

Submental Area Rejuvenation by Digastric Corset: Anatomical Study and Clinical Application in 20 Cases

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Abstract Knowing the difficulties and limitations of surgery for rejuvenating the submental area during a cervicofacial rhytidectomy, we came up with the concept of the digastric corset, which is described in this article along with the surgical importance of the platysma, digastric and mylohyoid muscles based on anatomical dissections. A study of ten cadavers was conducted to describe precisely the limits of the submental area, the mandibular edge between the two Furnas ligaments, and the hyoid bone. Each anatomical item was dissected plane by plane: the skin, platysma, digastrics muscles, and mylohyoid muscle. The sliding of each muscle relative to the others was studied, photographed, and recorded. Feldman's corset technique was tested on two cadavers and a digastric corset was performed on eight cadavers. After suprahyoid fat lipectomy, we suture the digastric retaining ligaments to the mylohyoid muscles using a running suture, like a corset, then the platysma muscles are put aside on the median line followed by lateral platysma suspension. The different steps are presented and the results of 20 patients who

underwent this procedure are presented after 1 year of follow-up. This study showed that the technique of a digastric corset anchored on the mylohyoid allows for one-step reconstruction of the floor of the mouth and a well-defined anterior cervical angle, a sign of a youthful-looking neck. This technique is indicated for difficult necks, when lateral repositioning of the platysma alone gives insufficient results. *Level of Evidence IV* This journal requires that authors assign a level of evidence to each article. For a full description of these Evidence-Based Medicine ratings, please refer to the Table of Contents or the online Instructions to Authors www.springer.com/00266.

Keywords Digastric muscle · Mylohyoid muscle · Neck rhytidectomy · Platysma suspension · Anterior cervical angle

Introduction

The essential landmarks of a young neck is the perfect delineation of the mandibular edge and the chin, a well defined anterior cervical angle, and visible larynx cartilage and sterno-cleido-mastoid muscles underneath the superficial tissues [1]. Thus, rejuvenation of the neck is sometimes difficult because many structures may be malpositioned anatomically and/or can be altered by aging. Skin, subcutaneous fat, platysma, subplatysmal fat, and deep muscles may all be affected at different levels [2].

Deep anatomical organs that make up the “visceral neck axis” are pharyngo-laryngo-tracheal structures. They define the anterior and medial anatomy of the neck, with the thyroid cartilage preminent, covered by muscles that insert on the sternum, the hyoid bone, and the mandibular bone. The hyoid bone occupies a central part of the deep structures of the neck

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and is linked to thyroid cartilage by the thyrohyoid membrane, to the skull base by the posterior belly of the digastrics and stylohyoid muscle, and to the mandible bone by the anterior belly of the digastrics (AD) and mylohyoid muscle.

Others elements that are not “musculoskeletal” in the upper part of the neck are the salivary glands (submandibular), lymph nodes, blood vessels, and nerves, all located under the platysma. Subplatysmal-supramylohyoid fat has been well described and reported by some authors to be similar to the buccal fat pad (Bichat’s fat pad). This fat follows body weight variation, being very thick in obese patients. Submandibular salivary gland anatomy varies between subjects, either with respect to dimensions, being very large in some subjects, or position, being very low naturally. Preoperative assessment of gland volume and position is mandatory as many patients do not notice having paramedian bulges, which are highlighted after a midline platysmaplasty and decrease the quality of postoperative results [3].

Platysma muscles cover these deep structures. In a youthful neck, visual cues of the thyroid cartilage, the position of the hyoid bone, the suprasternal notch and the sterno-cleido-mastoid muscles are important. These different structures are altered by aging or a patient’s anatomy may be unique. All these tissues must be examined to ensure the correct procedure is used and there is a good result [4].

In the aging neck, as well as in the aging face, mimic muscles become spastic. Platysma spasticity may be obvious from bands in the neck that deform the shape of the deep muscles and are worsened by fat that tends to accumulate in the subcutaneous plane. Successful treatment of platysmal bands may consist of the use of botulinum neurotoxin for mild bands, a myotomy, or cervical rhytidectomy [5–10]. Numerous procedures have been proposed for the treatment of the platysma, including muscle flaps, plications, resections, or composite flap translations. Knipper [11] found that midline suturing of the platysma did not give satisfactory results alone and better results were obtained with a poster-superior platysma shift.

However, the above techniques do not yield satisfactory results in some difficult necks. The main drawback of these procedures is that the cervical angle remains poorly defined, which is a sign of aging. To deepen the cervical angle, some have proposed performing a subcutaneous suction lipectomy, liposuctioning of fat between the AD, shaving the digastrics muscles, folding the posterior belly of the digastric muscles, creating a submandibular suspension, or partially removing the submandibular gland [11–16]. These procedures have their complications and specific outcomes. In particular, opening the subplatysmal space risks nerve injury, hematoma, and salivary fistula [17, 18].

Fig. 1 Surgery planning and result of digastric corset, platysma suspension, and cervicofacial face lift. **a–c** Preoperative planning of subcutaneous undermining, platysma suspension key points, and digastric markings. **a** Frontal view. **b** Lateral view with the head bent forward. **c** Lateral view with the head in a neutral position. **d–f** Results after surgery. The retrochin scar can be seen in **e**



In our experience with cervical rhytidectomy, the lateral and inferior parts of the neck are always well treated by a platysma suspension. We have noticed that we sometimes obtain good results with a Feldman platysma corset in very difficult necks in which we placed multiple up-and-down corset sutures. However, in some mildly difficult cases, the suprahyoid Feldman's corset technique did not yield satisfactory results. This is why we performed anatomical studies to further understand these inconsistent results with the deeper structures in the neck. In particular, we found a ligament or adherence between the anterior belly of the digastric muscle and the mylohyoid muscle that has not yet been described. It allows only the anteroposterior sliding of the digastric whereas lateral sliding is limited. This observation allowed us to tighten the mylohyoid muscle through the anterior bellies of digastric sutures.

Patients, Materials and Methods

Anatomical Study

Ten cadavers were studied in the Anatomy Department (Professeur Salamé, CHU de Caen, France). The submental area was prepared within its limits: mandibular bone edge, between the two Furnas ligaments (mandibular ligaments), and the hyoid bone. Each cadaver had been dissected plane by plane to isolate the skin, platysma muscle, digastric muscles, and mylohyoid muscle. The sliding of each plane relative to each other was studied, photographed, and recorded.

Feldman's corset technique was performed in the suprahyoid area on two cadavers. Subplatysmal suprahyoid fat was removed systematically. On the other eight cadavers, the digastric corset technique was performed with the AD brought aside, and the sutured medial platysmal bands associated with lateral platysma suspension.

Preoperative Examination

Preoperative examination should explore skin laxity and thickness, the presence of supraplatysmal and subplatysmal fat, platysmal flaccidity or banding, position of the hyoid bone, paramedian bulging, and digastric convexity. Difficult necks are identified by a combination of different factors, most of which involve subplatysmal structures. The fat compartment between the AD might be expanded. The anterior bellies of the digastrics might be thick and also be projected downward by the mylohyoid and tongue, taking on a convex shape [3]. In heavy necks, it is particularly difficult to assess the volume and position of the digastrics [4]. Submandibular salivatory gland bulging might be constitutive and also increased by aging [19].

As proposed by Mejia et al. [4], a simple test can be performed to differentiate subcutaneous from subplatysmal fat. Submental fat must be pinched between the fingers. The patient is asked to contract the platysma. Fat slipping from the fingers indicates that it is subplatysmal and therefore should be corrected directly. Other authors use ultrasound to assess the thickness of the submental fat [20]. However, in our experience, this clinical test is sufficient.

We use a simple clinical test to simulate the platysma suspension. Standing in front of the patient, the operator can reposition the platysma laterally by moving the skin landmarks of the platysma suspension with his fingers. If this maneuver restores the anatomy of the neck completely, then a platysma suspension alone will restore a youthful-looking neck. In cases where there is medial or paramedian bulging after this maneuver, the digastric corset should be performed.

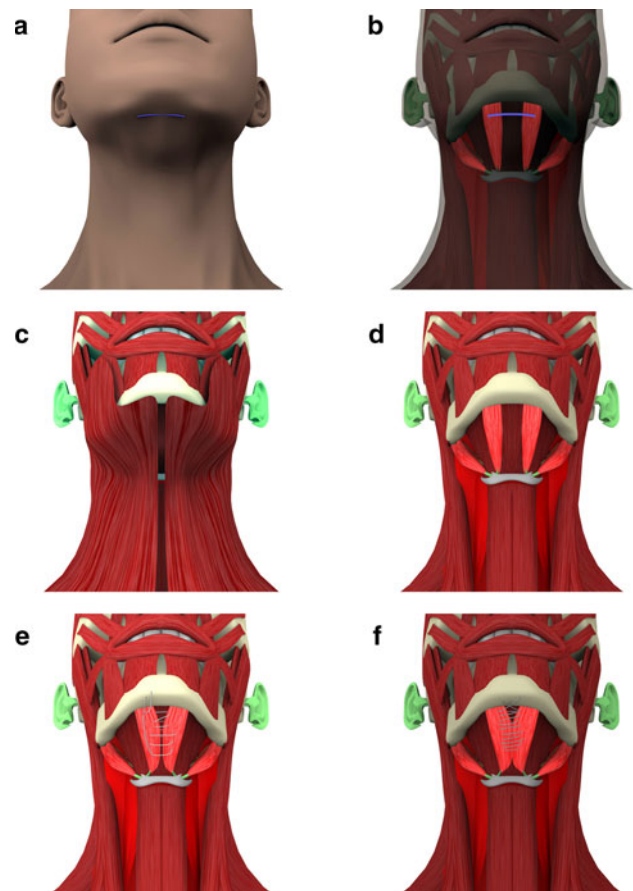


Fig. 2 Principles of the surgical procedure. **a** Incision is made in the submental crease. **b** Incision gives access to submandibular structures (platysma and skin removed). **c** Dissection must isolate the medial border of the platysma bands. **d** Fat between the anterior bellies of the digastrics is removed. **e** Running suture is placed down to the hyoid bone and back to the retrochin area. **f** Final position of the anterior bellies of digastric muscles after the sutures

Difficult necks are a combination of lowered and hypertrophied AD, excess subplatysmal fat, and submandibular gland ptosis. We treat these necks with a single surgical procedure using the digastric corset technique along with liposuction and platysmaplasty. The cosmetic neck deformity was assessed before and after surgery, as described by Knize [21].

Surgical Procedure

The surgical procedure begins by marking the incision lines on the awake patient. At the same time, markings for the cervical face lift and platysma suspension are made (Fig. 1a–c). The patient is prepared for the surgical procedure with full anesthesia, orotracheal intubation, skin preparation, and sterile draping. We perform a hydrodissection of the subcutaneous plane and platysma with epinephrine-serum solution (1 mg of epinephrine for 1 L of serum). If needed, liposuction is performed before open surgery.

In the submental area, the skin is incised deep to the subcutaneous fat (Figs. 2a, b, 3a). The skin is dissected off

the platysma with a Trepsat dissector in front of the platysma muscles (Fig. 2c). Then an incision is made between the platysma on the median line from the chin down to the hyoid bone. The platysma are dissected in the same area to access the interdigastric fat which is removed by dissection (limits: anterior: mandibular bone; lateral: digastrics; upper: mylohyoid muscle; lower: platysma; Figs. 2d, 3b). Laterally, one must be careful with dissection because retaining ligaments of the platysma to AD are important for the stretching of the platysma medially. Coagulation of blood vessels must be performed with caution [22, 23].

Anterior bellies of digastrics are brought to the sides of the median line using a running suture of nylon dec 2 (USP 3/0) or dec 3 (USP 2/0) or barbed polypropylene (Quill SRS USP 2/0). The suture is attached first on the anterior part of the AD, then to the hyoid bone, and then back to the retrochin area (Figs. 2e, f, 3c). It is noteworthy that the AD is not strong enough to withstand the tension, so each passage of the needle must be deep enough to hold the digastric retaining ligament, which links the AD to the mylohyoid muscle, completely closing the submandibular hollow between the AD and

Fig. 3 Preoperative view. **a** Incision gives access to the platysma bands. **b** Dissection of the platysma bands. **c** Running suture achieving the digastric corset leaned in the mylohyoid muscle is placed. **d** Using a strong hook, the operator can simulate the lateral platysma suspension and check the result

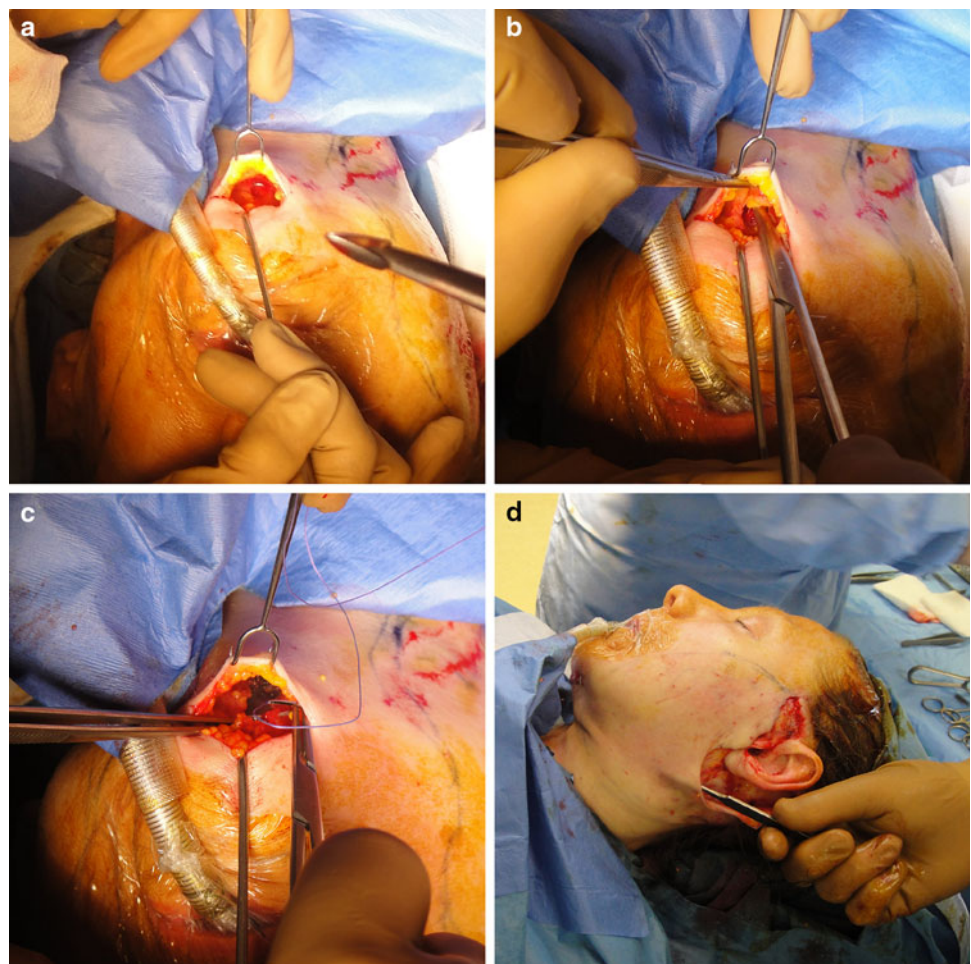


Fig. 4 Adherence between the platysma and the digastric. When platysma muscles are grasped with forceps and moved laterally, their medial borders do not move as the platysma are attached to the digastric below (a, b). c Platysma muscle removed, the anterior bellies of the digastric muscles appear (AD), and the mylohyoid muscles are deeper medially (asterisk)



Table 1 Clinical characteristics of patients

Characteristic	Mean value \pm SD [min–max]
Sex ratio	All females
Age (years)	61 \pm 6.9 [49–71]
Height (m)	1.65 \pm 0.07 [1.55–1.8]
Weight (kg)	61.4 \pm 9.9 [49–83]
Body mass index (kg/m ²)	23 \pm 2.8 [18.3–31.2]
Preoperative cosmetic deformity class	III–IV
Postoperative cosmetic deformity class	I–II

achieving the digastric corset. Platysma borders approximated with this maneuver are sutured as already described [3].

Platysma suspension is performed as already described at the same time using a cervicofacial rhytidectomy approach. Briefly, the skin is incised in the temple region, between the ear and cheek, around the earlobe and in the retroauricular fold with a precapillary incision. Cutaneous separation is performed in the cheek, mandibular, and laterocervical areas. Stitches are placed in the cheek to move and attach the free edge of the platysma muscle to the tympanoparotid fascia (Lore's fascia), pulling the posterior

border in the vertical and posterior directions (Fig. 3d and Video 1). The skin is sutured at the end of the procedure.

Results

Anatomical Study

Feldman's corset obtains good results in most cases, but the results in the medial upper part of the neck are insufficient. Notably, the first impression is that the digastric muscles and hyoid bone are not displaced by this technique.

We performed the digastric corset technique in two cases resulting in a deeper anterior cervical angle, closer to that of a young person, than Feldman's corset technique. The platysma has the same sliding plane as already described, in particular, an anterior adherence of the great auricular nerve and on the AD (Fig. 4a, b). Held by forceps, the digastric muscle slides in an anteroposterior way but not laterally. This is a result of adherence between the mylohyoid muscle and the AD (Video 2). When the digastric corset is performed, no bulging is noticed laterally and the mandibular border is well defined. Overall, there is

Fig. 5 Result of a digastric corset, platysma suspension, and cervicofacial face lift. **a**, **b** Before surgery. **c–e** After surgery. **b** and **e** show the head in a neutral position and **d** with the head bent forward



an upward movement of the floor of the mouth which affects the mylohyoid muscle (Video 3).

In conclusion, the digastric corset has better results than Feldman's corset with respect to deepening the anterior cervical angle.

Patients

The digastric corset technique has been performed in 20 cases (Table 1). Patients were not particularly overweight, with a mean body mass index of 23 kg/m², and had a mean age of 61 years. The technique was also used on patients who had undergone Feldman's corset before this study and had insufficient results by only a submental approach. The results presented here have been stable over the 1-year follow-up. All patients who underwent a digastric corset and platysma suspension displayed evident improvement of the cervicomandibular angle, mental prominence, and mandibular rim definition, and also had a great increase of the visibility of the "visceral axis" and the skin landmark of the sterno-cleido-mastoid muscles (Figs. 1, 5, 6, 7, 8).

Overall, the technique decreased the cosmetic neck deformity by at least two classes [21].

In all cases, healing was similar to that for a cervicofacial rhytidectomy in the subcutaneous plane with SMAS plication. There was barely any specific morbidity in the submental area, except for one case of prolonged edema after strong auto massages in the suprahyoid area, checked by echography; it resolved spontaneously (Table 2).

Results were immediate, during the surgery. Movement of the floor of the mouth is mostly upward. Patients did not have any problems when general anesthesia was stopped; breathing was completely normal. Patients also did not report any change in their voice. At the 1-year follow-up, results were stable and the submental scars were nearly invisible.

Discussion

We presented our technique of a suprahyoid digastric corset, anchored to the mylohyoid muscle after resection of

Fig. 6 Result of a digastric corset, platysma suspension, and cervicofacial face lift. **a–c** Before surgery. **d–f** After surgery. **b** and **e** show the head bent forward and **c** and **f** show the head in a neutral position



suprahyoid subplatysmal fat. It is the first technique that addresses the malpositioned floor of the mouth and has reliable and long-lasting results without much morbidity.

Subplatysmal lipectomy is well described as an efficient way to treat medial bulging in adipose necks. As a consequence, the medial hollowing is prevented when the anterior bellies of the digastrics are put aside. On the other hand, the mylohyoid muscle may herniate between the AD after fat removal. The digastric corset prevents these two drawbacks by reconstructing the floor of the mouth. Other procedures on the digastric have been described, such as shaving the excess volume of the anterior belly [4]. This technique is efficient but does not benefit from the surjet suture, which is like a quilting suture. Knipper [24] proposed plicating the posterior belly, which may correct the malpositioned hyoid bone, and closing the pharyngoesophageal complex by posterior transposition.

Suprahyoid lateral bulging is composed of the medial platysmal band and submandibular gland ptosis, both or which are treated by the digastric corset. Platysmal tightening on the midline and laterally by platysma suspension yields a more superficial corset, which does not correctly treat some difficult cases. The submandibular bulging has

been linked to salivatory gland displacement. Excision of this gland has been proposed, but surgical access to this region is tricky and risks nerve complications [18]. Our technique addresses the lateral part of the submental area through two mechanisms. First, repositioning the mylohyoid moves the roof of the submandibular pocket upward. Then, the platysma is tightened between the medial insertion, which is moved medially by the digastric suture and laterally by the platysma suspension. Both affect the submandibular gland in an upward movement, like a hammock, without directly opening the anatomical site, thus reducing the morbidity of the procedure when compared to others.

Composite platysma and skin flaps has been proposed, but dissection of the platysma takes time and the great auricular nerve may be altered by this procedure [17]. As some authors have reported, difficult necks are not completely treated through this approach. The medial approach to the platysma yields results close to those of Feldman's corset but implicates skin and muscle resection in the suprahyoid area. Endoscopic treatment of the platysma gives the same results, with supramylohyoid fat resection, platysma section to weaken the muscle, and lateral suspension.

Fig. 7 Result of a digastric corset, platysma suspension, and cervicofacial face lift. **a–c** Before surgery. **d, e** After surgery. **b** and **e** show the head bent forward and **c** and **e** show the head in a neutral position



Fig. 8 Result of a digastric corset, platysma suspension, and cervicofacial face lift. **a–c** Before surgery. **d–f** After surgery



Table 2 Postoperative complications

Complication	Case (frequency)
Long-lasting edema	1 (5 %)
Hematoma	0 (0 %)
Seroma	0 (0 %)
Infection	0 (0 %)
Tissue ischemia	0 (0 %)
Flap necrosis	0 (0 %)
Pathologic or unaesthetic scar	0 (0 %)
Nerve complication (paresis or section)	0 (0 %)

We had only one postoperative complication with our technique. No skin flap complications were observed. The anterior cervical approach of the neck leaves a short scar in the submental area, but this scar is located in the natural fold of the neck and is barely visible when in the standing position. The scar is of good quality as this region heals easily and there is no particular tension on the skin. The deep approach to the suprathyoid might cause a bit of bleeding because of the submental artery that arises from the anterior belly of the digastric in 70 % of cases [23]. Good electrocoagulation and a strong surjet suture between

the two digastric bellies completely closes the site of the subplatysmal suprahyoid fat; we experienced no submental hematoma. Platysmal closure on the middle line also reduces this space. The lateral approach to the neck is strictly subcutaneous, undermined from one side to the other with extensive liposuction so we do not have to dissect any blood vessels or nerves. This site heals easily without nerve complications.

Conclusion

Our technique is the first that addresses the malpositioned mylohyoid muscle in the neck. Suturing the anterior bellies of the digastrics not only treats the medial bulging but also tightens the floor of the mouth. The submandibular gland is displaced upward, as long as the platysma is suspended between the adherence of the platysma to the anterior belly of the digastric and the tympanoparotid fascia. This digastric corset allows recreation of the floor of the mouth, removal of the suprahyoid subplatysmal fat, and the achievement of a deep and well defined cervical angle (Fig. 9). Results are stable over time and ensure, when associated with platysma suspension, a younger-looking neck which cannot always be achieved by other techniques.

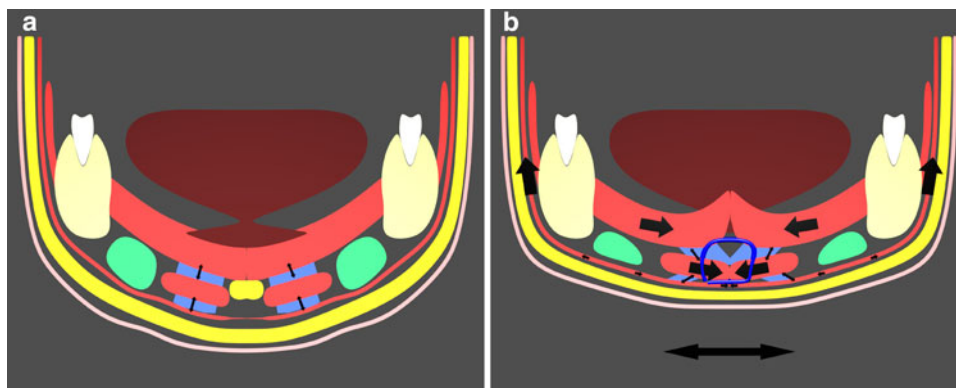


Fig. 9 Reconstruction of the floor of the mouth by the digastric corset, coronal section through the suprahyoid area. **a** Preoperative view of a difficult neck. **b** After a deep suture of the anterior bellies of the digastrics on the midline (in blue), tension is transmitted through

the digastric to mylohyoid retaining ligament to the mylohyoid muscle which is pulled upward. Association with platysma suspension allows a better correction of the lateral bulging in the anterior neck

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Conflict of interest The authors have no conflicts of interest to disclose.

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