the results of three procedures over 13 years, continued. (Left) At age 50, 5 years after a secondary face lift that included submental liposuction and subplatysmal fat reduction with secondary midline platysmaplasty, but not submandibular gland reduction. (Right) At age 52, 15 months postoperatively after tertiary face lift with major submandibular gland reduction. Also, the prejowl silicone implant was replaced with hydroxyapatite subperiosteal augmentation (1.2 ml) and upper lid adjustments.

partial closure of the submandibular space, by suturing the underside of the platysma down to the digastric tendon, with the avoidance of suction drainage adjacent to the gland, may have reduced the incidence of sialoceles, although topical diathermy has been recommended specifically to seal the raw glandular surface.^{10,18}

The likelihood that reduction of glandular volume would leave the patient with a permanent dry mouth is an important yet, until recently, not well-answered consideration that initially led us to perform minimal glandular reductions.

Eventually, the realization that a permanent dry mouth does not automatically result from reduction of gland volume allowed for unlimited glandular resection, confirmed by Feldman's recent report of 129 cases without a dry mouth.¹⁰ This absence of postoperative xerostomia partly reflects proper case selection, in that patients who had a preoperative dry mouth tendency were specifically excluded, whereas those who underwent glandular reduction presumably have sufficient reserve functional capacity of their salivary secretory system.

Fig. 4. (Left) Preoperative appearance of a 64-year-old woman. (Right) Two years postoperatively after face lift with major submandibular gland reduction and moderate subplatysmal fat reduction. Also, skeletal augmentation of the zygoma and lower maxilla (subperiosteal hydroxyapatite granules), coronal brow lift, upper and lower lid blepharoplasties, and small-volume lipofilling of the upper lids and lips were performed.

It is important to maintain an aesthetic focus during the phase of incremental reduction of the glandular volume. Just as a submental depression medial to the digastric from overresection of subplatysmal fat is to be avoided, so too is “skeletonization” of the muscle from overresection of the gland immediately lateral to it. The area of most contour improvement from the volume reduction is central in the digastric triangle extending posteriorly toward the parotid. Definition of the mandibular rim improves with this contouring,

whereas unnatural contours from overresection should be avoided.

CONCLUSIONS

Reduction of submandibular gland prominence is effective in aesthetic neck contouring, and the indication for it doubles in subsequent face lifts. Permanent dry mouth has been shown not to be a consequence of partial submandibular gland reduction. The one potential major

complication, in addition to those of standard midline platysmal plication, is the possibility of bleeding into the closed space of the neck, leading to urgent airway compromise. The complication rate may be reduced by maximizing surgical control, specifically by preliminary intracapsular mobilization of the gland and surgically reducing the residual cavity following the resection followed by overnight inpatient observation.

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PATIENT CONSENT

Patients provided written consent for the use of their images.

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