

TITLE: Rhytidectomy

SOURCE: Grand Rounds Presentation, UTMB, Dept. of Otolaryngology

DATE: May 21, 2003

RESIDENT PHYSICIAN: Russell D. Briggs, MD

FACULTY PHYSICIAN: Karen H. Calhoun, MD

SERIES EDITORS: Francis B. Quinn, Jr., MD and Matthew W. Ryan, MD

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Introduction

Rhytidectomy, or facelift, is a cosmetic surgery procedure designed to reposition the facial skin in an attempt to rejuvenate the aging face. The procedure has been around for a century but has seen increased attention and innovation in recent years. It is often performed in conjunction with other procedures designed to rejuvenate the aging face. With proper patient selection and technique, rhytidectomy can be a rewarding procedure for patient and physician alike.

History

In the early 20th century, several German and French surgeons began experimenting with face lifting. Little is known of these early techniques as the prevailing attitude of this time was that vanity was not a proper indication for surgery. As this was the pre-antibiotic era, surgeons were expected to treat only life threatening ailments. In addition, individual techniques were jealously guarded as surgeons recognized the increasing potential for greater financial and social reward. As a result, those who did perform cosmetic procedures maintained a low profile, and did not discuss their work in the literature.

However, there is ample evidence to suggest that face-lifting techniques were in common practice by the turn of the 20th century. The first face lift utilizing extensive subcutaneous undermining began to emerge in the late 1920's. These early facial rejuvenation techniques were primarily designed to rid the patient of lateral facial wrinkling. For the next half-century this technique remained essentially unchanged even though patients experienced suboptimal long-term results. The next significant advance arrived in 1974 with Skoog's description of the subfascial facelift. Instead of placing the tension on the subcutaneous tissue, the lift is achieved with sutures in a deeper layer of tissue. This technique vastly improved both the short and long term results. Skoog's anatomic relationships were detailed clearly by Mitz and Peyronie in 1976 by describing the superficial musculo-aponeurotic system, or SMAS. This gave rise to the development of the SMAS facelift which has been the gold standard for many years.

The 1990's saw the development of the deep-plane and composite rhytidectomies described by Hamra, and these alternatives may be adjuncts or may surpass the SMAS lift as the standard operation to which others are compared. The past few years have also seen the application of endoscopic techniques to face lifting as surgeons strive for smaller incisions and minimal skin excision. An explosion in variations has occurred in addition to adjunctive techniques such as of CO2 laser rejuvenation. The factors motivating these changes are most likely a combination of social acceptance and technologic advance. With an aging population and an ever increasing preoccupation with physical appearance, the demand for rejuvenation procedures will continue to expand.

Clinical Evaluation

As in most facial plastic procedures, the preoperative evaluation is important to evaluate the patient's needs and to determine what procedure to recommend. The patient that will benefit most from face lifting is one who retains elasticity in the skin for better redraping, and whose underlying anatomy includes distinct bony landmarks and a paucity of subcutaneous fat. Patients outside of this ideal may benefit from adjunctive techniques such as cervicofacial liposuction or laser facial rejuvenation to alter the subcutaneous and cutaneous anatomies. As in all surgical procedures, it is imperative that the patient have realistic expectations of the outcome, and thoroughly understand the risks associated with the procedure. Careful explanation of the limitations of the surgery, along with the potential problems that may develop is the best defense against unrealistic expectations. The patient must also understand the post operative regimen and be willing to comply. Those patients that are depressed and have situational problems in their lives will frequently carry these dissatisfactions into the postoperative period and in many cases will be less than totally satisfied with their surgery. A subjective, but useful rule advocated by Larrabee, is to not operate on a patient that one does not feel positive about.

Analysis of the face prior to lifting includes assessment of the chin and malar prominence, nasolabial folds, jowl area, jaw line, hyoid position, platysmal banding as well as the quality of the skin and the amount of subcutaneous fat. Adjunctive implanting procedures produce excellent results in the correction of underprojected malar prominence and chins, and should be considered in appropriate patients. Hypertrophic nasolabial folds have never responded well to SMAS lifting. Jowl and jaw line improvements remain significant with the standard SMAS lift, but the deep plane technique has been touted to provide better and longer lasting results. Hyoid position is difficult to alter, but is a good predictor of outcome. A low lying hyoid produces an obtuse and less attractive cervicomenal angle and should be discussed with the patient to ensure a reasonable expectation of outcome. Platysmal banding should be addressed with platysmaplasty, and routinely produces good results. Excessive subcutaneous fat should be addressed with liposuction, and skin quality improvements are easily attainable with CO2 laser treatments or chemical peeling. There are many variables in such an analysis, so that a systematic approach, followed by a detailed discussion with the patient, is necessary for preoperative planning. Preoperative photography includes the standard A-P, oblique, and profile views with close-ups of any pertinent areas. As always, consistency in this process is necessary to allow meaningful analysis post-operatively. Equally important is the photographic record of any asymmetries such as facial nerve weakness, asymmetric smile, asymmetric submandibular gland ptosis, eyelid ptosis, and scars. The latest development in photographic analysis is the

digital camera with images that can be manipulated on the computer. This technology allows the patient to see a photographic prediction of the post-operative result. As the price of these systems comes down, they will likely become an integral part of the preoperative process.

The preoperative workup also includes a thorough history and physical exam. Alcohol intake and tobacco use have a significant impact on bleeding and postoperative healing. Smokers have been shown to have a twelve fold increase in postoperative skin slough, so the technique must be modified in these patients. Having the patient stop smoking one month prior to and after surgery will significantly limit the perioperative risk. All patients should be instructed to discontinue aspirin, non-steroidals, steroids, and over-the-counter herbal supplements that may increase bleeding at least two weeks before surgery. Medical conditions such as diabetes and collagen-vascular diseases may make patients unsuitable. The workup in a purely elective procedure such as this must be thorough, because a preventable complication will have much greater significance. Once a patient has been selected for surgery it is useful to give them prescription ahead of time and to give them an instruction sheet to aid in peace of mind.

Anatomy

The SMAS is a cervicofacial layer of tissue made up of both fibrous and muscular elements that enmeshes and distributes force among the facial mimetic muscles. In the scalp, the galea is synonymous with the SMAS. As it proceeds inferiorly the SMAS is made up of the superficial temporal fascia or the temporoparietal fascia. At the level of the zygomatic arch, the SMAS is discontinuous and is not used as a surgical plane because of risk to the frontal branch of the facial nerve. Below this level however, the SMAS becomes substantial again, and exists superficial to the parotid fascia. Anteriorly, at this same level, this layer envelopes the zygomaticus major muscle. Because this muscle has cutaneous attachments at the nasolabial crease, traction on the SMAS pulls directly on this crease to actually widen and deepen it.

In the neck, the platysma is the SMAS layer with dehiscences at the midline and lateral to the angle of the mandible. The blood supply to the flaps elevated in facelift surgery come from branches of the external carotid arteries. The majority of the supply exists with the branches of the facial and infraorbital arteries. These are musculocutaneous branches. Because dissection is carried out under the fascial layer, it is important to leave fibrous septa attached to the flap, especially in smokers. This allows preservation of the septocutaneous vasculature without compromising flap mobility. Knowledge of the nervous anatomy pertinent to facelifting makes for a much safer procedure. Sensory nerves are the most commonly injured, with the greater auricular nerve making up the vast majority. With newer techniques of midface lifting and subperiosteal dissection, the infraorbital and mental nerves may also be encountered. Again, knowledge of their anatomy will help prevent complications. Surgeons experienced in parotidectomy undoubtedly have an advantage in facelifting with such intimate knowledge of the facial nerve anatomy. Having visualized the facial nerve completely dissected, we can appreciate that the branches most at risk are the marginal and frontal. This is due not only to their vulnerable location, but also because of a lack of anastomoses, that do exist in the central branches. The frontal branch emerges from the parotid to cross the zygoma beneath a dehiscent and unreliable SMAS.

Safe dissection here requires a subperiosteal plane. Above the zygoma, the nerve lies deep to the SMAS (superficial temporal fascia) as it courses between the superficial and deep layers of the deep temporal fascia. To avoid injury to the nerve at this level, dissection between the superficial and deep layers of the deep temporal fascia, or in a sub-follicular plane is necessary. This branch then goes on to innervate the frontalis and orbicularis musculature. The zygomatic and buccal branches exit the parotid at its anterior extent to innervate the paranasal and lip musculature. This innervation occurs on their deep surface making the supramuscular plane a safe level. The marginal mandibular branch lies one to two cm below the inferior border of the mandible before it courses anterosuperiorly to innervate the lip depressor musculature. This branch is protected by the platysma until approximately two cm from the oral commissure. Motor nerve damage is a rare, but devastating complication of facelifting. Knowledge of the anatomy, and the exercise of caution when dissecting near the zygoma or within two cm of the oral commissure will help keep such injuries a rarity.

SMAS Suspension Facelift

Although several variations to this technique now exist, the SMAS suspension technique remains the mainstay for most facial plastic surgeons. Familiarity with this technique is also a great advantage, if not a necessity, when experimenting with the newer techniques. This method produces reliable, long-term results with a minimum of morbidity, and may be combined with adjunctive liposuction or augmentation of the malar or mental areas, and chemical or laser exfoliation procedures.

Preoperative marking

In the preoperative holding area, landmarks and incision lines are drawn on the patient. With the patient upright, the nasolabial folds, jowl lines, and platysmal bands are marked. It is also common to draw an arc two cm from each oral commissure, a line at the mandibular angle, and a line approximating the frontal branch of the facial nerve. The pre and post-auricular and, if necessary, the submental incision lines are drawn. The patients temporal and post-auricular hair is rubber banded if necessary.

Anesthesia

Anesthesia for this procedure may be general, or local with intravenous sedation. A great number of surgeons prefer general anesthesia and maintain that the patient experience is better. Regardless of choice, the incision lines and areas of flap undermining are infiltrated with a mixture of epinephrine and lidocaine. Because of the volume necessary, it is preferable to use 0.5 or 0.25% lidocaine for flap infiltration to avoid toxicity. The incision lines may be injected with a stronger solution.

Incisions

The temporal incision parallels the gentle curvature of the hair line, usually 1 cm within the hair where the density of the follicles is sufficient to hide the scar and to help preserve the temporo-pre-auricular hair tuft. The incision is carried posteriorly and there is wide variation among surgeons as to how the incision is made. McCollough likes to go along the hairline

anteriorly (almost a pretrichal incision) to spare the temporal hair tuft, Ellenbogen does not go above the auricle at all, Beesom goes forward to spare the hair tuft and then posteriorly up above, deep into the hairline. Pitanguay and others go posteriorly on females up over the auricle and then in a sloping fashion onto the superior scalp deep within the hairline. Rolf Muenker, describes the incision as follows "temporal incision is made in a semilunar line 2 to 3 cm above the side burns and temporofrontal hairline, starting at the top of the ear and running superiorly in an angle of about 50 degrees. " They do not include superficial temporal fascia in the incision and flap development. By remaining superficial to the fascia they feel they avoid bleeding from the superficial temporal vessels and that the frontal branch of the facial nerve cannot be damaged in this plane. The temporal sparing incision is probably most important in males and in people getting a second or third facelift.

The preauricular incision follows the preauricular crease. Again there is disagreement here. For males the consensus is to take the incision in the pre-auricular crease. For females some argue for making the incision go behind the tragus, others say just to stay within 2mm of the tragus going slightly onto the tragus, still others just stay in the pre-auricular crease. If the decision is made to go behind the tragus, it is best done when the patient has a sharp, well-defined tragus which does not protrude.

The earlobe incision closely follows the lobule margin. Avoid undercutting the lobule and free the lobe completely from the underlying tissue. It is important to close the lobe without tension to avoid inferior pulling thereby producing a pixie ear.

The postauricular incision continues posteriorly on the concha to the level of the inferior crus. Many will move posteriorly into the post-auricular sulcus for a short distance before making the mastoid incision to help prevent webbing. Some also place a notch or z in the incision to prevent webbing and others make the incision right in the post-auricular sulcus.

The mastoid-occipital incision curves posteriorly gently onto the mastoid. When the level of the inferior crus is reached or at the junction where the auricle crosses the posterior hairline, the incision courses postero-inferiorly for some 5-8 cm, slightly above and parallel to the hair line and onto the nape of the neck. By staying close to the hairline you can prevent elevation of the hairline. However, some physicians like to take the incision straight back well into the hairline and do not feel this makes the hairline noticeably smaller.

Platysmaplasty

If platysmaplasty is planned, the submental incision is carried to a level just below the dermis. If desired, liposuction is usually performed next using the cannula to dissect a fan-shaped flap. The anterior edges of the platysma are then identified as the flap is elevated with scissor dissection in the subcutaneous plane. With the guideline of the previously marked platysmal bands, the actual bands are identified, cauterized, and incised as low as possible. The anterior edge of each muscle is then approximated with 2-0 vicryl. In most cases, skin excision here is not necessary; however, patients with marked excess may benefit from a Z-plasty or elliptical skin excision.

Flap elevation

Flap elevation is next begun in the peri-auricular area. As in the neck, a subcutaneous plane is used in all areas except above the zygoma. In this area, a subfollicular plane is necessary to avoid the superficially located frontal branch. Flap elevation behind the ear follows, and will be the most difficult as the subcutaneous tissues are very adherent. Frequent palpation, and visual cues such as a uniform 'marbling' of fat on the flap undersurface will ensure maintenance of a subcutaneous plane. As mentioned, dissection below this plane jeopardizes the greater auricular nerve. Development of about two to three cm of flap here is then followed by elevation in the infra- and pre-auricular areas. Make sure to make the infra-auricular incision precisely where the neck skin meets the lobule to avoid the pixie ear deformity. Flap elevation continues anteriorly and inferiorly. In patients who smoke or who have diabetes or atherosclerosis, a short flap technique is safest. Three to four cms are elevated anteriorly, and five to seven cms are dissected in the neck. The liposuction cannulas can then be used to tunnel without the use of suction. The tunnels created will allow mobility of the flap without significantly compromising the vascular supply. Adjunctive liposuctioning would also be carried out at this time if the jowls or lateral neck necessitated this. In the nonsmoker, the long flap technique becomes an option. Here the neck dissection is made continuous with that of the platysmaplasty, and the preauricular flap is taken just beyond the anterior parotid edge. In the midface the advantages of the long flap are subtle and do not usually justify the additional risk of limiting the blood supply. In the neck, however, communication between the platysmaplasty and the facelift flaps allows for smoother contour and a greater excision of redundant skin.

SMAS Suspension

With the flaps elevated, the suspension of the SMAS is accomplished with either plication or imbrication. Plication implies sutures that fold the SMAS onto itself to shorten it, where imbrication involves excising a block of SMAS and approximating the cut edges to tighten this layer. Imbrication does not provide any additional benefit according to cadaver studies by Webster, and involves an additional step. The placement of sutures and the vectors of tension are well agreed-upon. The first suture is applied at the jaw line and is anchored at the mastoid periosteum, or deep tissues in the pre-auricular area. The choice of suture varies; most surgeons use permanent, while others use a longer lasting absorbable such as vicryl. Several sutures are applied along each vector, and the horizontal mattress technique seems to hold the tissues best. The posterosuperior vector in the neck is then created with sutures in the platysma being tightened by the SCM fascia or mastoid periosteum. Flattening of the jowls is accomplished with the third vector, as the SMAS is pulled with a suture in the deep preauricular tissues.

The SMAS suspension results in a skin excess that will require judicious trimming. The only way to avoid scar widening with healing, is to eliminate any tension on the skin closure. The easiest way of ensuring this is to make pilot cuts in the redundant skin in the same direction that the SMAS was tightened. An anteroinferior incision is made where the lobule will attach. A tacking stitch is applied, and similar pilot cuts are made in front of and behind the ear. The excess skin is then removed by connecting the ends of these cuts.

Closure

Closure of the incisions is straightforward, but the decision whether or not to use drains must be made first. No studies have demonstrated a decrease in hematoma formation with the use of drains, but most would agree that a closed suction system will remove intervening fluid and provide better adherence between the skin flap and underlying SMAS. Kridel maintains that patients are more comfortable with the drains because of the lack of fluid build-up beneath the flaps. The skin is then closed with several deep sutures followed by a running 5-O nylon. The hair-bearing skin can be closed with staples. A burrow's triangle is often necessary in the postauricular scalp, and occasionally used in closure of the temporal incision.

Dressing

For dressing, a nonadherent material is placed over the incisions and gauze fluff is wrapped tightly beneath an ace bandage. The dressing should apply even pressure to the neck and midface skin flaps to promote adherence. After 24 hours, the bandage is removed, the patient is examined, and a commercially available nylon facelift dressing is applied for seven days. Sutures are removed in five days, and staples in seven to ten. The patient should keep activity to a minimum and maintain head elevation day and night for one week.

Complications

Complications in facelifting are most often a result of inadequate hemostasis or overextensive undermining of flaps. The most feared problem is facial nerve injury, but fortunately the incidence is uncommon, between 0.4% and 2.6%. The frontal branch is most commonly injured, and is vulnerable in its superficial path over and above the zygomatic arch. The marginal mandibular branch is at risk with dissection below the platysma at the mandibular angle, and buccal injury accompanies deep dissection medially in the midface. Facial nerve injury can be prevented by use of blunt finger dissection and bipolar electrocoagulation. Frontal branch injuries can be avoided by blunt finger dissection over the course of the nerve. This is the branch least likely to recover and the most likely motor branch to be injured. The buccal branch is the most likely to recover because of multiple interconnected branches. The marginal branch will usually recover spontaneously, but less likely than buccal. Most motor nerve injuries are discovered post-operatively. If discovered intraoperatively primary microsurgical repair is indicated. The vast majority of nerve injuries recover. Rarely, re-exploration and electromyography studies are needed. The greater auricular nerve is injured more commonly than the facial and is vulnerable when the postauricular flap is elevated off the adherent subcutaneous tissues. Such injuries should be repaired primarily if identified at the time of surgery.

The most common complication following facelifting is hematoma, with some reports placing the incidence as high as 8.5%. Skin necrosis routinely follows unrecognized hematomas. Expanding hematomas must be addressed by opening the incisions and obtaining hemostasis. Smaller ones may disappear with serial evacuations. Meticulous hemostasis, judicious flap dissection, and attention to postoperative pain are the best defense against this common complication.

Incisional problems can also ruin an otherwise perfect result, and are usually due to excessive tension. Widening of the scars, hypertrophic scarring, and skin slough can all result from this. Early treatment involves reducing edema, removing sutures causing tension, and, if skin slough occurs, expectant management with debridement and topical antibiotics. Hypertrophic scarring is treated with serial injections of triamcinolone on a monthly basis. Another problem along the incision line is alopecia. Most of the time this is temporary, with a return in about three months. However, approximately 1% of facelifts will be associated with permanent alopecia that may require scar excision or local flap reconstruction. Again, tension is the major culprit along with poorly planned incisions.

Infections are rare due to good blood supply of face, overall incidence 0.7-3.9%. Staphylococcal infection is the most common, it usually responds well to antistaphylococcal meds. Many physicians give intravenous perioperative antibiotics and post-op antibiotics for 1 or 2 days.

Skin slough incidence ranges from 1-6%. It occurs in direct proportion to tension on skin. It has a much higher incidence in smokers and using long flap techniques. This should be treated conservatively as often with time they heal well. Do not debride eschars unless there is obvious liquefaction. Place ointment to allow them to flake off spontaneously. Although the initial scarring can be significant, over months and years this scarring will reduce. A secondary facelift can help remove the scars.

Ear lobe deformities such as the pixie ear are often secondary to excessive tension on the ear lobe. There must be no tension on the ear lobe at all. Psychological problems can also occur: Transient post-operative depression is extremely common. This and all psychological complications can be helped by proper patient selection and preoperative counseling.

Deep Plane Facelifting

This technique evolved from the original SMAS suspension in an effort to better address the nasolabial fold. There is a limitation of the SMAS technique in eliminating the nasolabial fold. Because the flap is not elevated to the nasolabial fold, tension in the SMAS laterally serves to deepen the fold. The deep plane technique which was described by Hamra in 1990 allows elevation of a long enough flap to address this area, without compromising the blood supply. Most surgeons using this technique also claim that the technique will produce better long-term results. Kamer recently described his experience with the deep plane technique in 100 consecutive patients in the literature, and has since doubled that number. The results have not differed between the two groups. His technique begins with the same incisions described above, and even involves a similar subcutaneous dissection anteriorly for four to five cms. At a line drawn between the malar eminence and the mandibular angle, a vertical incision is made into the SMAS and dissection proceeds anteriorly. Within one to two cms, the zygomaticus muscle is identified and dissection continues on its superficial surface. The nerve branches enter the muscle deeply, and are therefore out of the way. This dissection is carried from the pre-zygomatic area to the corner of the mouth (modiolus), and anteriorly to the root of the nose. The dissection along the mandible continues as above, and the fascia overlying the masseter muscle is soon encountered. Kamer describes anterior dissection past the masseter to the point where the facial artery crosses the mandible. He maintains that if the underlying parotidomasseteric fascia

is left intact, no injury to the marginal mandibular nerve is possible. Treatment of the neck is similar to that described above, as is the suspension and closing techniques. The complication rate in this series was comparable to that of the standard technique. He saw a 2.8% incidence of hematoma formation, and no instances of motor nerve damage. Greater auricular nerve injuries were not mentioned. 10% of patients complained about scarring, and there were no keloids. Overall, he felt that the complication rate and recovery period were similar to the standard technique, and the flap viability and contour improvement in the nasolabial fold and jowl region were better.

Composite Rhytidectomy

The composite rhytidectomy is similar to the deep plane rhytidectomy with the exception that included in the flap is the lower orbicularis muscle. First both upper and lower blepharoplasties are done. The lower blepharoplasty incision is made using a skin muscle flap. Any excess orbital fat is removed at this time and the blepharoplasty skin-muscle is excised at this time. (The eyelid skin should not be excised after the facelift.) The orbicularis is elevated off the malar eminence and will be connected to the rest of the flap. A limited sub-cutaneous dissection is done up to a line from the malar eminence to a point approximately 2 cm anterior to the lobule of the ear. A subplatysmal dissection is done with vertical spreading scissors after an incision is made in the platysma muscle from the jawline up to the malar area with a knife. This dissection is carried past the level of the facial artery at the jawline but does not disrupt the platysma fibrous connections at the corner of the mouth. After identifying the lateral border of the orbicularis oculi muscle and the origin of the zygomaticus major muscle, a dissection is made on top of the zygomaticus major and minor muscles with spreading scissors. This "pre-zygomatic dissection" is done in the deep subcutaneous plane with all the fat being left on the flap.

The zygomaticus muscles are visualized as this dissection is carried down to and beyond the nasolabial fold. The fibrous connection between the upper platysma muscle and the zygomaticus major muscle is separated with spreading scissors. Communication is made between the face lift dissection and the previously made blepharoplasty dissection from approximately five o'clock to nine o'clock (on the right side, the opposite on the left side.) The communication could be approached from either dissection. The inferior margin of the orbicularis oculi (crescent shaped) is excised off the flap, with care being taken to remove muscle only. At this point the dissection is performed on the other side. Closure of the face part is then accomplished after advancing the platysma muscle and suturing the muscle at the jawline under tension to the pre-parotid fascia just anterior to the lobule of the ear. If the lobule is pulled forward, a knife is used to release it to return it to its original position. The facelift flap that carries the cheek fat is advanced with extraordinary tension and sutured with a dermis to deep fascia 3-0 Vicryl suture at the helical junction. Excess skin is trimmed and a retrotragal closure is accomplished. After the face lift and brow lift closures have been accomplished, the orbicularis oculi is sutured in a superomedial vector with 5-0 nylon to the periosteum of the lateral orbital rim, thus visibly advancing the lateral orbicularis toward the lateral canthal area. The skin is closed with 6-0 nylon sutures.

Future Considerations

The deep-plane and composite techniques are exciting new additions to this field, and many surgeons are accumulating experience with them. What makes these newer procedures even more appealing is the ability to perform them together with laser facial rejuvenation and chemical peels. Accomplishing both facelifting and skin treatment at one sitting will be more appealing to the patient, and the early results demonstrate dramatic results. Tightening of the cervicofacial skin, in combination with improving in the quality of the skin really does have a great deal of rejuvenation potential. The next decade will see further modifications and the development of newer techniques, but with their seemingly greater risk of nerve injury and the increased technical demands, many facial plastic surgeons will continue to use the SMAS suspension procedure.

In conclusion, rhytidectomy is an elective cosmetic procedure which, when performed correctly, is an important component of facial rejuvenation. Recent developments and techniques promise further surgical innovation. The otolaryngologist should be familiar with the preoperative issues, anatomy, technique and complications of this challenging and rewarding procedure.

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