ENDOSCOPIC ENDONASAL ORBITAL DECOMPRESSION (EEOD)

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Introduction

Basically, endoscopic endonasal orbital decompression (EEOD) involves the removal of the ethmoid chambers, taking out the lamina papyracea and placing multiple parallel, horizontal incisions in the periorbital fascia, thus allowing the retrobulbar contents to expand into the cavity created beforehand, i.e. the former sinus space. In fact, the primary goal of the procedure is to increase the size of the orbital cavity at the account of the ethmoid sinuses. As a result of the procedure, the elevated interstitial pressure within the retrobulbar space is reduced to normal.

Pathophysiology

The elevated level of interstitial pressure is the result of the spindle-like enlargement of the extraocular muscles (Fig. 1) and hypertrophy of the retrobulbar fat tissue because of hormonal disorders. In most cases of eyeball protrusion (exophthalmos), be it unilateral or bilateral, thyroid gland disorders can be identified as underlying cause of the disease.

In the vast majority of cases, enlargement of the extraocular muscles occurs with a significantly higher incidence in the inferior and medial rectus muscles as compared to others. This fact is quite favourable for the technique because the EEOD approach uses the most direct trajectory, that reaches the target site in close proximity to these two muscles (Fig. 2).

Bilateral spindle-like hypertrophy of the superior rectus muscle. Unilateral proptosis (left globe). The differences in the volume of the extraocular muscles are clearly visible, particularly with regard to the medial and inferior rectus muscles. The volume of the left eye has increased more than three times as compared to the right. Infraorbital nerve canal ( ). Hard, thick strut of bone along the boundary between the lamina papyracea and the medial orbital floor ( ).
The augmented retrobulbar structures are trapped within the hard, bony frame of the orbital cone; hence the only possible physical consequence is the abnormal protrusion of the eye. Even though a certain degree of protrusion temporarily reduces the elevated level of interstitial retrobulbar pressure, the progressive nature of the underlying disease keeps tissue enlargement going, which again induces an increase in intraorbital pressure, and consequently raises the degree of protrusion (Fig. 3). This is a concise description of how eyeball protrusion (exophthalmos) develops and takes on a momentum of its own.

Removal of the lamina papyracea in conjunction with the incisions placed in the periorbital fascia allows the retrobulbar tissues to partially translocate from the orbital cone to the former ethmoid labyrinth which, in turn, causes the eyeballs to resume their normal position (Figs. 4–6).

Bilateral proptosis. The degree of proptosis of both eyes very rarely coincides. In most patients, there is a certain degree of asymmetry. In this case, proptosis on the left is more pronounced.

Postoperative appearance one day after monocular surgery of the left eye. Note the regression on the right side even though this eye was untouched by surgery.

Preoperative appearance of a patient demonstrating proptosis mainly on the left.

Postoperative appearance of the same patient (as in Fig. 5) one month after surgery. Only the left globe was treated by surgery. The photograph clearly demonstrates spontaneous resolution of proptosis of the unoperated eye.
Indications for Endoscopic Endonasal Orbital Decompression (EEOD)

There are several indications for EEOD. The main indication is proptosis because of dysthyroid orbitopathy or Graves’ ophthalmopathy. Graves’ ophthalmopathy (or thyroid eye disease) is an autoimmune disorder that presents with incipient inflammation of the extraocular muscles and inflammatory cellular infiltration of interstitial tissues, orbital fat and lacrimal glands, finally giving rise to an increase in the volume of orbital contents. Typical clinical signs and symptoms are: unilateral (rarely) or bilateral (most frequently) proptosis, conjunctival hyperemia, eyelid retraction and restrictive myopathy. Severe soft-tissue involvement with exposure keratitis and compressive optic neuropathy are the most severe clinical signs of the disease. The ophthalmologist usually recommends that EEOD be performed in cases of active ophthalmopathy with rapid deterioration of vision caused by compressive optic neuropathy and/or exposure keratitis. Occasionally, the procedure is also performed for aesthetic reasons when ophthalmopathy is already under control, i.e. in a stable and inactive state.

**Diagnosis of compressive optic neuropathy is usually based on the following clinical findings:**

- Decrease in visual acuity not explained by the refractive state or anterior segment findings.
- Defective visual fields in Goldmann perimetry with no prior record of glaucoma.
- Neurological disease or other medical history, or
- Presence of optic disc congestion
- Anterior segment signs include superficial punctuate keratitis, superior limbic keratoconjunctivitis, injection and/or chemosis of the conjunctiva (Figs. 7–9).

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Patient presenting with an acute exudative form of active dysthyroid orbitopathy before (a) and three weeks after (b) bilateral surgery (preoperative acute blindness of the left eye, and severe deterioration of visual acuity of the right eye – an emergency case). Postoperatively, the patient showed almost complete restoration of visual acuity of the right eye and slight improvements on the left.

The same patient as in Fig. 8, three weeks after EEOD surgery. Minor medial displacement of the right globe as a result of decompression.
Additional indications for EEOD are:

- Intraorbital abscess,
- Intraorbital hematoma (Figs. 10, 11) or
- Intraorbital tumors (Fig. 12).

The findings mentioned above should be located medially to permit surgical access by ways of an EEOD approach. Both abscesses and hematomas can be evacuated by EEOD. However, in terms of tumor surgery, applicability of the method is inhibited by certain technical limitations, because in most cases the tumor also invades the retrobulbar part of the optic nerve making en-bloc excision very tricky. This holds even more true if one takes into account that the primary objective of the procedure is to preserve the patient’s visual perception while making sure that the risk of iatrogenic injury to the ophthalmic artery – travelling under the optic nerve through the optic canal – is reduced to a minimum.

The surgeon must pay careful attention to the ophthalmic artery running at the orbital surface along the very borderline between the lamina papyracea and the skull base. Occasionally, the vessel is found to be encased by intraorbital tumors, which inevitably means that any attempt to remove the tumor from the orbit carries the risk of precipitating very severe complications.

Finally, in most patients selected for optic nerve canal decompression by ways of the endoscopic endonasal approach, a preliminary, partial and circumscribed orbital decompression must be performed to determine the exact location of the optic nerve canal opening (in close vicinity of the annulus of Zinn).
Technique

The procedure is usually conducted under general hypotensive anesthesia. According to our standard protocol, we first insert cottonoid strips into the nasal cavity. The strips should be soaked in advance using 5% cocaine HCl solution with epinephrine (5:1 ratio). Instead of cocaine, oximetazoline 1% solution can be used either. The strips should be placed in the nasal cavity for, at most, 5–7 minutes to allow the medication to take effect. The surgeon proceeds by infiltrating the operating field with a 1% lidocaine (xylocaine) solution containing epinephrine (1:200,000), just to induce additional vasoconstriction and establish a dry, practically bloodless operating field.

Usually, we also infiltrate the adjacent area of the foramen of the greater (descending) palatine nerve, because in this way vasoconstriction can also be established in the areas of the anterior sphenoid sinus wall, spheneno-ethmoidal recess and orbital apex. The greater palatine nerve lies approx. 5–7 millimeters anterior to the boundary between the soft and hard palate, and about 5–7 millimeters medially to the dental row (Fig. 13).

We strongly recommend to wait at least three minutes after administration of infiltration anesthesia to allow the local anesthetic to take effect and produce the required vasoconstrictive effect.

The standard protocol for optic nerve decompression comprises a total of five steps, which are as follows.

1. Identification of the natural ostium of the sphenoid sinus and anterior sphenoid sinus wall.
2. Identification of the natural maxillary sinus ostium and creation of a middle meatal antrostomy
3. Total ethmoidectomy
4. Removal of the lamina papyracea and medial orbital floor
5. Placement of longitudinal incisions in the periorbital fascia.

Step I: Identification of the natural sphenoid sinus ostium and anterior sphenoid sinus wall

The purpose of the first step is to identify two anatomical landmarks, the natural ostium of the sphenoid sinus and the anterior sphenoid wall, which aid in precisely localizing the orbital apex. This is paramount because the orbital apex is the key structure that serves as a reference point leading to the site where the optic nerve travels within its dural sheaths through the optic canal to the brain. Accordingly, it is only prudent to stay away from this critical point and prevent inadvertent injury to the dura mater while performing orbital decompression.

The surgeon should be aware that preliminary identification of the sphenoid sinus ostium and anterior sphenoid sinus wall is not mandatory in all cases, because the posterior maxillary sinus wall predominantly lies in the same frontal plane as the anterior sphenoid sinus wall. Accordingly, in most patients elected for EEOD, identification and clear presentation of the posterior maxillary sinus wall is considered to be sufficient to localize the orbital apex, which is the key anatomical landmark that guides the surgeon to the zone of safe entry. A well-trained surgeon, who has attained a high level of experience and proficiency in the field may legitimately consider the initial sphenoid sinus surgery as a matter of option. However, it cannot be emphasized enough, that beginners of this type of surgery are strongly advised to perform this step in any case. The first step may be accomplished either by directly passing the endoscope between the nasal septum and middle turbinate, or – under less favourable circumstances – by performing a total ethmoidectomy. If anatomical conditions permit a direct approach, the use of a 0°-teleoscope is strongly recommended. The target site is the tail of the superior turbinate because this small anatomical entity serves as a landmark for localizing the natural sphenoid sinus ostium (Fig. 14).
Endoscopic Endonasal Orbital Decompression (EEOD)

Left nasal cavity. The blanched area visually confirms that the local anesthetic has taken effect after infiltration of the most posterior part of the nasal septum.

Local infiltration anesthesia is administered along the lateral nasal wall in the region of the maxillary line.

Endoscopic view of the regions previously subjected to local infiltration anesthesia. The regions are packed with gauze-flakes for a few minutes to stop minor mucosal bleeding from the puncture sites of the injection needle.

Prior to starting with identification of the sphenoid sinus ostium, it is advisable to infiltrate the adjacent areas with a local anesthetic containing epinephrine to create a strong vasoconstrictive and additional decongestive effect in the anterior sphenoid sinus wall. It is usually sufficient to infiltrate the deepest parts of the nasal septum (in the immediate vicinity of the rostrum), then the area of the sphenopalatine foramen, and finally, the remaining areas which are the same in all endoscopic sinus surgery procedures: in front of the middle turbinate insertion to the lateral nasal wall, and about one centimeter below this point, following the course of the so-called maxillary line, i.e. the edge of the frontal maxillary process (Figs. 15–18).

The surgeon may either use a rigid (upbiting or downbiting) KERRISON punch, or a STAMMBERGER circular cutting (“mushroom-shaped”) punch to enlarge the ostium (Figs. 19–21).

Endoscopic view of the left sphenoid sinus. A rigid down-biting KERRISON forceps is advanced to the inferior edge of the fenestration in the anterior sphenoid sinus wall. A relatively large opening has been already created.

Endoscopic view of the left sphenoid sinus. A STAMMBERGER circular cutting punch is applied to the inferior edge of the already created fenestration in the anterior sphenoid sinus wall.

The STAMMBERGER circular cutting punch in action.
Not infrequently, the natural sphenoid sinus ostium is not readily visible, because it is obscured by the superior (or supreme) turbinate, or by a pronounced deformity of the dorsal septum. In these cases, the next step is to create access to the sphenoid cavity by keeping strictly in an inferomedial direction and attempting to perforate the anterior sphenoid wall with a straight BLAKESLEY forceps, antrum curette or just by means of a straight FRAZIER suction tube, always keeping sight of the tail of the superior turbinate as the most important landmark. However, in such cases, one must take into account that the wall of the anterior sphenoid sinus may be well-pneumatized and difficult to penetrate. In up to 5% of cases, the sphenoid sinus is not pneumatized at all!

Once the natural ostium or the opening at the anterior sphenoid sinus wall can be clearly localized, they should be used as the starting point of dissection and enlarged in a caudal direction until the thick bone of the sphenoid floor becomes apparent. Proceeding medially, the intersphenoid septum and the rostrum of the sphenoid sinus body are encountered. Carefully dissecting upward, the planum sphenoidale comes into view.

Circular cutting punch in action.

A wide sphenoidotomy has already created allowing for good visualization of the sella turcica (STA) and optic nerve canal (ON).

Endoscopic internal aspect of the left sphenoid sinus. Note the exceptionally clear contours of the optic nerve (ON) and the internal carotid artery (ICA) in its bony canal. In between these two structures, the left half of the sella turcica (STA) is clearly visible.
Endoscopic Endonasal Orbital Decompression (EEOD)

A KUHN frontal sinus seeker is directed toward the planum sphenoidale.

The frontal sinus seeker is directed medially.

A curved curette is advanced to enter the left sphenoid sinus.

At this stage, it is very advisable to use a double-ended, maxillary sinus ostium seeker with ball-shaped tips, a double-ended KUHN frontal sinus seeker (one tip straight, one tip reverse angle, both sides curved either 90° or 77°), or a curved curette to explore the depth of the “balcony” behind the anterior sphenoid sinus wall (Figs. 29–33).

This is of paramount importance, particularly when extending the already created opening in the anterior sphenoid wall toward the lateral part of the sphenoid sinus. Care must be taken not to enlarge the natural sphenoid ostium in a lateral direction, bearing in mind, that despite a thorough preoperative work-up and diagnostic assessment with even excellent CT scans, the surgeon can never be absolutely sure about what is actually located behind the corner, especially in view of the fact that this area is immediately bordered by the cavernous sinus.

Once the natural sphenoid ostium has been enlarged, in all individuals with a sellar- and retrosellar-type sphenoid sinus the contours of the sella turcica can be easily identified. Conversely, in individuals with a poorly pneumatized sphenoid sinus (of the conchal or presellar type), the sella can be particularly difficult to localize. In these cases, especially in pituitary gland surgery, the use of a neuronavigation system is strongly recommended to prevent inadvertent intracranial insertion of the instrument in use.

Strictly speaking, in cases of EEOD, there is no need for prior identification of the sella turcica. It is absolutely sufficient to localize the wall of the anterior sphenoid sinus and its junction with the lateral nasal wall.

In less favourable anatomical circumstances, the aforementioned direct approach is not feasible. Total ethmoidectomy is the only way to safely approach the sphenoid sinus.
Endoscopic Endonasal Orbital Decompression (EEOD)

The goal of this step is to clearly identify two anatomical reference structures of major importance: the roof of the maxillary sinus, i.e. the medial orbital floor including the infraorbital nerve canal, and secondly, the posterior maxillary sinus wall. Proper identification of the posterior maxillary sinus wall enables the surgeon to anticipate the actual position of the common tendinous ring (annulus of Zinn) during the whole procedure. The annulus of Zinn, a funnel-shaped tendinous fibrous ring, is located near the orbital apex and gives rise to five of the six extraocular muscles. Dorsally, the annulus is firmly fused to the optic nerve and is divided into two compartments by a dural plane. The medial compartment contains the optic nerve and ophthalmic artery, whereas the lateral compartment incorporates the superior and inferior branches of the oculomotor nerve, abducent and nasociliary (V1) nerves. The annulus of Zinn is an important reference structure because it lies in close proximity to the orbital entrance of the optic nerve canal. This anatomical site is highly susceptible to iatrogenic damage and should never be exposed to undue pressure or traction. Any application of force to this site can immediately precipitate inadvertent injury of the optic nerve’s dural sheath. Taking into account that the optic nerve sheath is a continuation of the dura mater, the occurrence of such an incidence is tantamount to the iatrogenic creation of CSF leakage.

How to identify the natural maxillary sinus ostium?

How to perform middle meatal antrostomy?

The best way to identify the natural maxillary sinus ostium is to first remove the uncinate process (Figs. 34, 35), advance the forward-oblique telescope (angle of view 30° or 45°) toward the surgical field, and attempt to localize the ostium (Fig. 36).

As mentioned above, identification of the maxillary sinus ostium begins with partial uncinctomy, which at our institution is usually performed with a backbiting forceps. One should bear in mind, that the natural maxillary sinus ostium is most commonly located “just behind the corner”. So, if the ostium is still hidden and unlocatable, one should make an attempt to remove the uncinate process more anteriorly, all the while being aware of the nasolacrimal duct lying in close proximity to the area of manipulation. If the natural ostium is still invisible, the anterior wall of the ethmoid bulla should be removed by gently pulling it backward with the rear of a curette, and clearing away the fractured bone fragments with a BLAKESLEY forceps. At least the anterior part of the bulla should be removed until the natural opening can be clearly visualized, which will considerably facilitate the next surgical steps.
At this stage, one can proceed with the creation of a middle meatal antrostomy by removing the remnants of the ethmoid bulla.

The procedure continues with the uncinectomy of the vertical part of the uncinate process to obtain a wide view of the ostiomeatal complex (Figs. 38, 39), ethmoid bulla and the path leading to the frontal sinus ostium.

Concerning the medial orbital floor, one should keep in mind that obtaining a good view of this structure is a prerequisite for adequate anatomical orientation about the site where the lamina papyracea slopes upward at an almost vertical angle and finally attaches to the skull base.

This is useful because of two reasons: firstly, the surgeon can clearly identify the strut of the very thick, hard bone which in most cases can be visualized at the junction between the lamina papyracea and the medial orbital floor, and secondly, because this strut serves as a reference to the lateral level of the lamina papyracea enabling the surgeon to remove ethmoid cells while safeguarding the integrity of the lamina papyracea.

Why are the points above of such an importance?

- **Sparing the thick, inferomedial bony strut at the junction between the lamina papyracea and the medial orbital floor helps to minimize the risk of a detrimental, long-term outcome of EEOD: vertical globe dystopia.** This sequela is a late complication, usually detectable one year or more after surgery. The final clinical symptom is vertical diplopia, which is very difficult to cure (Fig. 40).
- **Iatrogenic injury to the lamina papyracea prior to completion of total ethmoidectomy without confirmed identification of Zinn's ring involves the risk of additional adverse effects, i.e., periorbitobal rupture caused by a sharp-edged lamina papyracea fragment.** One should bear in mind, that the increased retrobulbar pressure in patients with dysthyroid orbitopathy, in turn, raises the risk of accidental periorbitobal rupture. If this occurs, the retrobulbar fat rapidly bulges into the operating field and obscures vision making subsequent identification of the inferior orbital regions practically impossible.

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**Please note:**

One should not confuse the bony dehiscences in the area of the posterior (or, very rarely, the anterior) fontanel (inappropriately and wrongly termed accessory ostium) with the real natural maxillary ostium! An appropriate term for this finding is a “defect of the posterior fontanel” which undoubtedly is associated with chronic maxillary sinusitis, just as a defect at the eardrum undoubtedly is associated with chronic otitis media. We named this clinical entity “Two-Holes-Syndrome”, which, aside from gastroesophageal reflux (GERD) and allergy, is considered the prevalent cause of postnasal secretion (Fig. 37).

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The white dotted line clearly demonstrates the difference in height between the right and left pupilla.

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Fiber-endoscopic view of the left nasal cavity showing a large defect in the posterior fontanel region (>). The horizontal part of the uncinate process (UP) slopes down to the lower posterior parts of the lateral nasal wall. **MT** – middle turbinate.

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Uncincetomy is initiated by placing an incision with the sickle knife at the upper margin where the uncinate process attaches to the left lateral nasal wall.

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Starting at the anterior attachment of the uncinate process, the incision is carried in a posterior direction, approximately level with the free edge of the middle turbinate, to the lower posterior end of the process.
In such situations, the use of a powered cutting instrument, e.g., the UNIDRIVE® ENT system with DrillCut-X shaver handpiece and hollow cutting blades (KARL STORZ Tuttlingen, Germany), can be used to gently reduce the large amount of retrobulbar fat protruding into the surgical field. This maneuver should be reserved to experienced surgeons only, because inappropriate application involves the risk of accidental injury to the medial rectus muscle. The principal safety rule regarding the use of a powered shaver for this purpose is to keep the suction/cutting opening of the shaver blade directed upward or downward, thus allowing only the fat tissue to be aspirated and cut by the shaver. The medial rectus muscle is much more rigid and sturdy as the retrobulbar fat tissue, and is therefore less prone to be aspirated and cut by the blade tip, unless the suction/cutting window is tilted toward it. This is why the suction/cutting opening should always be guided upward or downward or sometimes even medially, while pushing aside the orbital contents and protecting the medial rectus muscle from any inadvertent trauma. Particular attention must be paid during creation of the middle meatal antrostomy. One must bear in mind, that lymphatic mucosal drainage occurs along pathways in the lateral nasal wall forming a close-meshed network anteriorly and inferiorly of the natural maxillary sinus ostium. This means, that the natural maxillary ostium should be enlarged in a superodorsal direction. We recommend, that the ostium be enlarged in a dorsal direction up to the level of the posterior maxillary sinus wall. If the antrostomy is extended too far anteroinferiorly, this can precipitate a defect of most part of the dense network of lymphatic vessels in this region. The delayed aftereffects of such an incident will be detectable in a couple of months with pronounced swelling of the maxillary sinus mucosa because of lymphatic stasis! When performing EEOD, the surgeon should make sure that the antrostomy opening be made a little wider than in patients treated by functional endoscopic surgery for chronic rhinosinusitis, paying tribute to the fact, that a certain volume of retrobulbar tissue will continue to protrude from the orbit after completion of the procedure. In some patients, the volume is so large in size, that it is capable of obstructing a small antrostomy window, a condition considered to play a major role in the pathogenesis of chronic maxillary sinusitis.

After removing the remnants of the ethmoid bulla, the posterior ethmoid should be entered through the basal lamella. In most cases it is absolutely sufficient to carefully press the blunt tip of a suction cannula against the basal lamella, which in this way can be easily fractured (Fig. 41).

In a step-by-step mode all posterior ethmoid cells should be removed until the remnants of the anterior sphenoid sinus wall can be completely visualized (Fig. 42).

Once the excess retrobulbar fat protruding from the orbit into the former ethmoid spaces has been removed, integrity of ventilation and drainage function of the sphenoid, maxillary and frontal sinuses along with patency of the ostiomeatal complex and sinus ostia must be confirmed. This underscores the significance of the preceding steps in making sure that the key landmarks, the natural ostia of all of the three sinuses, can be clearly visualized prior to placement of incisions in the periorbital fascia and prior to removal of orbital fat.
The frontal recess is an area of predilection for the occurrence of postoperative disorders that are correlated with impaired ventilation and drainage function. Therefore, particular attention must be paid to the frontal recess, i.e., the meticulous exposure of the frontal sinus from inferior (Fig. 43).

Among the clearly defined factors, that can adversely affect the successful outcome of endonasal endoscopic ethmoidectomy, i.e., EEOD, severe nasal septum deformities deserve particular mention. Deformities of type II, III, IV or VII, graded according to the author’s classification, occur with the highest incidence. Type I corresponds to the presence of a vertical ridge in the nasal valve, whereas type III is related to the same finding as type II, but at a more distal intranasal site, i.e., opposite to the head of the middle turbinate (Figs. 44, 45).

Deformities of type II and III constrict the lumen of the nasal cavity to such an extent, that introduction of a 4 mm-telescope along with concurrent passage of an operating instrument, required for performing EEOD, is made impossible.

A type IV septum deformity refers to the unilateral presence of a type II deformity in combination with type III at the contralateral side. Type VII denotes a deformity of a so-called “crumpled septum”, which manifests with a variety of severe deformities, usually of bizarre appearance. In the vast majority of cases of a type VII deformity, access to the ostiomeatal complex is severely obstructed, making the area not amenable to an endoscopic approach. (Fig. 46).

The endoscopic endonasal approach to the area of the ostiomeatal complex in patients with type VII deformity should only be planned as an elective two-stage procedure, beginning with septum surgery in the first stage, followed by EEOD of the worse eye with at least a 4-week interval in between. However, in cases of acute exudative dysthyroid orbitopathy with severe symptomatology, e.g., a rapid decline in visual acuity (progressive deterioration within 2–4 days or even earlier), pronounced chemosis with evidence of progressive exophthalmos, severe pain and photophobia, EEOD should be performed without delay, even in the presence of a septum deformity. Following completion of the first surgical step, which in such cases is septoplasty, the reconstructed nasal septum requires to be firmly anchored by placing adequate sutures (2–3 stitches at the contralateral side of the previous septum convexity), so as to pull the septum away from the anticipated surgical site treated in the next step.
Endoscopic Endonasal Orbital Decompression (EEOD)

View of the right nasal cavity. A pneumatized middle turbinate has been resected according to the surgical principles of Stammberger. Condition after removal of the uncinate process. Uneven surface of the anterior wall of the ethmoid bulla (MT). Ethmoidectomy is about to start.

Condition after complete removal of the ethmoid bulla, leaving untouched only a superior remnant (MT). Initially elevated piece of periorbital fascia (MT). The anticipated course of the posterior ethmoid artery (MT). The point of entry to the posterior ethmoid cavity (MT). MT – lateral surface of the middle turbinate.

Ethmoid cells and lamina papyracea have been removed entirely. MT – middle turbinate; anterior skull base (MT); boundary (MT); between the former lamina papyracea and the skull base; already denuded periorbita (MT); thick bony strut (MT) between the former lamina papyracea and the medial orbital floor; region of the annulus of Zinn (MT).

Among the factors capable of adversely affecting the outcome of EEOD, the presence of a large, well-pneumatized middle turbinate deserves to be mentioned as well. In such cases, the surgeon should first follow the endoscopic endonasal surgery concept of Stammberger and remove the lateral aspect of the middle turbinate with the aim of gaining more space prior to performing the EEOD procedure (Figs. 47–51).

Sickle knife (MT) after completion of the superior periorbital incisions. Without prior exertion of pressure on the eyeball from outside, a certain amount of retrobulbar fat tissue (RBFT) has already prolapsed into the former ethmoid cavities.

MT – middle turbinate

Final appearance upon completion of periorbital incisions. A large amount of retrobulbar fat tissue has been dislodged from the orbital space to the former ethmoid cavities. The endoscopic image confirms patency of the middle meatal antrostomy (MT) and free access to the frontal sinus (MT).

Step IV Removal of the lamina papyracea and medial orbital floor

Removal of the lamina papyracea is usually initiated in its medial aspect. The line of resection is followed backward as far as the common tendinous ring (annulus of Zinn), and upward to the anterior skull base, downward to the thick longitudinal bone, and finally reaches the anterior-most aspect in close proximity to the insertion of the uncinate process. Removal of the lamina papyracea is started by applying gentle pressure with the rear of the curette in lateral direction until the thin bony “shell” gives in and fractures (Fig. 52).

Left-sided EEOD. The lamina papyracea has been infractured. Applying gentle pressure with the rear of the curette, the lamina is laterally displaced in its anterior aspect while undermining its posterior one.
Endoscopic Endonasal Orbital Decompression (EEOD)

Endoscopic image taken while undermining the posterior part of the left lamina papyracea toward the orbital apex.

Detachment of the superior aspect of the lamina papyracea while approaching the anterior skull base.

Removal of a fragment of the lamina papyracea which has been elevated from the periorbita at a site almost contiguous with the remnants of the anterior sphenoid sinus wall (SSWR). The periorbita (PO) and the optic nerve canal (ON) have been adequately exposed.

Occasionally, (in 15% of cases) the thickness of the lamina papyracea does not match with its anatomical name: it is not at all thin and fragile like a sheet of paper, but very firm, tough and should therefore rather be named lamina ironacea. In the presence of this thick-walled variant, the surgeon must be patient and should first use a diamond drill to thin the bone within the anatomical boundaries of the lamina papyracea. Due diligence must be exercised during this step of the procedure to enable a safe and complete removal of the lamina papyracea overlying the periorbita. Once the lamina papyracea has been drilled away and infractured, the instrument should be carefully passed through the inlet and guided posteriorly while elevating the periorbital fascia from the bony capsule (Figs. 53, 54). The maneuver should be performed only as long as the instrument slides smoothly, i.e., without application of undue force.

It's up to the surgeon to decide, whether an attempt should be made to carefully mobilize the elevated bony capsule medially. This maneuver should produce a posterior fracture of the bone and cause the lamina papyracea fragment to flake off and lie unattached in the operating field. Subsequently, the bone fragment can be easily removed with the upward-biting BLAKESLEY forceps (Fig. 55).

Removal of the lamina papyracea continues by proceeding posteriorly, superiorly and inferiorly. While removing the lamina papyracea, great care should be taken to be as precise and radical as possible, particularly in superior direction (skull base), inferiorly down to the thick part of the bony frame of the maxillary sinus, and posteriorly as far as the annulus of Zinn, which always demarcates the end of the orbital apex and the beginning of the optic nerve canal (Fig. 56).
After removal of the posterior portion of the lamina papyracea, the anterior part is removed in the next step. At our institution, we usually begin at the site of the already exposed “free” margin, i.e., from where elevation of the posterior aspect was initiated.

Recently, a new instrument for this stage of the operation has been developed, the MLADINA retrograde elevator. This delicate instrument, resembling a simple pick, has shown to be a very reliable and user-friendly auxiliary instrument, that can be very helpful in the safe detachment of the first few millimeters of bone from the underlying periorbita, in some cases even much more. The instrument can assist in introducing the back-biting forceps into this space. In our institution, we also introduce this instrument in the ethmoid infundibulum during uncinectomy. The back-biting forceps is a smooth, minimally-invasive instrument that may also be used as blunt dissector that aids in elevating the anterior part of the lamina papyracea in a safe way (Figs. 60, 61).

In selected cases, the approach is extended as far as the orbital floor, i.e., through a large middle meatal antrostomy, removal of the posterior medial part of the orbital floor is extended to a point adjoining the infraorbital nerve canal, preventing, at any cost, iatrogenic injury of this structure.

In the vast majority of cases, we do not remove the longitudinal piece of the thick maxillary bone at the transition between the lamina papyracea and the orbital floor (Fig. 62), because we observed that such a maneuver increases the risk of vertical globe dystopia due to lack of bony support. The occurrence of such an event can result in vertical diplopia, a late complication, that clinically manifests only after 10–14 months following EEO.

Diagnosis and surgical management of vertical diplopia can be very challenging.
Endoscopic Endonasal Orbital Decompression (EEOD)

View of the left ostiomeatal complex after completion of ethmoidectomy. The MLADINA retrograde elevator is approaching the lamina papyracea (yellow arrow). The rear wall of the maxillary sinus is clearly visible (blue arrow).

The MLADINA retrograde elevator palpates the whole region of the lamina papyracea (purple arrow). The bony strut (black arrow), located at the borderline between the lamina papyracea and the maxillary sinus roof, must be preserved at all costs.

Shown above is the retrograde elevation of the anterior part of the lamina papyracea by use of the MLADINA retrograde elevator. The posterior part has already been elevated and removed with a curette (Figs. 52 – 56) and an upward-biting BLAKESLEY forceps (Fig. 55). The MLADINA retrograde elevator can grasp much more of the lamina than a simple “harpoon-shaped” hook. Due to its smooth, atraumatic tip design inadvertent damage to the periorbita can be reduced to the minimum. The angled tip considerably facilitates access to this part of the orbit, and enables the surgeon to exert moderate pressure to the already denuded periorbita with no harm at all, while simultaneously allowing for elevation of anterior remnants of the lamina papyracea.

Intraoperative sequence of continuing elevation of the anterior part of the lamina papyracea (a, b, and c) showing a new, well-denuded periorbital region. There are still some remnants of lamina papyracea in the anterior-most angle demarcated by the broken blue line.
Elevation is completed.

Preparatory steps prior to removal of the bone fragment (a, b). Once the lamina papyracea is totally removed, the completely denuded periorbita presents as shown in (c). Maxillary sinus ( ). The bony strut ( ) located at the borderline between lamina papyracea and the maxillary sinus roof must be preserved at all costs. Frontal sinus ( ). The whole length of the denuded lamina papyracea ( ).

Final appearance after completion of a left-sided EEOD procedure. The rear wall of the maxillary sinus ( ); Retrobulbar tissue prolapses into the former cavities of the ethmoidal sinuses ( ); left middle turbinate ( ).
Endoscopic Endonasal Orbital Decompression (EEOD)

Once the lamina papyracea and the medial orbital floor have been removed, the periorbital fascia should be widely exposed and any bony fragments should be cleared away. Beginning at the superior- and inferior-most margins, a series of horizontal incisions are placed on the periorbital fascia in a posteroanterior direction (Figs. 70–73).

While performing this maneuver gentle pressure should be applied to the globe from outside. Upon completion of all incisions initially planned, the globe should be pressed a little more vigorously, just to promote “delivery” of the retrobulbar fat, i.e., to cause the retrobulbar contents to bulge from the orbital cavity into the newly created spaces in the ethmoid and maxillary sinuses. At this very moment, i.e., during ocular manipulation, both surgeon and anesthesiologist must be aware of the inherent risk of an oculocardiac reflex which, at the worst, can result in severe bradycardia, dysrhythmia or even arrest.

Therefore, it is strongly recommended, that the anesthesiologist be instructed by the operating surgeon about his/her intentions prior to performing the ocular pressure test. In our clinical practice, a certain dose of i.v. atropine (anti-muscarinic acetylcholine antagonist) is administered prophylactically to prevent the onset of adverse effects of the oculocardiac reflex. According to the standard protocol used at our institution, postoperative nasal packing is not applied, because this can produce lateral pressure and push the only just released retrobulbar fat back into the orbital cavity. The only nasal packing applied after surgery, is a simple vestibular tamponade, which involves the placement of a few cottonoids and administration of antibiotic-steroid ointment in the nasal vestibule to close the nose. This is also intended as a precautionary measure to prevent the patient from blowing one’s nose in the first 24 hours after surgery. Particularly during the early postanesthetic recovery period, while not entirely conscious, the patient is prone to clear his/her nose in a kind of reflex, which can result in the formation of a very unpleasant orbital-periorbital emphysema (Figs. 75, 76).

In the event of this complication, the emphysema usually subsides spontaneously within some 72 hours. However, with the ambient air infiltrating the orbital contents, an acute inflammatory reaction can be evoked eventually leading to orbital cellulitis.

**Step V**

**Placement of longitudinal incisions in the periorbital fascia**

Once the sphenoid sinus (SS) and the anterior skull base (ASB) can be facilitated.

Once the sickle knife has been advanced, it may be used to lateralize the denuded periorbital (PO). In this way exposure of the boundary between the sphenoid sinus (SS) and the anterior skull base (ASB) can be facilitated.

The image captures the very moment, when the tip of the sickle knife is inserted in the posterosuperior aspect of the exposed periorbital (PO), at the beginning of step V.

As a result of the incision, bulges of retrobulbar fat can be seen protruding from the orbit without any additional pressure applied to the globe from outside.

SS – sphenoid sinus.

70

71

72

73

74

75

76

Postoperative enface view after endoscopic endonasal orbital decompression on the right eye. The patient had blown his nose too hard resulting in a lateroinferior dislocation of the globe.

The coronal CT scan of the same patient as in Fig. 74 showed massive intraorbital entrapment of air (A and ) in the right globe.
Conclusion

Endonasal endoscopic orbital decompression gives very good functional and cosmetic results. In our patient population, the mean withdrawal of protrusion after EEOD treatment was 4.6 mm. In all operated cases, significant reduction of intraocular pressure (IOP) and considerable improvement of the retraction of the upper and lower eyelid were noticeable. Symptoms related to exposure keratitis were observed to mitigate.

In the vast majority of patients, the subjective symptoms, such as retrobulbar pain, photophobia and prickling in the eyes, disappear after successful EEOD treatment. Regarding diplopia, there are two main groups of patients: the first one comprises those patients who did not suffer from diplopia prior to EEOD making up 48% of all orbitopathy patients. After surgery, 87% of the first group still did not show any signs of diplopia, 7% had transient diplopia which usually subsides not later than one week after surgery, and 6% of the patients develop a permanent diplopia (Fig. 76). The latter subgroup should be considered for secondary ophthalmologic surgery of the extraocular muscles, application of prisms in the glasses or both. Analysis of the postoperative data of the second group (52% with prior symptoms of diplopia) revealed the following distribution: 1% of patients demonstrated a reduction in symptomatology, 4% reported complete remission, 14% had no changes at all, and 81% presented with postoperative aggravation of diplopia.

Acknowledgements

The author wishes to express his profound and sincere gratitude to Dr. vet. med. Mario Satinović, the highly professional and competent representative of KARL STORZ company in Croatia, for his enthusiastic efforts in completing this booklet.

A special word of gratitude goes to Dr. med. Katarina Vuković from the ENT Department at the University Hospital Rebro-KBC, Zagreb, Croatia, and Dipl. Ing. Ivica Patrij from the Ministry of Defence of the Republic of Croatia, for their unselfish hard work and dedicated technical support in the course of this project.

Key to Anatomical Abbreviations

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<tr>
<th>Abbreviation</th>
<th>Definition</th>
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<td>A</td>
<td>entrapment of air within the orbit</td>
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<td>ASB</td>
<td>anterior skull base</td>
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<td>FS</td>
<td>frontal sinus</td>
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<td>ICA</td>
<td>internal carotid artery</td>
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<td>LP</td>
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<td>MS</td>
<td>maxillary sinus</td>
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<td>MT</td>
<td>middle nasal turbinate</td>
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<td>ON</td>
<td>optic nerve canal</td>
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<tr>
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<td>periorbita</td>
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<td>retrobulbar fat tissue</td>
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<td>nasal septum</td>
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<td>sphenoid sinus</td>
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<td>remnants of the sphenoid sinus wall</td>
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<td>superior turbinate</td>
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<td>STA</td>
<td>sella turcica</td>
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<td>UP</td>
<td>uncinate process</td>
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<td>V</td>
<td>anterior nasal valve</td>
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<td>ZR</td>
<td>Zinn's ring (annulus of Zinn)</td>
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Recommended Set for
Endoscopic Endonasal Orbital Decompression (EEOD)
HOPKINS® Telescopes
for Diagnosis, Surgery and Treatment of Nose and Paranasal Sinuses, diameter 4 mm, length 18 cm

7230 AA – CA

- **HOPKINS® Straight Forward Telescope 0°**, enlarged view, diameter 4 mm, length 18 cm, autoclavable, fiber optic light transmission incorporated, color code: green
- **HOPKINS® Forward-Oblique Telescope 30°**, enlarged view, diameter 4 mm, length 18 cm, autoclavable, fiber optic light transmission incorporated, color code: red
- **HOPKINS® Forward-Oblique Telescope 45°**, enlarged view, diameter 4 mm, length 18 cm, autoclavable, fiber optic light transmission incorporated, color code: black
- **HOPKINS® Lateral Telescope 70°**, enlarged view, diameter 4 mm, length 18 cm, autoclavable, fiber optic light transmission incorporated, color code: yellow

7229 AA – CA

- **HOPKINS® Straight Forward Telescope 0°**, enlarged view, diameter 2.7 mm, length 18 cm, autoclavable, fiber optic light transmission incorporated, color code: green
- **HOPKINS® Forward-Oblique Telescope 30°**, enlarged view, diameter 2.7 mm, length 18 cm, autoclavable, fiber optic light transmission incorporated, color code: red
- **HOPKINS® Forward-Oblique Telescope 45°**, enlarged view, diameter 2.7 mm, length 18 cm, autoclavable, fiber optic light transmission incorporated, color code: black
- **HOPKINS® Lateral Telescope 70°**, enlarged view, diameter 2.7 mm, length 18 cm, autoclavable, fiber optic light transmission incorporated, color code: yellow

It is recommended to check the suitability of the product for the intended procedure prior to use.
FESS Instruments

Accessories

723770 STAMMBERGER Telescope Handle, flat, standard model, length 11 cm, for use with HOPKINS® Straight Forward Telescopes 0° with diameter 4 mm and length 18 cm

723772 STAMMBERGER Telescope Handle, round, standard model, length 11 cm, for use with HOPKINS® Telescopes 30° – 120° with diameter 4 mm and length 18 cm

723774 STAMMBERGER Telescope Handle, round, length 11 cm, for use with HOPKINS® Telescopes with diameter 1.9/2.7 mm and length 18 cm

723750 A Protection Tube, for HOPKINS® Telescopes with length 11 cm

723750 B Protection Tube, for HOPKINS® Telescopes with length 18 cm

723005 A Trocar and Cannula for Sinuscopy, fenestrated beak, outer diameter 5 mm, length of the cannula 8.5 cm, for use with HOPKINS® Telescopes with diameter 4 mm

723005 B Trocar and Cannula for Sinuscopy, oblique beak, outer diameter 5 mm, length of the cannula 8.5 cm, for use with HOPKINS® Telescopes with diameter 4 mm

723103 B Trocar and Cannula for Sinuscopy, oblique beak, outer diameter 3.3 mm, length of the cannula 7.5 cm, for use with HOPKINS® Telescopes with diameter 2.7 mm
FESS Instruments
for Endoscopic Diagnosis, Surgery and Postoperative Treatment of Paranasal Sinuses and Anterior Skull Base

BLAKESLEY RHINOFORCE® II
Nasal Forceps, straight, size 0, with cleaning connector, working length 13 cm

BLAKESLEY-WILDE RHINOFORCE® II
Nasal Forceps, 45° upturned, size 0, with cleaning connector, working length 13 cm

BLAKESLEY-WILDE RHINOFORCE® II
Nasal Forceps, 90° upturned, size 1, with cleaning connector, working length 13 cm

BLAKESLEY-WILDE RHINOFORCE® II
Nasal Forceps, 45° upturned, handle in right horizontal position, size 1, with cleaning connector, working length 13 cm
FESS Instruments
for Endoscopic Diagnosis, Surgery and Postoperative Treatment of Paranasal Sinuses and Anterior Skull Base

451000 B – 451002 B

**RHINOFORCE® II Nasal Forceps**
- **GRÜNWALD-HENKE**
  - **451000 B**
    - **Straight, through-cutting, tissue-sparing, BLAKESLEY shape**, size 0, width 3 mm, with cleaning connector, working length 13 cm
  - **451001 B**
    - **Same**, size 1, width 3.5 mm
  - **451002 B**
    - **Same**, size 2, width 4 mm

**RHINOFORCE® II Nasal Forceps**
- **GRÜNWALD-HENKE**
  - **451500 B**
    - **45º upturned, through-cutting, tissue-sparing, BLAKESLEY shape**, size 0, width 3 mm, with cleaning connector, working length 13 cm
  - **451501 B**
    - **Same**, size 1, width 3.5 mm
  - **451502 B**
    - **Same**, size 2, width 4 mm

**RHINOFORCE® II Nasal Forceps**
- **MACKAY-GRÜNWALD**
  - **452001 B**
    - **Through-cutting, tissue-sparing, straight, delicate, 8 x 3 mm, size 1**, with cleaning connector, working length 13 cm
  - **452002 B**
    - **Same**, 11.5 x 3.5 mm, size 2

**RHINOFORCE® II Nasal Forceps**
- **MACKAY-GRÜNWALD**
  - **452501 B**
    - **45º upturned, delicate, 8 x 3 mm, size 1**, with cleaning connector, working length 13 cm
  - **452502 B**
    - **Same**, 11.5 x 3.5 mm, size 2

**RHINOFORCE® II Nasal Cutting Forceps**
- **STRUYCKEN**
  - **455010**
    - **With cleaning connector, working length 13 cm**
FESS Instruments
for Endoscopic Diagnosis, Surgery and Postoperative Treatment of Paranasal Sinuses and Anterior Skull Base

459012

459010  STAMMBERGER RHINOFORCE® II Antrum Punch, upside backward cutting, with cleaning connector, working length 10 cm

459011  Same, right side backward cutting

459012  Same, left side backward cutting

459016  STAMMBERGER RHINOFORCE® Antrum Punch, backward cutting, sheath 360° rotatable, with fixing screw, take apart, working length 10 cm, for use with cleaning adaptor 459015 LL

459015 LL  Cleaning Adaptor
FESS Instruments
for Endoscopic Diagnosis, Surgery and Postoperative Treatment of Paranasal Sinuses and Anterior Skull Base

STAMMBERGER RHINOFORCE® II Antrum Punch, small pediatric size, slender, upside backward cutting, with cleaning connector, working length 10 cm

Same, right side backward cutting

Same, left side backward cutting

STAMMBERGER RHINOFORCE® Antrum Punch, small pediatric size, slender, backward cutting, sheath 360° rotatable, with fixing screw, take apart, working length 10 cm, for use with cleaning adaptor 459015 LL

Cleaning Adaptor
FESS Instruments
for Endoscopic Diagnosis, Surgery and Postoperative Treatment of Paranasal Sinuses and Anterior Skull Base

459051  STAMMBERGER Antrum Punch, right side downward and forward cutting, working length 10 cm

459052  Same, left side downward and forward cutting

449201–449203  RHINOFORCE® II Nasal Scissors, straight, with cleaning connector, working length 13 cm

449202  Same, curved to right

449203  Same, curved to left
FESS Instruments
for Endoscopic Diagnosis, Surgery and Postoperative Treatment of Paranasal Sinuses and Anterior Skull Base

651050 STAMMBERGER Punch, circular cutting, for sphenoid, ethmoid and choanal atresia, with cleaning connector, working length 18 cm, diameter 4.5 mm

651055 Same, diameter 3.5 mm

651060 STAMMBERGER Punch, circular cutting, 65° upturned, for frontal sinus/recess, with cleaning connector, working length 17 cm, diameter 3.5 mm

651065 Same, diameter 4.5 mm

651061 STAMMBERGER Punch, tip egg-shaped, circular cutting, 65° upturned, for frontal sinus / recess, with cleaning connector, working length 17 cm, diameter 3.5 mm

651066 Same, diameter 4.5 mm

651050 R Cleaning Tool, for circular cutting punches type 651050 / 651055 / 60 / 65, double-ended, length 14 cm

651010 STAMMBERGER RHINOFORCE® II Forceps, cupped jaws, vertical opening, 65° upturned, with cleaning connector, working length 12 cm, cupped jaws diameter 3 mm

651020 Same, cupped jaws diameter 3 mm
Nose Sinuses
Microscopic/Endoscopic Surgery in the Area of Paranasal Sinuses, Skull Base and Pituitary Surgery

FESS Instruments
for Endoscopic Diagnosis, Surgery and Postoperative Treatment of Paranasal Sinuses and Anterior Skull Base
FESS Instruments
for Endoscopic Diagnosis, Surgery and Postoperative Treatment of Paranasal Sinuses and Anterior Skull Base

- **KUHN Frontal Sinus Seeker**, double-ended, No. 2, both sides curved 90°, one tip straight, one tip reverse angle, length 22 cm

- **KUHN Frontal Ostium Seeker**, double-ended, No. 6, both sides curved 77°, one tip straight, other tip reverse angle, length 22 cm

- **Antrum Curette**, oblong, small size, length 19 cm

- **KUHN-BOLGER Frontal Sinus Curette**, small, oblong, 55° curved, forward cutting, length 19 cm

- **Same**, 90° curved
FESS Instruments
for Endoscopic Diagnosis, Surgery and Postoperative Treatment of Paranasal Sinuses and Anterior Skull Base

586325 – 586340

586325  v. EICKEN Antrum Cannula, Luer-Lock, long curved, outer diameter 2.5 mm, working length 11 cm, length 15 cm
586330  Same, outer diameter 3 mm
586340  Same, outer diameter 4 mm

529305 – 529309

529305  FRAZIER Suction Tube, with mandrin and cut-off hole, with distance markings at 5 – 9 cm, 5 Fr., working length 10 cm
529307  Same, 7 Fr.
529309  Same, 9 Fr.
UNIDRIVE® S III ENT SCB/UNIDRIVE® S III ECO
The multifunctional unit for ENT

Special Features:

- Touch Screen: Straightforward function selection via touch screen
- Set values of the last session are stored
- Optimized user control due to touch screen
- Choice of user languages
- Operating elements are single and clear to read due to color display

One unit – multifunctional:
- Shaver system for surgery of the paranasal sinuses and anterior skull base
- INTRA Drill Handpieces (40,000 rpm and 80,000 rpm)
- Sinus Shaver
- Micro Saw
- STAMMBERGER-SACHSE Intranasal Drill
- Dermatome
- High-Speed Handpieces (60,000 rpm and 100,000 rpm)

Two motor outputs: Two motor outputs for simultaneous connection of two motors:
For example, a shaver and micro motor

- Soft start function
- Textual error messages

Integrated irrigation and coolant pump:
- Absolutely homogeneous, micro-processor controlled irrigation rate throughout the entire irrigation range
- Quick and easy connection of the tubing set

Easy program selection via automated motor recognition
Continuously adjustable revolution range
Maximum number of revolutions and motor torque: Microprocessor-controlled motor rotation speed. Therefore the preselected parameters are maintained throughout the drilling procedure.
Maximum number of revolutions can be preset
SCB model with connections to the KARL STORZ Communication Bus (KARL STORZ-SCB)
Irrigator rod included
Motor Systems
Specifications

System specifications

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<td><strong>Two outputs for parallel connection of two motors</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Integrated irrigation pump:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flow:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>adjustable in 9 steps</td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Approx. 4,000 rpm is recommended as this is the most efficient suction/performance ratio.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Motor Systems

Special features of high-performance EC micro motor II
and of the high-speed micro motor

Special features of high-performance EC micro motor II:
- Self-cooling, brushless high-performance EC micro motor
- Smallest possible dimensions
- Autoclavable
- Reprocessable in a cleaning machine
- Detachable connecting cable
- INTRA coupling for a wide variety of applications
- Maximum torque 4 Ncm
- Number of revolutions continuously adjustable up to 40,000 rpm
- Provided a suitable handle is used, the number of revolutions is continuously adjustable up to 80,000 rpm

High-Performance EC Micro Motor II, for use with UNIDRIVE® II/UNIDRIVE® ENT/OMFS/NEURO/ECO and Connecting Cable 20 7110 73, or for use with UNIDRIVE® S III ENT/ECO/NEURO and Connecting Cable 20 7111 73

Connecting Cable, to connect High-Performance EC Micro Motor 20 7110 33 to UNIDRIVE® S III ENT/ECO/NEURO

Special Features of the high-speed micro motor:
- Brushless high-speed micro motor
- Smallest possible dimensions
- Autoclavable
- Reprocessable in a cleaning machine
- Maximum torque 6 Ncm
- Maximum torque 6 Ncm
- Number of revolutions continuously adjustable up to 60,000 rpm
- Provided a suitable handle is used, the number of revolutions is continuously adjustable up to 100,000 rpm

High-Speed Micro-Motor, max. speed 60,000 rpm, including connecting cable, for use with UNIDRIVE® S III ENT/NEURO
### UNIDRIVE® S III ENT SCB

#### New

**UNIDRIVE® S III ECO**

**Recommended System Configuration**

#### UNIDRIVE® S III ENT SCB

- **40 7016 20-1**
  - **UNIDRIVE® S III ENT SCB**, motor control unit with color display, touch screen, two motor outputs, integrated irrigation pump and SCB module, power supply 100 – 240 VAC, 50/60 Hz
  - Including:
    - **Mains Cord**
    - **Irrigator Rod**
    - **Two-Pedal Footswitch**, two-stage, with proportional function
    - **Silicone Tubing Set**, for irrigation, sterilizable
    - **Clip Set**, for use with silicone tubing set
    - **SCB Connecting Cable**, length 100 cm
    - **Single Use Tubing Set***, sterile, package of 3

#### UNIDRIVE® S III ECO

- **40 7014 20**
  - **UNIDRIVE® S III ECO**, motor control unit with two motor outputs and integrated irrigation pump, power supply 100 – 240 VAC, 50/60 Hz
  - Including:
    - **Mains Cord**
    - **Two-Pedal Footswitch**, two-stage, with proportional function
    - **Silicone Tubing Set**, for irrigation, sterilizable
    - **Clip Set**, for use with silicone tubing set

### Specifications:

<table>
<thead>
<tr>
<th></th>
<th>UNIDRIVE® S III ENT SCB: 6.4°/300 cd/m²</th>
<th>Dimensions w x h x d</th>
<th>300 x 165 x 265 mm</th>
<th>Weight</th>
<th>5.2 kg</th>
<th>Certified to</th>
<th>EC 601-1, CE acc. to MDD</th>
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<tbody>
<tr>
<td><strong>Touch Screen</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Flow</strong></td>
<td></td>
<td>9 steps</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Power supply</strong></td>
<td></td>
<td>100-240 VAC, 50/60 Hz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* mtp medical technical promotion gmbh,
  Take-Off GewerbePark 46, D-78579 Neuhausen ob Eck, Germany
UNIDRIVE® S III ENT SCB
UNIDRIVE® S III ECO
System Components
## Optional Accessories
for UNIDRIVE® S III ENT SCB and UNIDRIVE® S III ECO

<table>
<thead>
<tr>
<th>Item Code</th>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
</table>
| 280053     | **Universal Spray**, 6x 500 ml bottles – HAZARDOUS GOODS – UN 1950 | including:<br>
|            | **Spray Nozzle**                                            |                                                                                           |
| 280053 C   | **Spray Nozzle**, for the reprocessing of INTRA burr handpieces, for use with Universal Spray 280053 B |                                                                                           |
| 031131-10* | **Tubing Set**, for irrigation, for single use, sterile, package of 10 |                                                                                           |
DrillCut-X® Shaver Handpieces

Special Features:

Max. 10,000 rpm for shaver blades, max. 12,000 rpm for sinus shaver

Straight suction channel

Integrated irrigation channel

Powerful motor, also suitable for harder materials

Absolutely silent running, no vibration

Completely immersible and machine-washable

LOCK allows fixation of shaver blades and sinus shavers

Extremely lightweight design

Optional, ergonomic handle, detachable

Can be adapted to navigation tracker

<table>
<thead>
<tr>
<th>Special Features</th>
<th>DrillCut-X® II</th>
<th>DrillCut-X® II N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. 10,000 rpm for shaver blades, max. 12,000 rpm</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>for sinus shaver</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Straight suction channel</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Integrated irrigation channel</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Powerful motor, also suitable for harder materials</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Absolutely silent running, no vibration</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Completely immersible and machine-washable</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>LOCK allows fixation of shaver blades and sinus</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>shavers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extremely lightweight design</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Optional, ergonomic handle, detachable</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Can be adapted to navigation tracker</td>
<td>–</td>
<td>●</td>
</tr>
</tbody>
</table>

40 7120 50  DrillCut-X® II Shaver Handpiece,
for use with UNIDRIVE® S III ECO/ENT/NEURO/OMFS

40 7120 55  DrillCut-X® II N Shaver Handpiece,
optional adaptability to Shaver Tracker 40 8001 22,
for use with UNIDRIVE® S III ECO/ENT/NEURO/OMFS
DrillCut-X® II Shaver Handpiece

Special Features:
- Powerful motor
- Absolutely silent running
- Enhanced ergonomics
- Lightweight design
- Oscillation mode for shaver blades, max. 10,000 rpm
- Rotation mode for sinus shavers, max. 12,000 rpm
- Straight suction channel and integrated irrigation

- The versatile DrillCut-X® II Shaver Handpiece can be adapted to individual needs of the user
- Easy hygienic processing, suitable for use in washer and autoclavable at 134° C
- Quick coupling mechanism facilitates more rapid exchange of work inserts
- Proven DrillCut-X® blade portfolios can be used

**40 7120 50** DrillCut-X® II Shaver Handpiece, for use with UNIDRIVE® S III ECO/ENT/NEURO/OMFS

**40 7120 90** Handle, adjustable, for use with DrillCut-X® II 40 7120 50 and DrillCut-X® II N 40 7120 55

Optional Accessory:

**41250 RA** Cleaning Adaptor, LUER-Lock, for cleaning DrillCut-X® shaver handpieces
DrillCut-X® II Shaver N Handpiece

**NEW**

**Special Features:**
- Powerful motor
- Absolutely silent running
- Enhanced ergonomics
- Lightweight design
- Oscillation mode for shaver blades, max. 10,000 rpm
- Rotation mode for sinus shavers, max. 12,000 rpm
- Straight suction channel and integrated irrigation
- The versatile DrillCut-X® II Shaver N Shaver Handpiece can be adapted to the individual needs of the user
- Easy hygienic processing, suitable for use in washer and autoclavable at 134° C
- Quick coupling mechanism facilitates more rapid exchange of working inserts
- Proven DrillCut-X® blade portfolios can be used
- Optional adaptability to Shaver Tracker 40 8001 22
- Allows shaver navigation when used with NPU 40 8000 01

**40 7120 55**
DrillCut-X® II N Shaver Handpiece, optional adaptability to Shaver Tracker 40 8001 22, for use with UNIDRIVE® S III ECO/ENT/NEURO/OMFS

**40 7120 90**
Handle, adjustable, for use with DrillCut-X® II 40 7120 50 and DrillCut-X® II N 40 7120 55

**Optional Accessory:**

**41250 RA**
Cleaning Adaptor, Luer-Lock, for cleaning DrillCut-X® shaver handpieces
Handle for DrillCut-X® II Shaver Handpiece
for use with DrillCut-X® II 40 7120 50 and DrillCut-X® II N 40 7120 55

Special Features:
- Ergonomic design
- Ultralight construction
- Easy handle control allows individual adjustment

- The adjustable handle can be mounted to DrillCut-X® II or -X II N Shaver Handpiece
- Easy fixation via rotary lock
- Sterilizable

40 7120 90

40 7120 90 Handle, adjustable, for use with DrillCut-X® II 40 7120 50 and DrillCut-X® II N 40 7120 55
Shaver Blades, straight
for Nasal Sinuses and Skull Base Surgery

For use with DrillCut-X® II and DrillCut-X® II N

Shaver Blades, straight, sterilizable

<table>
<thead>
<tr>
<th>Detail</th>
<th>for use with</th>
<th>Shaver Blade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>40712050 DrillCut-X® II Handpiece</td>
<td>length 12 cm</td>
</tr>
<tr>
<td></td>
<td>40712055 DrillCut-X® II N Handpiece</td>
<td></td>
</tr>
<tr>
<td>41201 KN</td>
<td>serrated cutting edge, diameter 4 mm, color code: blue-red</td>
<td></td>
</tr>
<tr>
<td>41201 KK</td>
<td>double serrated cutting edge, diameter 4 mm, color code: blue-yellow</td>
<td></td>
</tr>
<tr>
<td>41201 GN</td>
<td>concave cutting edge, oval cutting window, diameter 4 mm, color code: blue-green</td>
<td></td>
</tr>
<tr>
<td>41201 LN</td>
<td>concave cutting edge, oblique cutting window, diameter 4 mm, color code: blue-black</td>
<td></td>
</tr>
<tr>
<td>41201 SN</td>
<td>straight cutting edge, diameter 4 mm, color code: blue-blue</td>
<td></td>
</tr>
<tr>
<td>41201 KSA</td>
<td>serrated cutting edge, diameter 3 mm, color code: blue-red</td>
<td></td>
</tr>
<tr>
<td>41201 KKSA</td>
<td>double serrated cutting edge, diameter 3 mm, color code: blue-yellow</td>
<td></td>
</tr>
<tr>
<td>41201 KKSB</td>
<td>double serrated cutting edge, diameter 2 mm, color code: blue-yellow</td>
<td></td>
</tr>
<tr>
<td>41201 LSA</td>
<td>concave cutting edge, oblique cutting window, diameter 3 mm, color code: blue-black</td>
<td></td>
</tr>
</tbody>
</table>

Optional Accessory:

41200 RA Cleaning Adaptor, Luer-Lock, for cleaning the inner and outer blades of reusable Shaver Blades 412xx
**Shaver Blades, curved**  
for Nasal Sinuses and Skull Base Surgery

For use with DrillCut-X® II and DrillCut-X® II N

Shaver Blades, curved 35°/40°, sterilizable

<table>
<thead>
<tr>
<th>Detail</th>
<th>for use with</th>
<th>Shaver Blade length 12 cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>41202 KN</td>
<td>40712050 DrillCut-X® II Handpiece 40712055 DrillCut-X® II N Handpiece</td>
<td>curved 35°, cutting edge serrated backwards, diameter 4 mm, color code: blue-red</td>
</tr>
<tr>
<td>41204 KKF</td>
<td></td>
<td>curved 40°, cutting edge serrated forwards, double serrated, diameter 4 mm, color code: blue-yellow</td>
</tr>
<tr>
<td>41204 KKB</td>
<td></td>
<td>curved 40°, cutting edge serrated backwards, double serrated, diameter 4 mm, color code: blue-yellow</td>
</tr>
<tr>
<td>41204 KKFA</td>
<td></td>
<td>curved 40°, cutting edge serrated forwards, double serrated, diameter 3 mm, color code: blue-yellow</td>
</tr>
<tr>
<td>41204 KKBA</td>
<td></td>
<td>curved 40°, cutting edge serrated backwards, double serrated, diameter 3 mm, color code: blue-yellow</td>
</tr>
</tbody>
</table>

Optional Accessory:

41200 RA  **Cleaning Adaptor**, LUER-Lock, for cleaning the inner and outer blades of reusable Shaver Blades 412xx
Shaver Blades, curved
for Nasal Sinuses and Skull Base Surgery

For use with DrillCut-X II and DrillCut-X II N

Shaver Blades, curved 65°, sterilizable

<table>
<thead>
<tr>
<th>Detail</th>
<th>for use with</th>
<th>Shaver Blade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>40712050 DrillCut-X II Handpiece</td>
<td>length 12 cm</td>
</tr>
<tr>
<td></td>
<td>40712055 DrillCut-X II N Handpiece</td>
<td></td>
</tr>
</tbody>
</table>

- **41203 KNF**
  - curved 65°, cutting edge serrated forwards, diameter 4 mm,
  - color code: blue-red

- **41203 KNB**
  - curved 65°, cutting edge serrated backwards, diameter 4 mm,
  - color code: blue-red

- **41203 KKF**
  - curved 65°, cutting edge serrated forwards, double serrated,
  - diameter 4 mm,
  - color code: blue-yellow

- **41203 KKB**
  - curved 65°, cutting edge serrated backwards, double serrated,
  - diameter 4 mm,
  - color code: blue-yellow

- **41203 KKFA**
  - curved 65°, cutting edge serrated forwards, double serrated,
  - diameter 3 mm,
  - color code: blue-yellow

- **41203 KKBA**
  - curved 65°, cutting edge serrated backwards, double serrated,
  - diameter 3 mm,
  - color code: blue-yellow

- **41203 GNF**
  - curved 65°, concave cutting edge, oval cutting window, forward opening, diameter 4 mm,
  - color code: blue-green

- **41203 GNB**
  - curved 65°, concave cutting edge, oval cutting window, backward opening, diameter 4 mm,
  - color code: blue-green

Optional Accessory:

- **41200 RA**
  - Cleaning Adaptor, LUER-Lock, for cleaning the inner and outer blades of reusable Shaver Blades 412xx
**Shaver Blades, straight**  
for Nasal Sinuses and Skull Base Surgery

For use with DrillCut-X® II and DrillCut-X® II N

![Image of Shaver Blade](image)

**Shaver Blades, straight, for single use, sterile, package of 5**

<table>
<thead>
<tr>
<th>Detail</th>
<th>for use with</th>
<th>Shaver Blade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>for use with</strong></td>
<td><strong>length 12 cm</strong></td>
</tr>
<tr>
<td></td>
<td>40 7120 50 DrillCut-X® II Handpiece</td>
<td></td>
</tr>
<tr>
<td></td>
<td>40 7120 55 DrillCut-X® II N Handpiece</td>
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</tr>
<tr>
<td>41301 KN</td>
<td>serrated cutting edge, diameter 4 mm, color code: blue-red</td>
<td></td>
</tr>
<tr>
<td>41301 KK</td>
<td>double serrated cutting edge, diameter 4 mm, color code: blue-yellow</td>
<td></td>
</tr>
<tr>
<td>41301 GN</td>
<td>concave cutting edge, oval cutting window, diameter 4 mm, color code: blue-green</td>
<td></td>
</tr>
<tr>
<td>41301 LN</td>
<td>concave cutting edge, oblique cutting window, diameter 4 mm, color code: blue-black</td>
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<tr>
<td>41301 SN</td>
<td>straight cutting edge, diameter 4 mm, color code: blue-blue</td>
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<tr>
<td>41301 KSA</td>
<td>serrated cutting edge, diameter 3 mm, color code: blue-red</td>
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<tr>
<td>41301 KKSA</td>
<td>double serrated cutting edge, diameter 3 mm, color code: blue-yellow</td>
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<tr>
<td>41301 KKSB</td>
<td>double serrated cutting edge, diameter 2 mm, color code: blue-yellow</td>
<td></td>
</tr>
<tr>
<td>41301 LSA</td>
<td>concave cutting edge, oblique cutting window, diameter 3 mm, color code: blue-black</td>
<td></td>
</tr>
</tbody>
</table>
**Shaver Blades, curved**
for Nasal Sinuses and Skull Base Surgery

For use with DrillCut-X® II and DrillCut-X® II N

![Image of Shaver Blades](image)

<table>
<thead>
<tr>
<th>Detail</th>
<th>for use with</th>
<th>Shaver Blade length 12 cm</th>
</tr>
</thead>
</table>
| 41302 KN | **40 7120 50 DrillCut-X® II Handpiece**  
**40 7120 55 DrillCut-X® II N Handpiece** | curved 35°, cutting edge serrated backwards, diameter 4 mm, color code: blue-red |
| 41304 KKF|                                                    | curved 40°, cutting edge serrated forwards, double serrated, diameter 4 mm, color code: blue-yellow |
| 41304 KKB|                                                    | curved 40°, cutting edge serrated backwards, double serrated, diameter 4 mm, color code: blue-yellow |
| 41304 KKFA|                                                  | curved 40°, cutting edge serrated forwards, double serrated, diameter 3 mm, color code: blue-yellow |
| 41304 KKBA|                                                  | curved 40°, cutting edge serrated backwards, double serrated, diameter 3 mm, color code: blue-yellow |
Shaver Blades, curved
for Nasal Sinuses and Skull Base Surgery

For use with DrillCut-X® II and DrillCut-X® II N

![Image of shaver blades](image)

41303 KKB

Shaver Blades, curved 65°, for single use, sterile, package of 5

| Detail | for use with | Shaver Blade
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
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<td></td>
<td>length 12 cm</td>
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<td>curved 65°, cutting edge serrated forwards, diameter 4 mm, color code: blue-red</td>
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<tr>
<td>41303 KNF</td>
<td>40 7120 50 DrillCut-X® II Handpiece</td>
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<tr>
<td></td>
<td>40 7120 55 DrillCut-X® II N Handpiece</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>curved 65°, cutting edge serrated backwards, diameter 4 mm, color code: blue-red</td>
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<tr>
<td>41303 KNB</td>
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<tr>
<td></td>
<td></td>
<td>curved 65°, cutting edge serrated forwards, double serrated, diameter 4 mm, color code: blue-yellow</td>
</tr>
<tr>
<td>41303 KKF</td>
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<tr>
<td>41303 KKBA</td>
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<td></td>
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<td>curved 65°, cutting edge concave forwards, oval cutting window, diameter 4 mm, color code: blue-green</td>
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<tr>
<td>41303 GNF</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>curved 65°, cutting edge concave backwards, oval cutting window, diameter 4 mm, color code: blue-green</td>
</tr>
<tr>
<td>41303 GNB</td>
<td></td>
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</tbody>
</table>
**Sinus Burrs, curved**  
for Nasal Sinuses and Skull Base Surgery

For use with DrillCut-X® II and DrillCut-X® II N

![Sinus Burrs Image]

**Sinus Burrs, curved 70°/55°/40°/15°**, for single use, sterile, package of 5

<table>
<thead>
<tr>
<th>Detail</th>
<th>for use with</th>
<th>Sinus Burr length 12 cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>41304 W</td>
<td>40712050 DrillCut-X® II Handpiece</td>
<td>curved 40°, cylindric, drill diameter 3 mm, shaft diameter 4 mm, color code: red-blue</td>
</tr>
<tr>
<td>41303 WN</td>
<td>40712055 DrillCut-X® II N Handpiece</td>
<td>curved 55°, cylindric, drill diameter 3.6 mm, shaft diameter 4 mm, color code: red-blue</td>
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<tr>
<td>41305 RN</td>
<td></td>
<td>curved 15°, bud drill, drill diameter 4 mm, shaft diameter 4 mm, color code: red-black</td>
</tr>
<tr>
<td>41305 DN</td>
<td></td>
<td>curved 15°, diamond head, drill diameter 5 mm, shaft diameter 4 mm, color code: red-black</td>
</tr>
<tr>
<td>41305 D</td>
<td></td>
<td>curved 15°, diamond head, drill diameter 5 mm, shaft diameter 4 mm, color code: red-yellow</td>
</tr>
<tr>
<td>41305 DW</td>
<td></td>
<td>curved 40°, diamond head, drill diameter 5 mm, shaft diameter 4 mm, color code: red-yellow</td>
</tr>
<tr>
<td>41303 DT</td>
<td></td>
<td>curved 70°, diamond head, drill diameter 3.6 mm, shaft diameter 4 mm, color code: red-yellow</td>
</tr>
</tbody>
</table>
Accessories for Shaver

39550 A  **Wire Tray**, provides safe storage of accessories for KARL STORZ paranasal sinus shaver systems during cleaning and sterilization

for storage of:
– Up to 7 shaver attachments
– Connecting cable

**Please note:** The instruments displayed are not included in the sterilizing and storage tray.
INTRA Drill Handpiece
for Surgery in Ethmoid and Skull Base Area

Special Features:
- Tool-free closing and opening of the drill
- Right/left rotation
- Max. rotating speed up to 40,000 rpm / 80,000 U/min
- Detachable irrigation channels
- Lightweight construction
- Operates with little vibrations
- Low maintenance
- Reprocessable in a cleaning machine
- Safe grip

INTRA Drill Handpiece, angled, length 15 cm, transmission 1:1 (40,000 rpm), for use with KARL STORZ high-performance EC micro motor II and burrs

INTRA Drill Handpiece, straight, length 13 cm, transmission 1:1 (40,000 rpm), for use with KARL STORZ high-performance EC micro motor II and burrs

<table>
<thead>
<tr>
<th>Detail</th>
<th>Size</th>
<th>Dia. mm</th>
<th>Standard</th>
<th>Diamond</th>
<th>Diamond coarse</th>
</tr>
</thead>
<tbody>
<tr>
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649600 Standard Straight Shaft Burr, stainless, size 014 – 070, length 9.5 cm, set of 11
649700 Diamond Straight Shaft Burr, stainless, size 014 – 070, length 9.5 cm, set of 11
649700 G Rapid Diamond Straight Shaft Burr, stainless, with coarse diamond coating for precise drilling and abrasion without hand pressure and generating minimal heat, size 023 – 070, length 9.5 cm, set of 9, color code: gold
280033 Rack, for 36 straight shaft burrs with a length of 9.5 cm, foldable, sterilizable, size 22 x 14 x 2 cm
INTRA Drill Handpiece
for Surgery in Ethmoid and Skull Base Area

Special Features:
- Tool-free closing and opening of the drill
- Right/left rotation
- Max. rotating speed up to 40,000 rpm / 80,000 U/min
- Detachable irrigation channels

- Lightweight construction
- Operates with little vibrations
- Low maintenance
- Reprocessable in a cleaning machine
- Safe grip

INTRA Drill Handpiece, angled, length 18 cm, transmission 1:2 (80,000 rpm), for use with KARL STORZ high-performance EC micro motor II and burrs

Same, transmission 1:1 (40,000 rpm)

INTRA Drill Handpiece, straight, length 17 cm, transmission 1:1 (40,000 rpm), for use with KARL STORZ high-performance EC micro motor II and burrs

<table>
<thead>
<tr>
<th>Detail</th>
<th>Size</th>
<th>Dia. mm</th>
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<th>Diamond sterilizable</th>
<th>Diamond coarse sterilizable</th>
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<td>649770 L</td>
<td>649770 GL</td>
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</tr>
</tbody>
</table>

649600 L  **Standard Straight Shaft Burr**, stainless, size 014 – 070, length 12.5 cm, set of 11

649700 L  **Diamond Straight Shaft Burr**, stainless, size 014 – 070, length 12.5 cm, set of 11

649700 GL **Rapid Diamond Straight Shaft Burr**, stainless, with coarse diamond coating for precise drilling and abrasion without hand pressure and generating minimal heat, sizes 023 – 070, length 12.5 cm, set of 9, color code: gold

280034  **Rack**, for 36 straight shaft burrs with a length of 12.5 cm, foldable, sterilizable, size 22 x 17 x 2 cm
Accessories for Burrs

- **Rack** (280033), for 36 straight shaft burrs with a length of 9.5 cm, foldable, sterilizable, size 22 x 14 x 2 cm
- **Rack** (280034), for 36 straight shaft burrs with a length of 12.5 cm, foldable, sterilizable, size 22 x 17 x 2 cm
- **NEW** (280043), Rack, flat model, to hold 21 straight shaft burrs with a length of 7 cm (6 pcs) and 9.5 cm (15 pcs), folding model, sterilizable, size 17.5 x 11.5 x 1.2 cm

*Please note:* The burrs displayed are not included in the racks.
Accessories for Burrs

39552 A  **Wire Tray**, provides safe storage of accessories for KARL STORZ drilling/grinding systems during cleaning and sterilization, includes tray for small parts, for use with Rack 280030, rack **not** included for storage of:
- Up to 6 drill handpieces
- Connecting cable
- EC micro motor
- Small parts

39552 B  **Wire Tray**, provides safe storage of accessories for KARL STORZ drilling/grinding systems during cleaning and sterilization, includes tray for small parts, for use with Rack 280030, rack **included** for storage of:
- Up to 6 drill handpieces
- Connecting cable
- EC micro motor
- Up to 36 drill bits and burrs
- Small parts

**Please note:** The instruments displayed are not included in the sterilizing and storage tray.
UNIDRIVE® S III ENT SCB
High-Speed Handpieces, angled, 100,000 rpm

For use with High-Speed Drills, shaft diameter 3.17 mm
and with High-Speed Micro Motor 20712033

100,000 rpm
diameter 7.5 mm

20712033

252681

High-Speed Handpiece, medium, angled, 100,000 rpm,
for use with High-Speed Micro-Motor 20712033

93 mm

7.5 mm

252682

High-Speed Handpiece, long, angled, 100,000 rpm,
for use with High-Speed Micro-Motor 20712033

53 mm

7.5 mm
**UNIDRIVE® S III ENT SCB**

High-Speed Handpieces, angled, 60,000 rpm

For use with High-Speed Drills, shaft diameter 2.35 mm and with High-Speed Micro Motor 20 7120 33

60,000 rpm

Diameter 5.5 mm

252661  **High-Speed Handpiece**, short, angled, 60,000 rpm, for use with High-Speed Micro-Motor 20 7120 33

252662  **High-Speed Handpiece**, medium, angled, 60,000 rpm, for use with High-Speed Micro-Motor 20 7120 33

252663  **High-Speed Handpiece**, long, angled, 60,000 rpm, for use with High-Speed Micro-Motor 20 7120 33
UNIDRIVE® S III ENT SCB NEW
High-Speed Handpieces, straight, 60,000 rpm

For use with High-Speed Drills, shaft diameter 2.35 mm and with High-Speed Micro Motor 20 7120 33

- 60,000 rpm
- diameter 5.5 mm

252691 High-Speed Handpiece, short, straight, 60,000 rpm, for use with High-Speed Micro-Motor 20 7120 33

252692 High-Speed Handpiece, medium, straight, 60,000 rpm, for use with High-Speed Micro-Motor 20 7120 33
UNIDRIVE® S III ENT SCB
High-Speed Handpieces, malleable, slim, angled, 60,000 rpm

For use with High-Speed Drills, shaft diameter 1 mm
and with High-Speed Micro Motor 20712033

The handpieces have malleable shafts that can be bent up to 20° according to user requirements.

252671  High-Speed Handpiece, extra long, malleable, slim, angled, 60,000 rpm, for use with High-Speed Micro-Motor 20712033
252672  High-Speed Handpiece, super long, malleable, slim, angled, 60,000 rpm, for use with High-Speed Micro-Motor 20712033
UNIDRIVE® S III ENT SCB
High-Speed Standard Burrs, High-Speed Diamond Burrs

For use with High-Speed Handpieces, 100,000 rpm

100,000 rpm

diameter 7.5 mm

<table>
<thead>
<tr>
<th>Diameter in mm</th>
<th>medium</th>
<th>long</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
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<td>350120 M</td>
<td>350120 L</td>
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<td>350160 L</td>
</tr>
<tr>
<td>7</td>
<td>350170 M</td>
<td>350170 L</td>
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</table>

<table>
<thead>
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<th>Diameter in mm</th>
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<tbody>
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<td>7</td>
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<td>350270 L</td>
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## UNIDRIVE® S III ENT SCB NEW

High-Speed Diamond Burrs, High-Speed Acorn, High-Speed Barrel Burrs, High-Speed Neuro Fluted Burrs

For use with High-Speed Handpieces, 100,000 rpm

![Image of High-Speed Handpieces](image)

**High-Speed Coarse Diamond Burrs, 100,000 rpm, for single use, sterile, package of 5**

<table>
<thead>
<tr>
<th>Diameter in mm</th>
<th>medium</th>
<th>long</th>
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</thead>
<tbody>
<tr>
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<td>350360 L</td>
</tr>
<tr>
<td>7</td>
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<td>350370 L</td>
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</table>

**High-Speed Acorn, 100,000 rpm, for single use, sterile, package of 5**

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<tr>
<td>9</td>
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**High-Speed Barrel Burrs, 100,000 rpm, for single use, sterile, package of 5**

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**High-Speed Neuro Fluted Burrs, 100,000 rpm, for single use, sterile, package of 5**

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<th>long</th>
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<tr>
<td>3</td>
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<td>350730 L</td>
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</table>
### High-Speed Standard Burrs, 60,000 rpm, for single use, sterile, package of 5

<table>
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<th>medium</th>
<th>long</th>
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<td>–</td>
</tr>
<tr>
<td>2</td>
<td>330120 S</td>
<td>330120 M</td>
<td>330120 L</td>
</tr>
<tr>
<td>3</td>
<td>330130 S</td>
<td>330130 M</td>
<td>330130 L</td>
</tr>
<tr>
<td>4</td>
<td>330140 S</td>
<td>330140 M</td>
<td>330140 L</td>
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<tr>
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<td>330150 M</td>
<td>330150 L</td>
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<td>330170 M</td>
<td>330170 L</td>
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### High-Speed Diamond Burrs, 60,000 rpm, for single use, sterile, package of 5

<table>
<thead>
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</tr>
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<td>330220 M</td>
<td>330220 L</td>
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<tr>
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<tr>
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<td>330250 M</td>
<td>330250 L</td>
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<tr>
<td>6</td>
<td>330260 S</td>
<td>330260 M</td>
<td>330260 L</td>
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<td>7</td>
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<td>330270 M</td>
<td>330270 L</td>
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**UNIDRIVE® S III ENT SCB**

*High-Speed Diamond Burrs, High-Speed Cylinder Burrs, LINDEMANN High-Speed Fluted Burrs*

For use with High-Speed Handpieces, 60,000 rpm

---

### High-Speed Coarse Diamond Burrs, 60,000 rpm, for single use, sterile, package of 5

<table>
<thead>
<tr>
<th>Diameter in mm</th>
<th>short</th>
<th>medium</th>
<th>long</th>
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</thead>
<tbody>
<tr>
<td>3</td>
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### High-Speed Cylinder Burrs, 60,000 rpm, for single use, sterile, package of 5

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<tr>
<td>6</td>
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### LINDEMANN High-Speed Fluted Burrs, 60,000 rpm, for single use, sterile, package of 5

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<tr>
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</table>
## UNIDRIVE® S III ENT SCB
### High-Speed Diamond Burrs

For use with High-Speed Handpieces, 60,000 rpm

![Image of High-Speed Diamond Burrs](image)

<table>
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<tr>
<th>Diameter in mm</th>
<th>extra long</th>
<th>super long</th>
</tr>
</thead>
<tbody>
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<td>320230 SL</td>
</tr>
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<td>320240 EL</td>
<td>320240 SL</td>
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</table>

## High-Speed Coarse Diamond Burrs, 60,000 rpm

<table>
<thead>
<tr>
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<th>super long</th>
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<tbody>
<tr>
<td>2</td>
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<tr>
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<td>320330 SL</td>
</tr>
<tr>
<td>4</td>
<td>320340 EL</td>
<td>320340 SL</td>
</tr>
</tbody>
</table>
**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

**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

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 including:

- **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 | Power supply 100–120 VAC/200–240 VAC |
| Format signal outputs | 1920 x 1080p, 50/60 Hz | Power frequency 50/60 Hz |
| LINK video inputs | 3x | Protection class I, CF-Defib |
| USB interface | 4x USB, (2x front, 2x rear) |
| SCB interface | 2x 6-pin mini-DIN |

For use with IMAGE1 S

IMAGE1 S CONNECT Module TC 200EN

TC 300

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 including:

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

**Specifications:**

<table>
<thead>
<tr>
<th>Camera System</th>
<th>TC 300 (H3-Link)</th>
</tr>
</thead>
</table>
| Supported camera heads/video endoscopes | TH 100, TH 101, TH 102, TH 103, TH 104, TH 106  
(fully compatible with IMAGE1 S) |
| 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**

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

**Specifications:**

<table>
<thead>
<tr>
<th>IMAGE1 FULL HD Camera Heads</th>
<th>IMAGE1 S H3-Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product no.</td>
<td>TH 100</td>
</tr>
<tr>
<td>Image sensor</td>
<td>3x 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

**Specifications:**

<table>
<thead>
<tr>
<th>IMAGE1 FULL HD Camera Heads</th>
<th>IMAGE1 S H3-ZA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product no.</td>
<td>TH 104</td>
</tr>
<tr>
<td>Image sensor</td>
<td>3x 1/3&quot; CCD chip</td>
</tr>
<tr>
<td>Dimensions w x h x d</td>
<td>39 x 49 x 100 mm</td>
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<tr>
<td>Weight</td>
<td>299 g</td>
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<tr>
<td>Optical interface</td>
<td>integrated Parfocal Zoom Lens, $f = 15–31$ mm (2x)</td>
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<tr>
<td>Min. sensitivity</td>
<td>F 1.4/1.17 Lux</td>
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<tr>
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<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

<table>
<thead>
<tr>
<th>KARL STORZ HD and FULL HD Monitors</th>
<th>19&quot;</th>
<th>26&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wall-mounted with VESA 100 adaption</strong></td>
<td>9619 NB</td>
<td>9826 NB</td>
</tr>
<tr>
<td><strong>Inputs:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DVI-D</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Fibre Optic</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>3G-SDI</td>
<td>–</td>
<td>●</td>
</tr>
<tr>
<td>RGBS (VGA)</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>S-Video</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Composite/FBAS</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td><strong>Outputs:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DVI-D</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>S-Video</td>
<td>●</td>
<td>–</td>
</tr>
<tr>
<td>Composite/FBAS</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>RGBS (VGA)</td>
<td>●</td>
<td>–</td>
</tr>
<tr>
<td>3G-SDI</td>
<td>–</td>
<td>●</td>
</tr>
<tr>
<td><strong>Signal Format Display:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4:3</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>5:4</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>16:9</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Picture-in-Picture</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>PAL/NTSC compatible</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

**Optional accessories:**

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

### Specifications:

<table>
<thead>
<tr>
<th>KARL STORZ HD and FULL HD Monitors</th>
<th>19&quot;</th>
<th>26&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Desktop with pedestal</strong></td>
<td>optional</td>
<td>optional</td>
</tr>
<tr>
<td><strong>Product no.</strong></td>
<td>9619 NB</td>
<td>9826 NB</td>
</tr>
<tr>
<td><strong>Brightness</strong></td>
<td>200 cd/m² (typ)</td>
<td>500 cd/m² (typ)</td>
</tr>
<tr>
<td><strong>Max. viewing angle</strong></td>
<td>178° vertical</td>
<td>178° vertical</td>
</tr>
<tr>
<td><strong>Pixel distance</strong></td>
<td>0.29 mm</td>
<td>0.3 mm</td>
</tr>
<tr>
<td><strong>Reaction time</strong></td>
<td>5 ms</td>
<td>8 ms</td>
</tr>
<tr>
<td><strong>Contrast ratio</strong></td>
<td>700:1</td>
<td>1400:1</td>
</tr>
<tr>
<td><strong>Mount</strong></td>
<td>100 mm VESA</td>
<td>100 mm VESA</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>7.6 kg</td>
<td>7.7 kg</td>
</tr>
<tr>
<td><strong>Rated power</strong></td>
<td>28 W</td>
<td>72 W</td>
</tr>
<tr>
<td><strong>Operating conditions</strong></td>
<td>0–40°C</td>
<td>5–35°C</td>
</tr>
<tr>
<td><strong>Storage</strong></td>
<td>-20–60°C</td>
<td>-20–60°C</td>
</tr>
<tr>
<td><strong>Rel. humidity</strong></td>
<td>max. 85%</td>
<td>max. 85%</td>
</tr>
<tr>
<td><strong>Dimensions w x h x d</strong></td>
<td>469.5 x 416 x 75.5 mm</td>
<td>643 x 396 x 87 mm</td>
</tr>
<tr>
<td><strong>Power supply</strong></td>
<td>100–240 VAC</td>
<td>100–240 VAC</td>
</tr>
<tr>
<td><strong>Certified to</strong></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>
Cold Light Fountains and Accessories

495 NT  Fiber Optic Light Cable, with straight connector, diameter 2.5 mm, length 180 cm

495 NTW  Fiber Optic Light Cable, diameter 2.5 mm, length 180 cm with 90° deflection to the light source

495 NTX  Same, length 230 cm

LED NOVA® 150, High-Performance LED Cold Light Fountain

20 161201  LED Nova 150, High-Performance LED Cold Light Fountain with one KARL STORZ light outlet, power supply 100 - 240 VAC, 50/60 Hz including:
Mains cord

Cold Light Fountain XENON NOVA® 175

20 131501  Cold Light Fountain XENON NOVA® 175, power supply: 100–125 VAC/220–240 VAC, 50/60 Hz including:
Mains Cord

20 132026  XENON Spare Lamp, 175 watt, 15 volt

Cold Light Fountain XENON 300 SCB

20 133101-1  Cold Light Fountain XENON 300 SCB with built-in antifog air-pump, and integrated KARL STORZ Communication Bus System SCB power supply: 100–125 VAC/220–240 VAC, 50/60 Hz including:
Mains Cord
Silicone Tubing Set, autoclavable, length 250 cm
SCB Connecting Cord, length 100 cm

20 133027  Spare Lamp Module XENON with heat sink, 300 watt, 15 volt

20 133028  XENON Spare Lamp, only, 300 watt, 15 volt
KARL STORZ AIDA® compact NEO advanced

Brilliance in documentation

Data Acquisition
Still images, video sequences and audio comments can easily be recorded during an examination or intervention by pressing the on-screen button, activating the footswitch, or pressing the camera head button.

All captured data are displayed on the right-hand side as a thumbnail preview to ensure the data have been generated. Patient data can be entered via an on-screen or standard keyboard. The system also offers the possibility to transfer all relevant patient data via a DICOM worklist or a link to the hospital information system (HIS) without requiring manual entry in the patient entry screen.

Flexible Review, Data Storage and Efficient Data Export
Captured still images or video files can easily be viewed, edited, or deleted on-screen before final storage. KARL STORZ AIDA® compact NEO efficiently stores all recorded data on DVD, CD, USB stick, external/internal drive, the relevant network and/or on a FTP server. It is also possible to save the data directly on the PACS and/or HIS servers via HL7/DICOM. Data that cannot be stored successfully remains in a cache until final archiving is possible.

Special Features:
- SD and HD signal support:
  - Y/C (S-Video)
  - Composite input
  - DVI-D input
- Picture-in-Picture function:
  Display of channel 2 (SD) in channel 1 (FULL HD)
- Resolution:
  - Still images 1920 x 1080 and SD
  - Videos 1080p, 720p and SD
- Interface package (DICOM/H7) included
- NEO Secure security software
- Recommended applications:
  - Universal (cart or OR1™ installation)

*Available in the following languages:
DE, ES, FR, IT, PT, PL, RU, DK, SE, JP, CN
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

*Including:*
- 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:
WITH COMPLIMENTS OF KARL STORZ—ENDOSKOEPE