ENDOSCOPIC FOREHEAD LIFT
Endoscopic Approach to Upper-Third Facial Rejuvenation

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1.0 Introduction

The key qualities of a beautiful face are symmetry and balance. The challenge that the aging process most often poses to the facial plastic surgeon is gradual dissonance of the facial features. While the nose is the most prominent of these, sequelae from aging are most dramatically displayed in the upper third of the face: eyebrows begin to sag; wrinkles form on the forehead; and eyelids show signs of hooding. Bringing back equilibrium to this area has thus become a significant goal of facial rejuvenation surgery.

The use of endoscopes has revolutionized how facial plastic surgeons approach rejuvenating the upper third of the face, i.e., the forehead between the hairline and the eyebrows. Within the past decade, endoscopic lifting of the face and brow has gained significant popularity and replaced many traditional surgical approaches. The primary advantage of endoscopic forehead rejuvenation, or endoscopic forehead lift, are the minimally invasive incisions used to expose the large anatomic unit of the forehead, temporal region and lateral orbit. Post-operative recovery is, in turn, shorter and less painful.

Despite the many advantages of this new and exciting technology, endoscopic surgery is best suited for patients with mild to moderate ptotic brows. Endoscopic forehead rejuvenation relies on four primary steps: (1) subperiosteal elevation dissection of the frontal, parietal and occipital scalp to the level of the superior and lateral orbital rims; (2) release of the superior and lateral orbital periosteum; (3) selective myotomies of the brow depressors; and (4) permanent fixation of the elevated brow.

In this monograph, we review the traditional techniques of forehead rejuvenation and elaborate on the advantages of utilizing the endoscope. We then present our approach to endoscopic rejuvenation of the upper third of the face using KARL STORZ instruments.
2.0 Standard Aesthetic Proportions of the Upper Third of the Face

Cephalometrics of the upper third of the face are determining factors to the balance and symmetry that define facial beauty. Traditionally, the length of the face has been divided into three equally sized parts. Measurements are made from the midline of the face, from the trichion to the glabella, glabella to the subnasale and the subnasale to the menton. In surgical practice, the forehead, from the hairline to the eyebrows, comprises the upper third of the face.

While defining the ideal eyebrow position is much less mathematical, the aesthetically favorable female eyebrow takes on a gracefully arching structure located slightly above the supraorbital rim. In males, the arch is flatter and rests at the level of the supraorbital rim. For both genders, the eyebrow begins at a vertical line from the alar-facial groove through the medial canthus and ends at the diagonal line from the alar-facial groove through the lateral canthus. The horizontal position of the eyebrow’s highest point is located at the vertical line tangential or just lateral to the lateral limbus. The medial and lateral ends of the eyebrow rests on a horizontal line. In terms of shape, the medial end of the female eyebrow is rounded and gradually tapers laterally.

Fig. 1a
Standard aesthetic proportions of the upper third of the face.

Fig. 1b
Ideal eyebrow position.
Aging Process of the Forehead

Facial aging is a gradual process, which begins to manifest itself as horizontal wrinkles in the patient’s forehead region in their early 30s. By the time patients reach their 40s, the horizontal lines begin to deepen and vertical wrinkles become more visible in the glabellar region. These changes are followed by drooping of the eyebrows below the supraorbital rims, folding of the infrabrow tissue over the thin eyelid skin and both medial and lateral “hooding” of the upper eyelid as the patient continues to age. Brow and glabellar ptosis alters what was once an aesthetically pleasing Y-shaped sweep between the eyebrow, medial orbit and lateral nose, to a T-shape. The overall result is a configuration that conveys age, sadness and anger.

Forehead anatomy, unlike other parts of the face, is more prone to rhytid and furrow formation because the eyelid, skin and muscles are intimately related. With little or no subcutaneous tissue between skin and muscle, such a close anatomic relationship leads to a direct transmission of muscle motion to the overlying skin, resulting in deep furrows and wrinkles.

Fig. 2a – d
Aging process of the forehead.
Note the gradual changes to the forehead and eyebrows as patient ages.
3.0 Anatomy of the Forehead Muscles

Successful cosmetic surgery starts with a thorough understanding of basic facial anatomy. The upper third of the face is composed of very active subcutaneous fascia and the occipitofrontalis, corrugator supercili and procerus muscles. Knowing the location and actions of these muscles provides insight for correcting horizontal wrinkles on the forehead, horizontal lines on the root of the nose and vertical glabellar frown lines. Understanding the course of various sensory and motor nerves can help prevent accidents and pitfalls.

Forehead Group

The occipitofrontalis muscle is a fibrous sheet consisting of thin and wide muscle bellies joined through an intermediate aponeurosis. The fibrous portion, or aponeurotic galea, caps the skull. It extends from the medial supraorbital ridge to the medial two-thirds of the superior nuchal line and is laterally attached with the superficial temporal fascia. The aponeurosis gives origin to the frontal bellies at the coronal suture. At its posterolateral borders, it is in continuity with the occipital bellies. The frontal bellies frequently appear in a quadrilateral shape and can be identified as a slim sheet that is contiguous with the procerus and corrugator supercili muscles. The lateral fibers are blended with the pars orbitalis of the orbicularis oculi muscle. The medial fibers are contiguous with the muscle fibers of the procerus and the intermediate fibers are mixed with those of the corrugator supercili.

**Actions:** Working as a whole, the usual action of the occipitofrontalis muscle is to raise the eyebrows and to crease the forehead horizontally. The occipital belly pulls the aponeurotic galea that sustains the frontal belly to execute its upward movement. Alternate action of the frontal and occipital bellies moves the scalp forward and backward. The frontal bellies, acting separately, only raise the eyebrows. The frontal movement is antagonistic to those of the orbicularis oculi, procerus and corrugator supercili muscles.

Nasal Group

The procerus is a small pyramidal fasciculate muscle arising from the tendinous fibers that cover the inferior portion of the nasal bone and upper lateral nasal cartilage to be inserted into the skin between the eyebrows. Its fibers become continuous above the nose with the medial fibers of the frontal belly of the occipito-frontalis.

**Actions:** The procerus muscle pulls the glabella downward, creating a small transverse crease at the root of the nose.
Orbital Group

The corrugator supercili is defined by two different features. It can be found as a short, narrow pyramidal muscle located at the medial end of the supraorbital ridge, or as a long, narrow, straight muscle along the medial half of the supraorbital ridge. Both forms arise from a portion of the upper medial deeper fibers of the pars orbitalis of the orbicularis oculi muscle at the upper nasal process from the maxilla. The muscle fibers lie beneath the frontal belly.

**Actions:** The corrugator supercili is the principal muscle that causes vertical glabellar frowns between the eyebrows. These lines are caused by the action of the paired corrugator supercili muscles in drawing the eyebrows downward and medially.

Nerve Supply

The facial nerve supplies the forehead, nasal and orbital muscles to execute voluntary movements. The occipital branch, the largest branch of the posterior auricular nerve, innervates the occipital belly of the occipitofrontalis muscle. The temporal branch crosses the zygomatic arch at its lateral half toward the frontal belly of the occipitofrontalis, corrugator supercili and orbicularis oculi. The zygomatic branch supplies the corrugator supercili and orbicularis oculi. The deep buccal branch innervates the procerus muscle.
4.0 Traditional Approaches to Surgical Treatment of the Upper Third of the Face

Several different approaches to forehead rejuvenation have been widely employed to correct the aging upper third of the face. The three classic approaches include: the coronal forehead lift; the high forehead lift; and the midforehead lift. Although certain patients may still benefit from one of these classic approaches, each procedure carries more disadvantages as compared to the endoscopic method without necessarily adding to forehead aesthetics.

Coronal forehead lift

The coronal forehead lift involves the development of a scalp forehead flap in a subgaleal plane over the glabellar and supraorbital rims. The forehead muscles are incised to relax the overlying rhytids. A coronal strip of hair-bearing scalp is removed, the size ranging from 1–2 cm x 25–30 cm. The scalp defect is then closed, elevating the brow-glabella complex.

Disadvantages:
1. Excision of a strip of hair-bearing scalp
2. Alopecia, which may be substantial for patients with decreased hair density
3. Difficulty raising the brow-glabella complex from a distant area, leading to unreliable brow elevation
4. Elevation of anterior hairline
5. Potential for excess blood loss
6. Stretch back of scalp and forehead skin with excessive elevation

Fig. 5a
Coronal forehead lift incision outline.

Fig. 5b
Coronal forehead lift with a strip of scalp removed.
High forehead lift

A modified pretrichial lift is used when a patient has a high forehead and involves a geometric incision just anterior to the hairline (Fig. 6a). The level of dissection and elevation of the brow–glabella complex is identical to the coronal forehead lift technique (Fig. 6b). A strip of nonhair-bearing skin is excised anterior to the hairline. Closure elevates the brow–glabella complex (Fig. 6c).

Disadvantages:
1. Visibility of anterior hairline incision and scar formation
2. Denervation and numbness of the scalp posterior to the incision line
3. Cannot be used in patients with a low anterior hairline or a smooth forehead
Midforehead Lift

The midforehead lift involves an incision in a natural horizontal crease followed by removal of a strip of forehead skin. Dissection in the subcutaneous plane extends inferiorly to the supraorbital rims. Access to the corrugator and procerus muscles is achieved through a subgaleal dissection centrally and inferiorly. Myoplasty can be done if indicated and the frontalis muscle can be divided between the supraorbital nerves. The skin is closed in a running fashion.

**Disadvantages:**

1. Only useful for patients with deep forehead creases and rhytids
2. Mild forehead scar
3. Possible transection of all sensory nerves to the forehead during inferior flap elevation
4. Loss of forehead skin with subcutaneous flap elevation

Fig. 7a  Midforehead lift incision outline.

Fig. 7b  Midforehead lift with a strip of skin removed.

Fig. 7c  Midforehead lift closure.
5.0 Patient Interview and Consultation

Patient selection and evaluation are a critical part of preoperative planning, necessitating careful consideration of factors that determine the clinical appearance of the upper third of the face. An array of factors including age, genetics, environmental exposure history and overall health contribute to the relaxation of the forehead and descent of the brow. More importantly, however, are the various facial features such as position of frontal hairline/eyebrows, forehead/glabellar rhytids and skin quality/redundancy. The “frame height” and “brow glide” also help determine which patients will best benefit from an endoscopic approach to facial rejuvenation.

In evaluating patients for upper third face rejuvenation, one of the most important assessments is the position of the frontal hairline. The position of the frontal hairline will often determine the type of forehead rejuvenation technique to be employed. A high forehead with an elevated hairline is a relative contraindication to the endoscopic approach. However, because there are no visible scars with the endoscopic approach, certain patients can tolerate a higher than “normal” forehead height without appearing unnatural. Patients with male-pattern baldness who understand the possibility of minimally visible scaring are acceptable candidates for an endoscopic procedure. However, a history of hypertrophic scaring and skin pigmenatry changes as a result of previous surgeries should be noted. If visible scaring is to be expected, patients with thin, nonsebaceous and less pigmented skin are more ideal candidates.

An accurate assessment of the position of the brow is also critical in the upper third facial analysis. Due to the dynamic forces of various upper facial muscles, the brow becomes ptotic over time. The visual effect of brow ptosis often results in a tired, sad or angry look. The clinical appearance of patients with brow ptosis can often be categorized as “brow elevator” or “squinter and frowner.” “Brow elevators” will elevate the brow artificially when they open their eyes to increase their visual field. This action results in repetitive frontalis muscle contraction leaving visible horizontal forehead wrinkling. The appearance of these horizontal lines can usually be diminished with brow elevating surgery. However, the postoperative position of the eyebrows will be minimally changed unless the surgeon accounts for the artificial brow elevation. This is easily accomplished by having an “eyes closed” preoperative view during which the patient is not elevating the brow. Patients who elevate their brows during facial expression should also be evaluated for eyelid ptosis. Patients with eyelid ptosis use brow elevation as a compensatory mechanism; therefore, any forehead rejuvenation surgery will make the appearance of eyelid ptosis worse. “Frowners and squinters” with their prominent vertical glabellar creases manifest earlier signs of upper face aging. These patients often demonstrate hypertrophy of the procerus, corrugator and depressor supercilii and require more meticulous attention.

The patient’s skin surface quality and mobility should be also evaluated. Ramirez suggests that Asians and American Indians have tighter or thicker skin in the forehead and significant bony attachments of the frontal/orbital soft tissue compared to Caucasians. In these isolated groups, the endoscopic approach may not work effectively unless extended release and more reliable fixation of the soft tissue is made. However, more recent experiences have disputed such claims with reportedly successful results using the endoscopic method in Asian patients.
The patient’s skin redundancy should also be examined carefully. It is not uncommon for aging patients to have redundant tissues develop in the eyelid complex. This cannot be addressed with a forehead lift alone. Such patients with redundant tissue and/or “puffy” eyelids often require blepharoplasty and repositioning or conservative removal of the orbital fats in conjunction with a forehead rejuvenation procedure.

As part of the preoperative assessment, “frame height” and “brow glide” measurements should be taken. Frame height is the distance from the mid-pupil to the top of the central brow. Brow ptosis is defined to be present if this distance is less than 2.5 cm. “Brow glide” is measured by lifting the brow and recording maximal excursion of the medial, central and lateral portions of the brow from the neutral position. The average measurement is 1–2 cm. Ethnicity affects brow glide and patients of Asian, African-American and Mediterranean descent may have reduced measurements. Patients who demonstrate high glide indices will not have comparable results to patients who have lower indices. For the best aesthetic result, patients with mild to moderate brow ptosis or those requiring less than 1.5 cm elevation of the midbrow are considered the best candidates for the endoscopic technique. Those requiring greater elevation should be treated with a skin resection forehead/browlift procedure.
6.0 Endoscopic Forehead Rejuvenation

For nearly 100 years, aesthetic rejuvenation of the aging face has focused on the surgical elevation of the brow and improving the appearance of the forehead. In the past decade, the application of endoscopic forehead lifting has revolutionized how aesthetic surgeons approach mild to moderate ptotic brow and forehead rhytids.

As one of the earliest pioneers of endoscopic forehead rejuvenation, Keller, in 1991, described foreheadplasty using endoscopic visualization to incise the procerus, corrugator and depressor musculature and perform a temple lift. Keller, Isser and Ramirez soon advanced the technique by varying it on the basis of the configuration of the skull, bony architecture and soft tissue thickness and tightness. A move toward smaller incisions also ensued.

Since then, numerous authors have reported their personal experiences and further added to the endoscopic forehead rejuvenation technique. Despite these revisions, the basic concept of endoscopic forehead rejuvenation remains unchanged: (i) a sub- or supraperiosteal dissection of the scalp to the level of the superior and lateral orbital rims and zygomatic arch; (ii) incision and release of the orbital periosteum and; (iii) selective myotomies of the brow depressors.

The current trend has focused on less invasive incisions, wider undermining and a permanent fixation technique. Endoscopic foreheadplasty has proven to be as reliable as the traditional open approaches, but with significantly less surgical morbidity and postoperative discomfort. It has therefore become an excellent alternative in aesthetic rejuvenation of the upper third of the aging face.

Fig. 9
Facial anatomy.
Indications

It is imperative for the aesthetic facial surgeon to understand the appropriate indications for the endoscopic approach to forehead rejuvenation. Not every patient with an aging forehead will maximally benefit from endoscopic rejuvenation. Patients with one or more of the following indications would most benefit from the endoscopic approach:

1. Glabellar ptosis
2. Vertical glabellar rhytids
3. Forehead rhytids and frontalis hyperactivity
4. Mild to moderate ptosis of the eyebrow (less than 1.5 cm elevation of the midbrow)
5. Pseudoptosis eyelids

Relative contraindications

No absolute contraindications exist for the endoscopic approach to rejuvenation of the upper third face as long as suitable modifications are made. Nonetheless, several relative contraindications do exist, and both surgeons and patients should understand that these contraindications would likely result in a less than ideal outcome. These are listed below:

1. High hairline
2. Asian and American Indian patients
3. Significant fronto-orbital irregularities

Advantages

The endoscopic approach to forehead rejuvenation offers many advantages over traditional approaches. The main advantages are listed below:

1. Accurate resection or manipulation of the brow depressor muscles
2. Preservation of the scalp sensory nerves
3. Minimal rate of alopecia
4. Less recurrent brow ptosis
5. More control of brow position
6. Minimal elevation of the hairline
7. Can be used in thin hair or bald patients
8. Quicker recovery time
9. Less postsurgical numbness
10. Less postsurgical edema
7.0 Temporary vs. Permanent Fixation

One of the controversies of the endoscopic forehead technique is the inexact predictability of the postoperative brow position. Some surgeons have reported a loss of forehead elevation in the early postoperative period, and many advocate routine overcorrection to compensate for this loss. The basis for this is unclear. However, as demonstrated in an animal model, significant adherence of periosteum to bone took at least 6–12 weeks (Histology 1–3). In the process of re-adherence, fibrous ingrowth into bony microfissures in the outer cortex of the calvarium, bony remodeling, and thickening of the periosteum were noted. While disruption of the brow depressor musculature and sectioning of the brow periosteum allow for immediate brow elevation, correct brow positioning is ultimately dependent on the stability from periosteal adherence to the calvarium formed during the first several weeks of the postoperative period.

Various temporary fixation techniques with timing ranging from 3 days to 2 weeks have been used to achieve a stable and predictive brow position. However, based on animal studies and clinical experience, it is now clear that any type of temporary fixation technique is suboptimal. A permanent fixation technique, including cortical bone tunneling (Fig. 10) or any type of long-term fixation screws, which allows for a stable periosteal adherence to the calvarium, will offer the most precise and efficacious brow position.

Fig. 10
Bone tunneling method works equally effective for permanent fixation without the need for screws.
Histology 1
Postoperative 1-week. A focal fibroblastic response and inflammation with sites of focal hemorrhage and bony remodeling are noted. The periosteum is thickened, but there is no adherence to bone.

Histology 2
Postoperative 6-weeks. The periosteum is thinner than at week 1, with approximately 70 percent of the surface examined showing adherent periosteum. More bony remodeling is noted, with minimal to no inflammatory response.

Histology 3
Postoperative 12-weeks. No acute inflammatory cells are seen. Thinner periosteum with complete adherence to bone and bony remodeling are noted.

Fig. 11a
The preoperative brow position reflects a balance between the brow elevator (fronto-occipitalis: red arrows) and brow depressors (corrugator and procerus: blue arrows; orbicularis muscles: purple arrows).

Fig. 11b
Immediately after subperiosteal elevation and depressor muscle sectioning, the brow position rises (blue arrows) due to the unopposed tonic contraction of fronto-occipitalis.

Fig. 11c
With time, the involuntary frontalis contraction relaxes. If this occurs prior to periosteal refixation to the calvarium at the elevated position, the brow will “relax” and settle at a lower, “dropped” position, compromising results.
8.0 Surgical Technique

Marking

All patients are marked preoperatively in an upright position in the presurgical waiting area. These markings include the anticipated course of the temporal branch of the facial nerve, placement of the temporal and parietal incisions, and the desired brow elevation (5–8 mm medially and 8–10 mm laterally).

The desired amount of brow elevation is marked in the following way. The position of the ptotic brow is marked (using a fine-tip marker pen) at its medial head, above the lateral limbus and the lateral canthus. Next, using accepted aesthetic norms, the brow is elevated manually to the desired position. The brow is then released, and the corresponding area of the frontal skin is marked. The distance between the pairs of marks is measured. Palpation and marking of the supraorbital notch is a useful landmark when later aggressive endoscopic dissection is performed (Figs. 12a – c). The course of the temporal branch of the facial nerve is marked by connecting the following points: one on the facial skin 1 cm anterior to the inferior ear lobule, another 3 cm anterior to the superior external auditory canal and the last, 1.5 cm lateral to the lateral brow (Fig. 13a).

Six incisions are marked: two medial paramedian incisions each 2 cm lateral to the midline, 1.5 cm long and 5 mm behind the anterior hairline; two lateral paramedian incisions, centered on the lateral canthus, 1.5 cm in vertical length, just behind...
the anterior hairline; and two temporal incisions 2 cm long and approximately 2 cm behind and parallel to the temporal hairline. If greater access is needed to the forehead in the patient with a high curved forehead, additional paramedian vertical incisions can also marked behind the anterior hairline. One should not forget to modify the incisions in patients with male pattern baldness to effectively hide them. However, even in bald patients the incision scars are minimal and the endoforehead lift can be effectively used for forehead rejuvenation (Figs. 13b, c).

Dissection

General endotracheal anesthesia may be used, but we prefer monitored intravenous anesthesia in conjunction with supplemental local anesthetics; 1% lidocaine with 1:100,000 epinephrine is our standard local anesthetic. We inject in the following order: first into the region of the supraorbital and supratrochlear nerves to provide a regional nerve blockade; then the marked parietal scalp incision sites, the surrounding parietal, frontal, and glabellar soft tissues in a periosteal plane; and last the temporal incisions and surrounding soft tissue in a subcutaneous plane. Care is taken to prevent injury to the superficial temporal artery and vein (Figs. 14a – d).

Prior to making the anterior scalp incisions, the superior forehead and brow are manually depressed into their natural ptotic position with the surgeon’s free hand.

The four parietal scalp incisions are made with a #15 scalpel blade and are carried down to and through the underlying periosteum (Fig. 15). Control holes are drilled into the calvarium at the anterior extent of each vertical incision with a hand drill fitted with a 1.7 mm diameter drill bit and a 4 mm stop (Figs. 16a, b).
Using a millimeter caliper, the premeasured desired distance for brow elevation is marked on the calvarium posterior to the four control holes (Figs. 17a, b). Fixation holes are then drilled into the calvarium at these points (Figs. 18a, b).

Next, a wide subperiosteal undermining of the parietal scalp is accomplished with a lateral dissection to each temporal crest (Figs. 19a, b). Posterior dissection is completed with a large curved elevator to the superior and mid occipital scalp (Fig. 20). Anterior dissection is carried over the forehead with a sharp down-turned elevator staying 2 cm above the superior orbital rims. In the area of the glabella a sharp large curved elevator is used to elevate the soft tissue down to the superior nasal bones (Fig. 21).

The temporal incisions are made (Fig. 22) and a plane of dissection deep to the superficial temporal fascia is developed with a broad periosteal dissector. A front-to-back sweeping motion exposes the deep temporal fascia, which is not penetrated (Figs. 23a, b). A superior and medial sweeping motion with the elevator allows for incision of the tightly adherent temporal fascia and periosteum at the temporal crest. (Fig. 24) This maneuver connects the temporal pocket to the parietal pocket.

Continuing the dissection in an anterior-inferior directed motion carries the flap elevation down to the lateral orbital rim. Multiple small vessels including the sentinel vein may be encountered at this point of the dissection and are cauterized medially to the elevated flap with a bipolar cautery forceps (Figs. 25a, b).
Caution is particularly important at this point. The dissection must stay lateral to the canthal tendon in order to not detach this important anatomic structure (Fig. 26). Inferior dissection continues in an anterior to posterior direction, staying just along the superior edge of the zygomatic arch. Dissecting inferior to the zygoma may result in injury to the temporal branch of the facial nerve. The soft tissues are elevated back to and in front of the anterior helix and then carried above and behind the auricle into the mastoid region. Care must be noted here as well. Do not proceed too posterior, or the mastoid vein may be injured resulting in severe bleeding.

With endoscopic visualization through a lateral paramedian incision, the curved sharp dissector is inserted through the temporal incision on the same side of the head, and a lateral-to-medial dissection of the periosteum from the supraorbital rim is performed (Fig. 27). The supraorbital and supratrochlear neurovascular bundles are identified and preserved (Fig. 28).

**Fig. 24**
A superior and medial sweeping motion allows for incision of the periosteum at the temporal crest.

**Figs. 23a, b**
Deep temporal fascia is exposed but not penetrated.

**Figs. 25a, b**
Multiple small vessels including the sentinel vein are encountered. These vessels are carefully cauterized using a bipolar cautery forceps.

**Fig. 26**
Periosteal attachments of the lateral half of the superior and lateral orbital rim are incised.

**Fig. 27**
Performing dissection lateral to the canthal tendon and along the superior lateral orbital rim.

**Fig. 28**
The supraorbital and supratrochlear neurovascular bundles are seen through the endoscope and preserved.
An upturned periosteal spreader is used along the supraorbital rim in a lateral-to-medial direction (Fig. 29). This dissection provides for further periosteal release that exposes the underlying retroorbicularis oculi fat pad and produces limited myotomies in the overlying orbicularis oculi muscle.

Next, a thin nerve dissector is introduced to further incise the medial supraorbital periosteum. The neurovascular bundles and depressor supercilii muscle, corrugator supercilii muscle, and procerus muscle are identified with this dissection. The endoscope is then inserted into the medial paramedian site to view the glabellar area to perform the myotomies.

A #10 Fr. fluted drain is placed across the supraorbital brow and brought out through the right superior postauricular scalp.

Medial and central brow fixations are performed using a 2 mm diameter titanium anchor in each of the four fixation holes.
through the medial paramedian incision down to level of the (Fig. 30). A curved endoscopic forehead punch or grasping forceps is inserted through a paramedian incision and then utilized to perform myotomies of the procerus, corrugator, and depressor supercilii muscles. Myotomy of the corrugator muscle is performed both medial and lateral to the supratrochlear bundle. Hemostasis is controlled with bipolar electrocautery applied to insulated forceps. A 10 Fr. fluted drain is routinely placed across the supraorbital brow and brought out through the right superior posterior scalp (Fig. 31).

The release of the brow and forehead soft tissues allows intrinsic elevation of the brow with posterior pull of the occipital-galea-frontalis complex.

**Permanent Fixation**

Medial and central brow fixation is performed by placement of a 2 mm diameter (3.5 mm length) titanium anchor in each of the four holes (Figs. 32a, b). These small screws are fitted with a 2-0 ETHIBOND® (ETHICON) suture (Figs. 33a – c). The free end of the suture is threaded through the eyelet of a free needle (Fig. 34). Next, the needle is passed through the periosteal/galeal soft tissue at the anterior extent of each incision and brought out of the incision (Figs. 35a – c).
Fig. 36
Overview of the medial and central permanent fixation suture technique.
The sutures are tied down under direct vision so the anterior extent of the incision lies over the titanium anchor (Fig. 36). This provides exact elevation and fixation at the desired brow height. The parietal incisions are closed with 3-0 Prolene® in a vertical mattress manner and supplemented with stainless steel staples (Figs. 37a, b).

Using the desired amount of brow elevation for the lateral canthus and temporal region, a fixation point is identified superior and posterior to the inferior edge of the temporal incisions. Two 2-0 polygalactin sutures are placed in the deep temporal fascia at this point and are then passed through the dermis and temporoparietal fascia of the edge of the inferior temporal flap (Fig. 38). Manual advancement of the inferior temporal flap by an assistant is performed as the two polygalactin sutures are tied down and secured (Fig. 39). This provides elevation of the lateral brow. The edges of the temporal incisions are approximated with a 3-0 Prolene® suture in a vertical mattress fashion and then closed with stainless steel staples (Figs. 40a, b).

A soft, mildly compressive circumferential head dressing is placed and removed along with the drain on the first or second postoperative day (Fig. 41). The patient is instructed to place antibiotic ointment on the scalp suture lines two or three times per day. On the fifth postoperative day gentle hair washing is allowed. The sutures and staples are removed during the second postoperative week.
Preoperative

Postoperative

9.0 Clinical Cases

Figs. 1a – 3b
Patient’s brow ptosis, horizontal forehead rhytids and lateral crow’s feet are subtle and minimal, but real (Figs. 1a, 2a, 3a). Postoperatively, patient appears youthful and rejuvenated (Figs. 1b, 2b, 3b).

Fig. 1a

Fig. 1b

Fig. 2a

Fig. 2b

Fig. 3a

Fig. 3b
Figs. 4a – 6b
A significant unilateral right brow ptosis conveys anger and age. A deviated nose also adds to the unbalanced appearance of the face (Figs. 4a, 5a, 6a). After endoscopic forehead lift and rhinoplasty, patient appears younger and more attractive. Note the symmetric brow position (Figs. 4b, 5b, 6b).

Preoperative

Postoperative
Patient’s brow ptosis, crow’s feet, facial rhytids and pigmentary changes contribute to a fatigued and aged look. (Figs. 7a, 8a, 9a). Patient underwent endoscopic forehead lift, face lift and laser resurfacing (Figs. 7b, 8b, 9b).
Ptotic medial portion of the brow and glabellar rhytids express anger in this patient (Figs. 10a, 11a). A significant improvement is achieved with the endoscopic forehead lift (Figs. 10b, 11b).
Patient’s mild brow ptosis and horizontal forehead rhytids convey early aging (Figs. 12a, 13a). Patient appears more refreshed after the endoscopic forehead lift (Figs. 12b, 13b).
Figs. 14a – 15b
Patient’s mild brow ptosis and significant forehead and glabellar rhytids have been addressed by the endoscopic forehead lift (Figs. 14a, 15a). Postoperatively, patient appears much younger (Figs. 14b, 15b).
Figs. 16a – 17b
Patient’s stern look suggests seriousness and mild anger (Figs. 16a, 17a). Patient’s appearance has now been softened and rejuvenated. Note the change in brow position (Figs. 16b, 17b).
The ptotic brows convey fatigue (Figs. 18a, 19a). Postoperatively, patient appears younger and eyes seem to "open-up" (Figs. 18b, 19b).
10.0 References


### 11.0 Instruments for Endoscopic Forehead Lift

**Recommended Set according to Dr. Thomas Romo III, FACS**

<table>
<thead>
<tr>
<th>Product Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>50230 BWA</td>
<td>1 HOPKINS® Wide Angle Forward-Oblique Telescope 30°, enlarged view, diameter 4 mm, length 18 cm, autoclavable, fiber optic light transmission incorporated, color code: red</td>
</tr>
<tr>
<td>50230 BA</td>
<td>1 HOPKINS® Forward-Oblique Telescope 30°, enlarged view, diameter 4 mm, length 18 cm, autoclavable, fiber optic light transmission incorporated, color code: red</td>
</tr>
<tr>
<td>50200 ES</td>
<td>1 Optical Dissector, with distal spatula, fenestrated, large, sharp, for use with HOPKINS® telescopes 50230 BA/BWA</td>
</tr>
<tr>
<td>58210 AGA</td>
<td>1 CLICKLINE Dissecting and Grasping Forceps, heavy, dismantling, jaws horizontal opening, curved sheath, size 3 mm, working length 18 cm, including: Metal Handle, insulated Outer Tube, with working insert</td>
</tr>
<tr>
<td>50232 GW</td>
<td>1 CLICKLINE Dissecting and Grasping Forceps, heavy, dismantling, jaws horizontal opening, curved sheath, size 3 mm, working length 18 cm, including: Metal Handle, insulated Outer Tube, with working insert</td>
</tr>
<tr>
<td>50245 GW</td>
<td>1 CLICKLINE Scissors, dismantling, curved jaws, horizontal opening, curved sheath, size 5 mm, working length 18 cm, including: Metal Handle, insulated Outer Tube, with working insert</td>
</tr>
<tr>
<td>496400</td>
<td>3 MASING Surgical Handle, length 14 cm, for use with blades 208010–15, 208210–15</td>
</tr>
<tr>
<td>499205</td>
<td>2 Double Hook, sharp, 5 mm wide, length 15 cm</td>
</tr>
<tr>
<td>506400</td>
<td>1 AUFRICHT Nasal Retractor, length 16.5 cm</td>
</tr>
<tr>
<td>512211</td>
<td>1 Scissors, tungsten carbide inserts, sharp/sharp, straight, length 11 cm</td>
</tr>
<tr>
<td>512411</td>
<td>1 Scissors, tungsten carbide inserts, blunt/blunt, straight, length 11 cm</td>
</tr>
<tr>
<td>516013</td>
<td>2 Needle Holder, tungsten carbide inserts, length 13 cm</td>
</tr>
<tr>
<td>516412</td>
<td>2 OLSEN-HEGAR Needle Holder-Scissors, tungsten carbide inserts, delicate, length 12 cm</td>
</tr>
<tr>
<td>525500</td>
<td>1 Rule, stainless steel, flexible, length 20 cm</td>
</tr>
<tr>
<td>525510</td>
<td>1 CASTROVIEJO Caliper, measuring range 0–15 mm, length 8 cm</td>
</tr>
<tr>
<td>533112</td>
<td>2 ADSON Tissue Forceps, 1 x 2 teeth, length 12 cm</td>
</tr>
<tr>
<td>533212</td>
<td>2 ADSON-BROWN Tissue Forceps, atraumatic, fine side grasping teeth, length 12 cm</td>
</tr>
<tr>
<td>752500</td>
<td>1 GOOD Scissors, length 19.5 cm</td>
</tr>
<tr>
<td>796011</td>
<td>3 BACKHAUS Towel Forceps, length 11 cm</td>
</tr>
<tr>
<td>810802</td>
<td>1 Cup Medicine, stainless steel, 25 cc, height 28 mm, diameter 60 mm</td>
</tr>
<tr>
<td>810806</td>
<td>1 Cup Medicine, stainless steel, 60 cc, height 33 mm, diameter 70 mm</td>
</tr>
<tr>
<td>841219</td>
<td>2 Bipolar Coagulating Forceps, insulated, straight, blunt, tip 1 mm wide, length 19 cm</td>
</tr>
</tbody>
</table>

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*It is recommended to check the suitability of the product for the intended procedure prior to use.*
Videoendoscopic Imaging Systems and Accessories:

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TH 100</td>
<td>1 IMAGE1 S H3-Z Three-Chip FULL HD Camera Head,</td>
</tr>
<tr>
<td></td>
<td>IMAGE1 S compatible, max. resolution 1920 x 1080 pixels, progressive scan,</td>
</tr>
<tr>
<td></td>
<td>soakable, gas- and plasma-sterilizable, with integrated Parfocal Zoom Lens,</td>
</tr>
<tr>
<td></td>
<td>focal length f = 15 – 31 mm (2x), 2 freely programmable camera head buttons,</td>
</tr>
<tr>
<td></td>
<td>for use with IMAGE1 S and IMAGE1 HUB™ HD/HD</td>
</tr>
<tr>
<td>TC 200EN</td>
<td>1 IMAGE1 CONNECT, connect module, for use with up to 3 link modules,</td>
</tr>
<tr>
<td></td>
<td>resolution 1920 x 1080 pixels, with integrated KARL STORZ-SCB and digital</td>
</tr>
<tr>
<td></td>
<td>Image Processing Module, power supply 100 – 120 VAC/200 – 240 VAC, 50/60 Hz</td>
</tr>
<tr>
<td></td>
<td>including: Mains Cord, length 300 cm</td>
</tr>
<tr>
<td></td>
<td>DVI-D Connecting Cable, length 300 cm</td>
</tr>
<tr>
<td></td>
<td>SCB Connecting Cable, length 100 cm</td>
</tr>
<tr>
<td></td>
<td>USB Flash Drive, 32 GB</td>
</tr>
<tr>
<td>26004 M</td>
<td>1 Unipolar High Frequency Cord, with 4 mm plug for HF unit, models Berchtold</td>
</tr>
<tr>
<td></td>
<td>and Martin, length 300 cm</td>
</tr>
<tr>
<td>26005 M</td>
<td>1 Unipolar High Frequency Cord, with 5 mm plug for HF unit, models KARL</td>
</tr>
<tr>
<td></td>
<td>STORZ AUTOCON® system (50, 200, 350), AUTOCON® II 400 SCB® (111, 115)</td>
</tr>
<tr>
<td></td>
<td>and Erbe type ICC, length 300 cm</td>
</tr>
<tr>
<td>847000 M</td>
<td>1 Bipolar High Frequency Cord, for Martin and Berchtold coagulators, length</td>
</tr>
<tr>
<td></td>
<td>300 cm</td>
</tr>
<tr>
<td>847000 E</td>
<td>1 Bipolar High Frequency Cord, to KARL STORZ Coagulator 26021 B/C/D,</td>
</tr>
<tr>
<td></td>
<td>860021 B/C/D, 27810 B/C/D, 28810 B/C/D, AUTOCON® system (50, 200, 350),</td>
</tr>
<tr>
<td></td>
<td>AUTOCON® II 400 system SCB (111, 113, 115) and Erbe-Coagulator, T- and ICC-</td>
</tr>
<tr>
<td></td>
<td>row, length 300 cm</td>
</tr>
</tbody>
</table>

**Please note:**
For detailed information on the KARL STORZ Endovision video systems and additional accessories see the latest edition of brochure TELEPRESENCE – imaging systems, documentation, illumination.

9826 NB 1 26" FULL-HD Monitor, wall-mounted with VESA 100 adaptaion, color systems PAL/NTSC, max. screen resolution 1920 x 1080, image format 16:9, power supply 100 – 240 VAC, 50/60 Hz including:
- External 24 VDC Power Supply
- Mains Cord

201340 01 1 Cold Light Fountain XENON NOVA® 300, lamp type: 300 W XENON lamp, power supply: 100–125 VAC / 220–240 VAC, 50/60 Hz, including mains cord

20 1330 28 1 XENON Spare Lamp, 300 watt, 15 volt, for XENON NOVA® 300

495 NA 1 Fiber Optic Light Cable, diameter 3.5 mm, length 230 cm

20 5205 01 1 AUTOCON® 50, High Frequency Surgery Unit, power supply: 100/120/230/240 VAC, 50/60 Hz, including:
- Mains Cord
- Adaptor, unipolar HF-output, 4 mm/5 mm

**Please note:**
Additional accessories for AUTOCON® 50 (high frequency cords, neutral electrodes, handles, surgery set, etc.) see catalogue PLASTIC SURGERY.
HOPKINS® Telescopes – Optical Dissector

50230 BA/BWA  
HOPKINS® Wide Angle Forward-Oblique Telescope 30°, enlarged view, diameter 4 mm, length 18 cm, autoclavable, fiber optic light transmission incorporated, color code: red  
or:  
HOPKINS® Forward-Oblique Telescope 30°, enlarged view, diameter 4 mm, length 18 cm, autoclavable, fiber optic light transmission incorporated, color code: red

50200 ES  
Optical Dissector, with distal spatula, fenestrated, large, sharp, for use with HOPKINS® telescopes 50230 BA/BWA
Elevators, sharp – Nerve Hooks
working length 6 cm / 15 cm

58210 AGA Elevator, sharp, width 9 mm, curved, working length 15 cm
58210 BA Raspatory, straight, width 6 mm, working length 15 cm
58210 CA Elevator, sharp, spatula 12 x 12 mm, straight, working length 15 cm
58210 CGA Elevator, sharp, spatula 12 x 12 mm curved, working length 15 cm
58210 FGA Elevator, sharp, spoon-shaped spatula, width 12 mm, slightly curved, curved, working length 15 cm
58210 GGA Elevator, sharp, bow-shaped spatula, width 9 mm, curved, working length 15 cm
58210 LGA Elevator, sharp, for lifting and dissection of the orbita rim periosteum, distal end of spatula 90° curved upwards, width 9 mm, upper part sharp, curved, working length 15 cm
58210 MGA Elevator sharp, curved, curved upwards, upper part sharp, width 9 mm, length 15 cm
58210 WGA Elevator, sharp, triangular-shaped, width 4 mm, curved, working length 15 cm
58210 TKA Elevator, sharp, spatula slightly curved, width 8 mm, straight, working length 6 cm
58210 UKA Elevator sharp, straight, width 8 mm, length 6 cm
58210 ZA Raspatory, straight, strongly curved, pointed, width 3 mm, working length 15 cm
Dissecting and Grasping Forceps, Punch and Scissors

curved sheath, CLICKLINE, dismantling – non-rotating

50232 GG  CLICKLINE Dissecting and Grasping Forceps, heavy, dismantling, curved sheath, size 3 mm, working length 18 cm, including:
Metal Handle, insulated
Outer Tube, with working insert

50232 GW  CLICKLINE Dissecting and Grasping Forceps, heavy, dismantling, jaws horizontal opening, curved sheath, size 3 mm, working length 18 cm, including:
Metal Handle, insulated
Outer Tube, with working insert

50245 GW  CLICKLINE Scissors, dismantling, curved jaws, jaws horizontal opening, curved sheath, size 5 mm, working length 18 cm, including:
Metal Handle, insulated
Outer Tube, with working insert
Surgical Handle and Blades, Nasal Retractor, Scissors, Needle Holders

- **MASING Surgical Handle**, length 14 cm, for use with blades 208010–15, non-sterile, 208210–15, sterile
- **JOSEPH Double Hook**, sharp, width 5 mm, length 15 cm
- **AUFRICHT Nasal Retractor**, length 16.5 cm
- **Scissors**, tungsten carbide inserts, sharp/sharp, straight, length 11 cm
- **Scissors**, tungsten carbide inserts, blunt/blunt, straight, length 11 cm
- **Needle Holder**, tungsten carbide inserts, length 13 cm
- **OLSEN-HEGAR Needle Holder-Scissors**, tungsten carbide inserts, delicate, length 12 cm
Rule and Caliper, Tissue Forceps, Scissors, Towel Forceps, Bipolar Coagulating Forceps and Cups

- **Rule**, stainless steel, flexible, length 20 cm
- **CASTROVIEJO Caliper**, measuring range 0–15 mm, length 8 cm
- **ADSON Tissue Forceps**, 1 x 2 teeth, length 12 cm
- **ADSON-BROWN Tissue Forceps**, atraumatic, fine side-grasping teeth, length 12 cm
- **GOOD Scissors**, length 19.5 cm
- **BACKHAUS Towel Forceps**, length 11 cm
- **Cup Medicine**, 25 ccm, diameter 60 mm, height 28 mm
- **Cup Medicine**, 60 ccm, diameter 70 mm, height 33 mm
- **Bipolar Coagulating Forceps**, insulated, straight, blunt, tip 1 mm wide, length 19 cm
**IMAGE1 S Camera System**

**Economical and future-proof**
- Modular concept for flexible, rigid and 3D endoscopy as well as new technologies
- Forward and backward compatibility with video endoscopes and FULL HD camera heads
- Sustainable investment
- Compatible with all light sources

**Innovative Design**
- Dashboard: Complete overview with intuitive menu guidance
- Live menu: User-friendly and customizable
- Intelligent icons: Graphic representation changes when settings of connected devices or the entire system are adjusted
- Automatic light source control
- Side-by-side view: Parallel display of standard image and the Visualization mode
- Multiple source control: IMAGE1 S allows the simultaneous display, processing and documentation of image information from two connected image sources, e.g., for hybrid operations

**Dashboard**

**Live menu**

**Intelligent icons**

**Side-by-side view: Parallel display of standard image and Visualization mode**
**IMAGE1 S Camera System**

**Brilliant Imaging**
- Clear and razor-sharp endoscopic images in FULL HD
- Natural color rendition

**NEW**

- Reflection is minimized
- Multiple IMAGE1 S technologies for homogeneous illumination, contrast enhancement and color shifting

---

FULL HD image

CLARA

FULL HD image

CHROMA

FULL HD image

SPECTRA A*

FULL HD image

SPECTRA B**

---

* SPECTRA A: Not for sale in the U.S.
** SPECTRA B: Not for sale in the U.S.
TC 200EN

**IMAGE1 S CONNECT**, connect module, for use with up to 3 link modules, resolution 1920 x 1080 pixels, with integrated KARL STORZ-SCB and digital Image Processing Module, power supply 100–120 VAC/200–240 VAC, 50/60 Hz

- **Mains Cord**, length 300 cm
- **DVI-D Connecting Cable**, length 300 cm
- **SCB Connecting Cable**, length 100 cm
- **USB Flash Drive**, 32 GB, USB silicone keyboard, with touchpad, US

*Available in the following languages: DE, ES, FR, IT, PT, RU*

**Specifications:**

- **HD video outputs**: - 2x DVI-D
  - 1x 3G-SDI
- **Format signal outputs**: 1920 x 1080p, 50/60 Hz
- **LINK video inputs**: 3x
- **USB interface**: 4x USB, (2x front, 2x rear)
- **SCB interface**: 2x 6-pin mini-DIN

Power supply: 100–120 VAC/200–240 VAC
Power frequency: 50/60 Hz
Protection class: I, CF-Defib
Dimensions w x h x d: 305 x 54 x 320 mm
Weight: 2.1 kg

For use with **IMAGE1 S**

**TC 300**

**IMAGE1 S H3-LINK**, link module, for use with **IMAGE1 FULL HD three-chip camera heads**, power supply 100–120 VAC/200–240 VAC, 50/60 Hz, for use with **IMAGE1 S CONNECT TC 200EN**

- **Mains Cord**, length 300 cm
- **Link Cable**, length 20 cm

**Specifications:**

- **Camera System**: TH 100, TH 101, TH 102, TH 103, TH 104, TH 106 (fully compatible with IMAGE1 S)
  - 22 2200 55-3, 22 2200 56-3, 22 2200 53-3, 22 2200 60-3, 22 2200 61-3, 22 2200 54-3, 22 2200 85-3 (compatible without IMAGE1 S technologies CLARA, CHROMA, SPECTRA*)
- **LINK video outputs**: 1x
- **Power supply**: 100–120 VAC/200–240 VAC
- **Power frequency**: 50/60 Hz
- **Protection class**: I, CF-Defib
- **Dimensions w x h x d**: 305 x 54 x 320 mm
- **Weight**: 1.86 kg

* SPECTRA A: Not for sale in the U.S.
** SPECTRA B: Not for sale in the U.S.
# IMAGE1 S Camera Heads

**NEW**

For use with IMAGE1 S Camera System
IMAGE1 S CONNECT Module TC 200EN, IMAGE1 S H3-LINK Module TC 300 and with all IMAGE1 HUB™ HD Camera Control Units

---

### TH 100

**IMAGE1 S H3-Z Three-Chip FULL HD Camera Head**, 50/60 Hz, IMAGE1 S compatible, progressive scan, soakable, gas- and plasma-sterilizable, with integrated Parfocal Zoom Lens, focal length \( f = 15–31 \) mm (2x), 2 freely programmable camera head buttons, for use with IMAGE1 S and IMAGE1 HUB™ HD/HD

<table>
<thead>
<tr>
<th>Specifications:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IMAGE1 FULL HD Camera Heads</strong></td>
<td><strong>IMAGE1 S H3-Z</strong></td>
</tr>
<tr>
<td>Product no.</td>
<td>TH 100</td>
</tr>
<tr>
<td>Image sensor</td>
<td>3x ( \frac{1}{3} )&quot; CCD chip</td>
</tr>
<tr>
<td>Dimensions w x h x d</td>
<td>39 x 49 x 114 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>270 g</td>
</tr>
<tr>
<td>Optical interface</td>
<td>integrated Parfocal Zoom Lens, ( f = 15–31 ) mm (2x)</td>
</tr>
<tr>
<td>Min. sensitivity</td>
<td>F 1.4/1.17 Lux</td>
</tr>
<tr>
<td>Grip mechanism</td>
<td>standard eyepiece adaptor</td>
</tr>
<tr>
<td>Cable</td>
<td>non-detachable</td>
</tr>
<tr>
<td>Cable length</td>
<td>300 cm</td>
</tr>
</tbody>
</table>

---

### TH 104

**IMAGE1 S H3-ZA Three-Chip FULL HD Camera Head**, 50/60 Hz, IMAGE1 S compatible, **autoclavable**, progressive scan, soakable, gas- and plasma-sterilizable, with integrated Parfocal Zoom Lens, focal length \( f = 15–31 \) mm (2x), 2 freely programmable camera head buttons, for use with IMAGE1 S and IMAGE1 HUB™ HD/HD

<table>
<thead>
<tr>
<th>Specifications:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IMAGE1 FULL HD Camera Heads</strong></td>
<td><strong>IMAGE1 S H3-ZA</strong></td>
</tr>
<tr>
<td>Product no.</td>
<td>TH 104</td>
</tr>
<tr>
<td>Image sensor</td>
<td>3x ( \frac{1}{3} )&quot; CCD chip</td>
</tr>
<tr>
<td>Dimensions w x h x d</td>
<td>39 x 49 x 100 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>299 g</td>
</tr>
<tr>
<td>Optical interface</td>
<td>integrated Parfocal Zoom Lens, ( f = 15–31 ) mm (2x)</td>
</tr>
<tr>
<td>Min. sensitivity</td>
<td>F 1.4/1.17 Lux</td>
</tr>
<tr>
<td>Grip mechanism</td>
<td>standard eyepiece adaptor</td>
</tr>
<tr>
<td>Cable</td>
<td>non-detachable</td>
</tr>
<tr>
<td>Cable length</td>
<td>300 cm</td>
</tr>
</tbody>
</table>
Monitors

9619 NB

19" HD Monitor, color systems PAL/NTSC, max. screen resolution 1280 x 1024, image format 4:3, power supply 100–240 VAC, 50/60 Hz, wall-mounted with VESA 100 adaption, including:

External 24 VDC Power Supply
Mains Cord

9826 NB

26" FULL HD Monitor, wall-mounted with VESA 100 adaption, color systems PAL/NTSC, max. screen resolution 1920 x 1080, image format 16:9, power supply 100–240 VAC, 50/60 Hz including:

External 24 VDC Power Supply
Mains Cord
## Monitors

### KARL STORZ HD and FULL HD Monitors

<table>
<thead>
<tr>
<th></th>
<th>19&quot;</th>
<th>26&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wall-mounted with VESA 100 adaption</td>
<td>9619 NB</td>
<td>9826 NB</td>
</tr>
</tbody>
</table>

**Inputs:**
- DVI-D
- Fibre Optic
- 3G-SDI
- RGBS (VGA)
- S-Video
- Composite/FBAS

**Outputs:**
- DVI-D
- S-Video
- Composite/FBAS
- RGBS (VGA)
- 3G-SDI

**Signal Format Display:**
- 4:3
- 5:4
- 16:9
- Picture-in-Picture
- PAL/NTSC compatible

### Optional accessories:

- 9826 SF  **Pedestal**, for monitor 9826 NB
- 9626 SF  **Pedestal**, for monitor 9619 NB

### Specifications:

<table>
<thead>
<tr>
<th></th>
<th>19&quot;</th>
<th>26&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>KARL STORZ HD and FULL HD Monitors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Desktop with pedestal</td>
<td>optional</td>
<td>optional</td>
</tr>
<tr>
<td>Product no.</td>
<td>9619 NB</td>
<td>9826 NB</td>
</tr>
<tr>
<td>Brightness</td>
<td>200 cd/m² (typ)</td>
<td>500 cd/m² (typ)</td>
</tr>
<tr>
<td>Max. viewing angle</td>
<td>178° vertical</td>
<td>178° vertical</td>
</tr>
<tr>
<td>Pixel distance</td>
<td>0.29 mm</td>
<td>0.3 mm</td>
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<tr>
<td>Reaction time</td>
<td>5 ms</td>
<td>8 ms</td>
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<tr>
<td>Contrast ratio</td>
<td>700:1</td>
<td>1400:1</td>
</tr>
<tr>
<td>Mount</td>
<td>100 mm VESA</td>
<td>100 mm VESA</td>
</tr>
<tr>
<td>Weight</td>
<td>7.6 kg</td>
<td>7.7 kg</td>
</tr>
<tr>
<td>Rated power</td>
<td>28 W</td>
<td>72 W</td>
</tr>
<tr>
<td>Operating conditions</td>
<td>0–40°C</td>
<td>5–35°C</td>
</tr>
<tr>
<td>Storage</td>
<td>-20–60°C</td>
<td>-20–60°C</td>
</tr>
<tr>
<td>Rel. humidity</td>
<td>max. 85%</td>
<td>max. 85%</td>
</tr>
<tr>
<td>Dimensions w x h x d</td>
<td>469.5 x 416 x 75.5 mm</td>
<td>643 x 396 x 87 mm</td>
</tr>
<tr>
<td>Power supply</td>
<td>100–240 VAC</td>
<td>100–240 VAC</td>
</tr>
<tr>
<td>Certified to</td>
<td>EN 60601-1, protection class IPX0</td>
<td>EN 60601-1, UL 60601-1, MDD93/42/EEC, protection class IPX2</td>
</tr>
</tbody>
</table>
AUTOCON® II 400 SCB
High Frequency Surgery Unit – Recommended System Configuration

AUTOCON® II 400 SCB, Set  |  AUTOCON® II 400 SCB  |  Socket Position
--- | --- | ---
|  |  | 1  | 2  | 3  | 4

**Standard**

| AUTOCON® II 400 SCB, Set | AUTOCON® II 400 SCB |  |  |  |  |
|---|---|---|---|---|
| **20 5352 01-111** | **20 5352 20-111** | Bipolar | Bipolar | Unipolar 3-pin and Erbe | Neutral Electr. 6.3 mm jack |
| **20 5352 01-112** | **20 5352 20-112** | Bipolar US-2-pin | Bipolar US-2-pin | Unipolar 3-pin and Bovie | Neutral Electr. 2-pin |

**Bipolar**

| AUTOCON® II 400 SCB, Set | AUTOCON® II 400 SCB |  |  |  |
|---|---|---|---|
| **20 5352 01-113** | **20 5352 20-113** | Bipolar | Bipolar | Bipolar Multifunction | Blind Socket |
| **20 5352 01-114** | **20 5352 20-114** | Bipolar US-2-pin | Bipolar US-2-pin | Bipolar Multifunction | Blind Socket |

**High-End**

| AUTOCON® II 400 SCB, Set | AUTOCON® II 400 SCB |  |  |  |
|---|---|---|---|
| **20 5352 01-115** | **20 5352 20-115** | Bipolar | Bipolar Multifunction | Unipolar 3-pin and Erbe | Neutral Electr. 6.3 mm jack |
| **20 5352 01-116** | **20 5352 20-116** | Bipolar US-2-pol. | Bipolar Multifunction | Unipolar 3-pin and Bovie | Neutral Electr. 2-pin |
High Frequency Cords
for unipolar and bipolar coagulation

KARL STORZ Instrument High Frequency Electrosurgical Generator

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>26004 M</td>
<td>Unipolar High Frequency Cord, with 4 mm plug for HF unit, models Berchtold and Martin, length 300 cm</td>
</tr>
<tr>
<td>26005 M</td>
<td>Unipolar High Frequency Cord, with 5 mm plug for HF unit, models KARL STORZ AUTOCON® system (50, 200, 350), AUTOCON® II 400 SCB (111, 115) and Erbe type ICC, length 300 cm</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>847000 M</td>
<td>Bipolar High Frequency Cord, for Martin and Berchtold coagulators, length 300 cm</td>
</tr>
<tr>
<td>847000 E</td>
<td>Bipolar High Frequency Cord, to KARL STORZ Coagulator 26021 B/C/D, 860021 B/C/D, 27810 B/C/D, 28810 B/C/D, AUTOCON® system (50, 200, 350), AUTOCON® II 400 system SCB (111, 113, 115) and Erbe-Coagulator, T- and ICC-row, length 300 cm</td>
</tr>
</tbody>
</table>

Cold Light Fountain XENON NOVA® 300

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
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<tbody>
<tr>
<td>201340 01</td>
<td>Cold Light Fountain XENON NOVA® 300 lamp type: 300 W XENON lamp, power supply: 100–125VAC/220–240VAC, 50/60 Hz, including: Mains Cord</td>
</tr>
<tr>
<td>201330 28</td>
<td>XENON Spare Lamp, only, 300 watt, 15 volt</td>
</tr>
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</table>

Fiber Optic Light Cable

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>495 NL</td>
<td>Fiber Optic Light Cable, straight connector, diameter 3.5 mm, length 180 cm</td>
</tr>
<tr>
<td>495 NA</td>
<td>Same, length 230 cm</td>
</tr>
</tbody>
</table>
**Equipment Cart**

**Equipment Cart**
wide, high, rides on 4 antistatic dual wheels
equipped with locking brakes 3 shelves,
mains switch on top cover,
central beam with integrated electrical subdistributors
with 12 sockets, holder for power supplies,
potential earth connectors and cable winding
on the outside,

**Dimensions:**
Equipment cart: 830 x 1474 x 730 mm (w x h x d),
shelf: 630 x 510 mm (w x d),
caster diameter: 150 mm

inluding:
**Base module equipment cart**, wide
**Cover equipment**, equipment cart wide
**Beam package equipment**, equipment cart high
3x **Shelf**, wide
**Drawer unit with lock**, wide
2x **Equipment rail**, long
**Camera holder**

**Monitor Swivel Arm,**
height and side adjustable,
can be turned to the left or the right side,
swivel range 180°, overhang 780 mm,
overhang from centre 1170 mm,
load capacity max. 15 kg,
with monitor fixation VESA 5/100,
for usage with equipment carts UG xxx
Recommended Accessories for Equipment Cart

**Isolation Transformer,**
200 V–240 V; 2000 VA with 3 special mains socket, expulsion fuses, 3 grounding plugs, dimensions: 330 x 90 x 495 mm (w x h x d), for usage with equipment carts UG xxx

**Earth Leakage Monitor,**
200 V–240 V, for mounting at equipment cart, control panel dimensions: 44 x 80 x 29 mm (w x h x d), for usage with isolation transformer UG 310

**Monitor Holding Arm,**
height adjustable, inclinable, mountable on left or right, turning radius approx. 320°, overhang 530 mm, load capacity max. 15 kg, monitor fixation VESA 75/100, for usage with equipment carts UG xxx
Notes: