ENDOSCOPIC PITUITARY AND SKULL BASE SURGERY
Anatomy and Surgery of the Endoscopic Endonasal Approach

3rd Edition

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Introduction

The endoscopic endonasal approach to the sellar region is an evolution of the conventional transsphenoidal technique performed with the operating microscope. For more than 40 years, our school has focused its study and efforts on this technique and has contributed to the recent success of the endoscopic transsphenoidal procedure, which has been employed extensively since 1997. It is a surgical approach through both nostrils, using the endoscope as a pure visualization tool bringing the eye of the surgeon and of the entire OR staff close to the relevant surgical target site. In the nasal step of this procedure, the first surgeon holds the endoscope with the non-dominant hand, while during the subsequent phases two surgeons are jointly working together using a four-hand technique. Accordingly, the first surgeon is enabled to proceed bimanually just as with the microsurgical technique. On the other hand, the second surgeon takes the task of dynamically guiding the endoscope by actively moving it backward and forward, thus allowing adequate depth perception.

More recently, the evolution of the endoscopic surgical techniques and the technological advancements have prompted the development of a variety of modifications of the standard transsphenoidal approach to the sellar region. It was Prof. Kassam’s team in Pittsburgh (PA, USA) that introduced the concept of a systematic anterior endonasal approach to the skull base on the sagittal and coronal planes. Teamwork proficiency and adherence to strict anatomical principles is of paramount importance in this concept, which is continuously evolving. As a matter of fact, today, such approaches are targeted mainly on the midline skull base from the frontal sinus to the lower clivus.

The present brochure provides a step-by-step guide to the surgical pathway defined by the natural splanchnocranial cavities, shown here in an anatomic dissection study that was performed on cadaver specimens. In addition, the same steps are described on the basis of in vivo endoscopic neurosurgical procedures.

The text concludes with a detailed description of the instruments and videoendoscopic equipment required for the various stages of surgery. Some of these instruments were developed by the authors in close collaboration with KARL STORZ Tuttlingen, Germany.
General Aspects of the Procedure

The first attempts to use the endoscope in sellar region surgery dates back to 1963 when the French neurosurgeon Gérard Guiot proposed the use of endoscopy to supplement the transsphenoid transseptal approach for exploration of the sellar cavity. The recent progress achieved at several schools of otorhinolaryngology in endoscopic surgery of the nasal and paranasal sinuses has caused Guiot’s idea to be reconsidered, but with a more up-to-date slant this time. No longer is it considered a complement to microscopic surgery; rather it has now become “fully” endoscopic pituitary surgery – the term “fully” being appropriate because the procedure is performed with the endoscope as the only optical device used to visualize the surgical target area (Fig. 1).

The endoscope has opened the eyes of the surgeon to structures like the planum sphenoidale, the clivus, the carotid and optic bony protuberances, from upside down the common surgical sellar view. Nevertheless, the present frontier is represented by the extended or expanded endoscopic endonasal skull base approaches.

Fig. 1 Transsphenoidal endonasal endoscopic approach.
This approach has several benefits:

- It avoids the need for the oral and the rhinoseptal submucosal nasal route;
- The special features of the telescopes used in this approach allow for a wider exposure of the operating field including the options of advancing toward the anatomical target area or inspecting the sphenoid sinus, sellar, suprassellar and retroclival regions via wide-angle panoramic view (Figs. 2, 3);
- The high-resolution close-up view of the anatomical structures allows a lesion arising from or involving such areas to be removed more safely, which, in turn, contributes to a reduced incidence of overall complications;
- An improved postoperative course provides greater comfort for the patient: since there is no need to distend the nasal speculum the risk of inadvertent trauma to naso-facial structures is reduced;
- It avoids the need for postoperative nasal packing, thus minimizing breathing difficulties and discomfort for the patient, particularly beneficial for elderly patients;
- It reduces the duration of hospitalization and, therefore, the costs.

This approach:

- Requires the physician to go through a learning curve. In-depth hands-on training, virtual reality-based simulation training, and specific endoscopic skills are needed, in order to be able to recognize multiple anatomic landmarks that are used during surgery. Last but not least, the use of specific instrumentation facilitates the procedure.
Bone Anatomy of the Nasal Cavities and the Sphenoid Sinus

3.1. Nasal Cavities

Each of the nasal cavities can be compared to a transversely flattened channel, larger at the bottom and narrowing as it proceeds upward. It has four walls and two openings.

The inferior wall comprises, the maxillary palatine process at the front, and, the horizontal lamella of the palatine bone at the back. From anterior to posterior, the superior wall is made up of the nasal bone, frontal bone, cribriform plate of the ethmoid, and anterior surface of the sphenoid bone.

The medial nasal wall (Fig. 4) is made up of the perpendicular plate of the ethmoid above, and, of the vomer below. These two bones articulate with each other describing a broad inward angle filled with cartilage – the septal cartilage – which plays a crucial role in the formation of the nasal septum. The latter only rarely follows the median plane; most often it deviates somewhat to either the left or right.

![Nasal cavity, medial wall.](image-url)
The lateral nasal wall (Fig. 5) is tilted downward in a mediolateral direction and is made up of six bones: the maxillary, lacrimal, ethmoid and sphenoid bone, the vertical portion of the palatine bone and the inferior nasal turbinate. The surface is highly irregular and is covered with depressions and orifices that place the nasal cavities in communication with the various facial and cranial bone sinuses. The superior and middle turbinates form a single body with the ethmoid while the inferior turbinate is a separate, totally independent bone. At times, just above the superior turbinate, there is a small extra turbinate, called the supreme turbinate. Each of these has a convex medial surface, a concave upper surface, an upper adherent edge and a lower free edge facing the nasal cavity. The spaces lying between the turbinates and the corresponding portion of the lateral nasal fossa wall constitute the three meati (upper, middle, lower). The medial portion of the middle nasal meatus has a small rounded protrusion – the ethmoid bulla – which is always present, although its volume varies greatly.

The posterior opening of the nasal cavities is made up of the choanae, formed by the sphenoid at the top, the horizontal portion of the palatine bone at the bottom, the medial plate of the pterygoid process laterally, and by the posterior margin of the vomer medially.

The anterior opening of the nasal cavities is called the apertura piriformis and made up of the two maxillary bones and the nasal bones.
3.2. Sphenoid Sinus

The sphenoid sinus – a cavity in the sphenoid bone – is the posteriormost paranasal cavity. A median septum, most often veering laterally, divides it into two completely independent parts, right and left. Frequently, numerous minor septa are also present and vary in shape, thickness, location, orientation and extension. Most often, these septa divide the cavity into a series of small compartments that are lined with nasal mucosa.

In the adult, the sphenoid sinus can have one of three variations depending on the extent to which the sphenoid bone is pneumatized: sellar, presellar and conchal. The sellar-type sinus (Fig. 6) is the most common (approx. 75%) and, in this case, the air cell extends under the sella turcica, passing the clivus plane; in the presellar-type sinus (approx. 24%) (Fig. 7) the cavity does not pass the vertical plane parallel to the anterior sella wall; the conchal-type sinus (Fig. 8), where the thickness of the bone separating the sella from the sphenoid sinus exceeds 10 mm, is highly uncommon in adults.

The natural sphenoid ostium, the entrance to the sphenoid sinus, is located in the spheneno-ethmoid recess, medial to the superior and/or supreme turbinate. The anatomic landmark used to identify the ostium is the upper margin of the choana: from here, moving vertically approximately 1.5 cm upward within the sphenenoethmoid recess, the sphenoid ostium can be found; the latter provides access to the sphenoid sinus. With age, as bone is resorbed and the walls progressively thin, the volume of the sinus cavity often increases and, at times, the sphenoid mucosa can come into direct contact with the sellar dura mater. The sellar floor comes into view at the posterior sphenoid sinus wall and continues above with the planum sphenoidale and below with the clivus. Two bulges in the lateral wall of the sphenoid cavity are of utmost importance: the optic nerve prominences, above, caused by the bony covering of the optic nerves, and the carotid prominences, below, encasing the internal carotid arteries. On each side, between the two prominences, there is a recess: the opto-carotid recess. It varies in depth and is made up of the pneumatization of the anterior clinoid process. The inferolateral portion of a well-pneumatized sphenoid sinus presents additional small prominences, formed by the second and third branches of the trigeminal nerve.

4 Anatomical Structures Involved in the Endonasal Approach to the Sella

In correspondence with the anatomical structures subjected to anatomical dissection, the procedure can be subdivided into three stages: nasal, sphenoid and sellar.

4.1. Endoscopic Nasal Exploration

When the scope is introduced parallel to the floor of the nasal cavity, the first structure to come into view is the inferior turbinate (Fig. 9). Lateral to this structure we see the lower meatus, where the nasolacrimal duct opens. The scope is advanced in an anteroposterior direction along the floor of the nasal cavity, passing between the posterior end of the inferior turbinate and the nasal septum (Fig. 10), to reach the choana where the Eustachian tube opens (Fig. 11).

Above and posterior to the head of the inferior turbinate we find the middle turbinate (Fig. 12). In some cases, its head may be pneumatized to some degree; in this case the term “concha bullosa” is used (Fig. 13).
Moving the endoscope forward between the middle turbinate and nasal septum, at a 30° upward angle relative to the floor of the nasal cavity, we reach the sphenoid ostium extending between the roof of the choana and the natural sphenoid ostium (Figs. 14–16).

This ostium varies in size and cannot always be viewed as it may be covered by the tail of the superior or the supreme turbinate. At this point, it is not necessary to visualize the sphenoid ostium since the access to the sphenoid cavity can be gained as well by proceeding from the choana slightly upward for approx. 1.5 cm along the spheno-ethmoid recess.

If the ostium is particularly wide, as may be the case in older patients, introduction of the endoscope through the ostium may allow the sellar region to be viewed (Fig. 17).
4.2. Endoscopic Sphenoid Sinus Exploration

After having identified the sphenoid cavity, the nasal septum is detached from the anterior wall of the sphenoid sinus with a high-speed microdrill using a diamond burr of 5 mm in diameter. Fig. 18 shows the anterior sphenoid sinus wall, which is removed from the KERRISON rongeurs) and the microdrill. During this step it is possible to view into the infero-lateral aspect and identify the sphenopalatine artery.

This artery is the terminal branch of the internal maxillary artery, which in turn is a branch of the external carotid artery. The sphenopalatine artery enters the nasal cavity through the sphenopalatine foramen (Fig. 20) which is located topographically behind the tail of the middle turbinate.

Within the nasal cavity the artery ramifies into two branches, the medial of which forms the naso–palatine artery and, passing above the choana, it vascularizes the nasal septum. The other branch, the posterior nasal artery, joins the lateral nasal wall to vascularize the turbinates (Fig. 21).

Within the sphenoid cavity, one or several septa are identified and may be removed, as needed, to expose all accessible anatomical landmarks on the posterior sphenoid sinus wall. The sphenoid septa can be removed with through-cutting nasal forceps to avoid any elevation of the sphenoid mucosa. The posterior wall of the sphenoid sinus presents depressions and bony prominences that cover vulnerable neurovascular structures.

The major anatomical landmarks for proper identification of the sellar floor are as follows (Figs. 22, 23):

- the planum sphenoidale, above;
- the clivus, below;
- the carotid protuberances, laterally;
- the optic nerve prominences;
- the opto-carotid recesses.
4.3. Endoscopic Sella Opening

A microdrill with diamond burr is used to create an opening in the sellar floor. With the help of a KERRISON bone punch and/or a STAMMBERGER circular cutting punch the fenestration is enlarged step-by-step to such an extent, that the carotid prominences laterally, the planum sphenoidale above, and the clivus below, come into view (Fig. 24).

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Endoscopic Endonasal Approach to the Sella

5.1. Operating Room Set-up

The design of the operating theatre is by its own a surgical instrument. An integrated operating room helps to optimize teamwork and improve patient care. In the operating room, all of the equipment, i.e., cold light source, video camera, monitor, and video recording system, are placed ergonomically behind the head of the patient and in front of the first surgeon, who is at the right side of the patient. The anesthesiologist is positioned with his/her equipment at the left side of the patient at the level of the head. The second surgeon is at the left side of the patient, and the scrub nurse is positioned at the level of the patient’s legs (Figs. 25–26).
During a fully endoscopic endonasal transsphenoidal approach, rigid diagnostic HOPKINS® telescopes – *without* a working channel – are used. There are three types of telescopes available, that vary in length, diameter and direction of view: 

- 0°, 30°, 45° telescopes, length 18 cm, diameter 4 mm; 
- 0° and 30° telescopes, length 18 cm, diameter 2.7 mm; 
- 0° and 30° telescopes, length 30 cm, diameter 4 mm. The 0° scope, length 18 cm, diameter 4 mm, is the one most frequently used (Figs. 27–30).

In view of the fact, that the scope is mainly an optical device, it is usually not equipped with an operating channel. Accordingly, the surgical instruments are introduced alongside the scope.

A special outer sheath and irrigation system (CLEARVISION® II, KARL STORZ Tuttlingen, Germany) are used to rinse the distal objective lens, obviating the need for repeated withdrawal and reinsertion of the scope into the nasal cavity during surgery.

The most commonly used 0° scope (diameter 4 mm, length 18 cm) (Fig. 28) is usually *operated freehand throughout the entire surgical procedure*. During the sellar step of the procedure, the endoscope is held dynamically by a second surgeon, allowing the first surgeon to work bimanually with two instruments. 30° or 45° telescopes are used in selected cases or in specific phases of the surgical procedure, e.g., the exploration of the sellar cavity after tumor removal (Figs. 29, 30). Usually, the surgical approach is performed through both nostrils.

Two or three operating instruments – depending on the specific needs and circumstances – plus the endoscope can be inserted through both nostrils, thus providing increased working space and improved maneuverability.

The use of neuronavigation during a standard endoscopic approach is currently reserved for selected cases only, e.g., in the presence of a conchal-type sphenoid sinus, and/or in certain cases of recurrences with a previous history of trans-sphenoidal surgery, or in patients with large lesions involving the para-suprasellar areas. Furthermore, the use of a micro-doppler probe can be useful to localize the course of the ICA during removal of pituitary adenomas with lateral extension into the cavernous sinus.

### 5.2. Patient Positioning

During the endoscopic approach to the sellar area, the patient is positioned supine on the operating table, with the trunk raised 10° and the head in neutral position, rotated 10° towards the surgeon. The head is adequately secured in a horse-shoe headrest without rigid three-pin fixation (Fig. 31).
5.3. Disinfection and Decongestion of the Nasal Cavities

Using a small KILLIAN-type nasal speculum, cotton pledgets soaked in 50% povidone-iodine are placed along the floor of the nasal cavities and in the space between the nasal septum and the middle turbinates. They are allowed to take effect for approximately five minutes. The cotton pledgets soaked with povidone-iodine are then removed and disinfection of the nasal skin is performed. Using the same procedure as described above, eight cotton pledgets (four per nostril) soaked in a decongestant solution (1 mg of adrenaline, 5 ml of 20% diluted lidocaine and 4 ml of saline solution) are placed between the nasal septum and the middle turbinate to achieve a vasoconstrictive effect particularly at the relevant, richly vascularized areas involved in the subsequent procedure. They are allowed to take effect for approximately 15 minutes during which the patient is draped.

5.4. Surgical Procedure

The procedure consists of three main aspects: exposure of the lesion, removal of the relevant pathology and reconstruction of the sella. It involves three phases, the nasal, the sphenoid, and the sellar stages.

5.4.1. Nasal Stage

During this stage, a 0°-scope (4 mm in diameter, 18 cm in length) is used freehand. Once the scope has been inserted into the right nostril, the inferior and middle turbinates, and the nasal septum are identified (Figs. 32, 33). The scope is moved along the floor of the nasal cavity, following the inferior turbinate to reach the choana, which is the key anatomical landmark of this step of the procedure (Fig. 34).

The middle turbinate is gently lateralized to make sure that the surgical pathway, that passes between the nasal septum and the turbinate itself (Figs. 35–36), is wide enough.
Once the cotton pledgets have been removed, there will be a noticeable increase in space between the nasal septum and the middle turbinate allowing for adequate inspection of the posterior portion of the nasal cavity, where the choana, the sphenoid recess, and the sphenoid ostium are identified (Fig. 37).

5.4.2 Sphenoid Stage

The sphenoid stage of the procedure begins after decongestion or coagulation of the sphenoid recess with the dissection of the mucosa to expose the anterior face of the sphenoid (Figs. 38–41).

This part of the procedure is usually performed through both nostrils. The unilateral route may be used in some selected cases, provided the nasal cavity offers adequate space for passage of instruments, in the presence of a well-pneumatized sphenoid sinus, and, if the lesion to be treated is of small to medium size.

Subsequently, the bone of the anterior sphenoid sinus wall is widely opened with a microdrill and/or bone punches (Fig. 42), proceeding circumferentially, taking care not to oversize the opening in the inferolateral direction, where the sphenopalatine artery and its major branches traverse.
In case of arterial bleeding from a branch of the sphenopalatine artery, it is worth using bipolar coagulation, in order to prevent postoperative early or delayed epistaxis.

Once the anterior wall of the sphenoid sinus becomes visible, it is removed in a circumferential manner using a microdrill with a diamond bur, 5 mm in diameter (Figs. 43–44). Care must be taken not to remove too much bone and mucosa in the infero-lateral direction, where the sphenopalatine artery enters the nasal cavity while crossing the sphenopalatine foramen.

In some cases, a median or paramedian septum is present inside the sphenoid cavity (Fig. 45), while in others multiple septa are found. Particularly in the latter case, the septa may be located at the site of the optic or carotid prominence, a condition which requires the surgeon to pay particular attention during removal of these structures. At this point, the field of vision must encompass the entire sellar region. The endoscopic technique thus provides a panoramic view of the entire sphenoid cavity and allows identification of all anatomical landmarks which is mandatory for obtaining access to the sellar floor (optic and carotid protuberances, clivus, planum sphenoidale and opto-carotid recess) (Fig. 46).
5.4.3. Sellar Stage

In order to free both hands of the first surgeon and allow for comfortable introduction of two instruments, from this stage onwards, the endoscope is guided dynamically by the assisting second surgeon.

Prior to opening the sellar floor, the assisting surgeon must take care that the endoscope has the proper initial orientation to ensure that all anatomical landmarks inside the sphenoid cavity are displayed in their appropriate positions (Figs. 47–48).

Creation of an opening in the sellar floor may be accomplished by several methods and use of various instruments, depending on the individual anatomical situation (intact, thinned-out, eroded sellar floor). Consistency of the sellar floor depends on the type of lesion present in the sellar cavity. It is nearly always intact in many types of craniopharyngiomas, in Rathke’s cleft cysts, and in microadenomas, while it is frequently thinned-out and/or eroded in pituitary macroadenomas.

Therefore, depending on its thickness, the sellar floor may be initially opened with a microdrill when intact (Fig. 49), or by means of a dissector, when thinned out or eroded. The opening may be then enlarged with KERRISON bone punches, if thickness is reduced or if there are signs of erosion.

The opening of the sellar floor should be enlarged as required by each individual case and, if necessary, as far as the planum sphenoidale above, the inferior clivus below, and the cavernous sinuses, laterally.

Once the opening of the floor has been completed, the dura mater may appear intact, thinned-out or infiltrated by the lesion (Fig. 50).

An ultrasound doppler probe can be helpful for identifying the carotid arteries, thus allowing a safer dura opening.
Taking into account that the distal portions of the surgical field are located in the focal plane of the scope, the surgical knife is not always under direct visual control during this stage of surgery, particularly during its advancement. For this reason, the use of a scalpel with telescopic blade is highly recommended. The blade of this dedicated instrument is retracted before the tip enters the endoscope’s field of vision, where the blade is extended. In this way, iatrogenic trauma to the mucosa during insertion of the instrument can be prevented.

Once the dural incision has been made (Fig. 51), the intrasellar lesion is removed by curettage and aspiration, using curettes and suction tubes of varying diameters and angulations (Figs. 52–57).
In the case of a macroadenoma (Fig. 58), the inferior and lateral components of the lesion should be removed before addressing the superior aspect (Figs. 59–62). Indeed, removal of the superior part first will cause the suprasellar cistern and the redundant diaphragma sellae to prematurely descend into the operative field, thus reducing the chance to expose and remove the lateral portions of the lesion.

Conversely, in case of a microadenoma, one should attempt to identify a leavage plane of the tumor pseudocapsule for “en bloc” excision which, if possible, should be accomplished without compromising the residual pituitary gland tissue.

Fig. 58  Sagittal MRI scan showing an intra- and suprasellar macroadenoma.

Fig. 59  Intraoperative images (a, b) showing progressive dissection of the tumor from the suprasellar cistern. Suprasellar cistern (SC); tumor (T).

Fig. 60  Case of intrasellar adenoma located in the right portion of the sella. Dura mater (dm); tumor (✱).

Fig. 61  The adenoma is removed “en bloc”. Tumor (✱)

Fig. 62  Panoramic view after the removal of the adenoma. Dura mater (dm); residual gland (✱✱).
Tumor removal is usually performed with a 0°-scope. In addition, 30°- or 45°-scopes can be helpful for inspecting the sellar cavity after tumor removal, evaluating the presence of some remnant or identifying the site of cerebrospinal fluid leakage (CSF) over the cistern surface (Figs. 63, 64).

**5.4.4. Sellar Repair**

Upon completion of the endoscopic procedure, sellar reconstruction is required, mainly when an intraoperative CSF leak has occurred. Autologous or heterologous materials, either resorbable or not, are used, if necessary, to achieve a safe and effective sellar reconstruction.

The aim of the repair is to guarantee a watertight closure, reduce the dead space, and prevent the descent of the chiasm into the sellar cavity (Figs. 65, 66). This must be performed with care to avoid overpacking, which carries the risk of subsequent damage to the optic chiasm.

**Fig. 63** Case of an intraoperative CSF leak after evacuation of an intrasellar and suprasellar arachnoid cyst. The 0°-scope allows the dorsum sellae and parts of the suprasellar cistern to be inspected. Suprasellar cistern (SC); dorsum sellae (DS).

**Fig. 64** With the direction of view pointing upward, the 30°-scope allows to detect the arachnoid tearing (arrowhead). Suprasellar cistern (SC).

**Fig. 65** Sellar packing. Placement of a single-layer dural substitute for protection of the suprasellar cistern. Dura mater (dm); dural substitute (✱).

**Fig. 66** Sellar packing. The sellar cavity is filled with pieces of collagen sponge. Dura mater (dm); dural substitute (✱); collagen sponge (✱✱).
If a CSF leak becomes evident during the operation, it is necessary to accurately seal the sellar cavity. Different techniques are used (intra- and/or extradural closure of the sella, and packing of the sella with or without packing of the sphenoid sinus), depending on the size of the osteo-dural defect and of the “dead space” inside the sella.

According to Esposito-Kelly’s paradigm, intraoperative CSF leaks are managed as follows:

- **Grade 1** (small weeping leak): collagen sponge placed over the exposed suprasellar cistern, followed by filling of the sellar cavity with fibrin glue and intra- or extradural closure of the sellar floor.
- **Grade 2** (moderate CSF leak): in this case, reconstruction starts with the management of the arachnoid defect. A small amount of fibrin glue is injected though the arachnoid defect and, if possible, the redundant arachnoid is used to cover the defect. Different layers of collagen sponge are then placed over the cisternal surface, whilst autologous abdominal fat or fibrin glue is used to fill the sellar cavity. Thereafter, the sellar floor is closed intra- or better extradurally with a dural substitute, and other layers of collagen sponge are positioned to cover the posterior wall of the sphenoid sinus. These layers are kept in place by means of fibrin glue (Tisseel®; Baxter AG, Vienna, Austria), see also Fig. 123.
- **Grade 3** (profuse CSF leak): this condition more often concerns the case of an extended approach for suprasellar lesions rather than standard pituitary surgery. Whichever approach is used, reconstruction proceeds in the same way as for Grade 2 up to the closure of the sellar floor, which in this case is performed with a single large layer of dural substitute in the extradural space. In addition, a sheet of resorbable solid material, tailored to conform to the size and grade of the defect, is then placed over the dural substitute and embedded in the extradural space dragging the dural substitute into overlay position (Fig. 124). The dural substitute is positioned and the bone substitute is embedded in the extradural space dragging the dural substitute. Other layers of dural substitute or mucoperichondrium are overlapped. Eventually, a vascularized nasoseptal flap according to Hadad-Bassagasteguy’s technique can be used.

Once sellar reconstruction has been finished, the surgical procedure is completed by medializing the middle turbinate previously displaced to avoid maxillary sinusitis.
Anatomical Structures Involved in Extended Endonasal Approaches to the Skull Base

In order to achieve a wider working space that facilitates maneuvering of instruments while exploring areas around the sella, or even in selected sellar lesions, the basic rules for extended approaches to the skull base (Figs. 67, 68), according to Kassam’s indications, have to be applied.

The following basic steps are therefore required:

- unilateral removal of the middle turbinate;
- lateralization of the middle turbinate in the other nostril;
- removal of the posterior portion of the nasal septum;
- removal of the superior turbinate and of the posterior ethmoid air cells (on the same side where the middle turbinate has been removed).

6.1. Anterior Skull Base Approaches

6.1.1. Endoscopic Anatomy of the Planum Sphenoidale

Immediately above the sellar floor, the angle formed by the convergence of the sphenoid planum with the sellar floor, represented by the tuberculum sellae, can be observed. The sphenoid planum is slightly anterior to it, bounded on both sides by the protuberances of the optic nerves, that diverge towards the apices of the orbits (Fig. 69).

Fig. 67 Schematic drawing showing the different trajectories that are followed to expose the olfactory groove (red), the planum sphenoidale (turquoise), the sella (yellow), the clivus (blue) and the cranio-vertebral junction (purple).

Fig. 68 Anatomic view of the cranial surface of the skull base showing the boundaries of bone removal obtained through the endoscopic endonasal route.

Fig. 69 Wide exposure of the planum sphenoidale. The broken line demarcates the boundary of bone removal to gain access to the suprasellar area; the pointers indicate the medial opto-carotid recess. Planum sphenoidale (PS); tuberculum sellae (TS); carotid protuberance (CP); sellar floor (SF); opto-carotid recess (ocr); optic protuberance (OP); posterior ethmoidal artery (PEA).
After the bone has been removed, the dura over the sellar floor, the tuberculum sella and planum sphenoidale is opened gaining access to the main suprasellar neurovascular structures (Figs. 70–72). The entire suprasellar region can be divided into four areas by two ideal planes, one passing through the inferior surface of the chiasm and mammillary bodies, and another passing through the posterior margin of the chiasm and dorsum sellae: the suprachiasmatic, subchiasmatic, retrosellar and intraventricular area (Fig. 73).

In the suprachiasmatic area, the anterior margin of the chiasm, the medial portion of both optic nerves, the anterior portion of the circle of Willis, and the gyri recti of the frontal lobes are exposed (Figs. 74, 75).
In the subchiasmatic space, the pituitary stalk is encountered first, surrounded by the superior hypophyseal artery coming from the ICA with its branches; the internal carotid artery, its bifurcation and the A1 segment, as the superior aspect of the pituitary gland and the dorsum sellae can be seen laterally and deeply (Fig. 76).

In the retrosellar area, above the dorsum sellae, the upper third of the basilar artery, the pons, the superior cerebellar arteries, the oculomotor nerves, the posterior cerebral arteries and, lastly, the mammillary bodies and the floor of the third ventricle are visualized (Figs. 77, 78).

Opening the floor of the third ventricle at the level of tuber cinereum, a panoramic view of the intraventricular area is obtained (Figs. 79, 80).
6.1.2. Endoscopic Anatomy of the Olfactory Groove

In order to gain access to this area of the skull base, middle turbinates of both nostrils, anterior and posterior ethmoid cells and the superior half of the nasal septum are completely removed. When explored through the endonasal route, the olfactory groove is a rectangular area of the cranial base demarcated by the lamina papyracea (orbital walls) laterally, the planum sphenoidale posteriorly, and the frontal sinus anteriorly. Such an area is composed of two symmetrical parts divided by the perpendicular plate of the ethmoid, the lamina cribrosa medially and the ethmoidal labyrinth laterally (Figs. 81–83).

The anterior and posterior ethmoidal arteries, which both are branches of the ophthalmic artery, reach the cribriform plate emerging from the anterior and posterior ethmoidal canals respectively (Fig. 84). The anterior ethmoidal artery (AEA) traverses the ethmoidal planum horizontally between the second and third ethmoidal lamellae. The course of the AEA inside the homonymous canal is an important anatomical reference used to locate the frontal sinus. Furthermore, the posterior ethmoidal artery can be considered a sort of anatomical boundary between the sphenoid and the ethmoid planum. These arteries represent critical landmarks in the endoscopic endonasal approach to the anterior skull base and, if necessary, should be coagulated with bipolar forceps and then cut. Extreme care must be taken so as not to expose the anterior and/or posterior ethmoidal arteries to any traction, which can lead to retraction inside the orbit, where bleeding can cause a retrobulbar hematoma, with loss of vision.

Once the anterior skull base has been exposed in the area between the orbits and the dura opening has been completed, the intracranial contents become visible (Fig. 85).
6.2. Posterior Skull Base Approaches

6.2.1. Endoscopic Anatomy of the Clivus

The clivus is divided by the inferior wall (floor) of the sphenoid sinus in two portions, the upper, i.e. the sphenoid and the lower, i.e. the rhinopharyngeal segment. Therefore, the vomer and the floor of the sphenoid sinus have to be completely removed to allow exposure of both parts of the clivus. The lateral boundary is the vidian nerve, which can be identified at the exit from its canal, lateral to the vomer-sphenoid junction (Fig. 86). This nerve leads to the anterior genu of the horizontal segment of the internal carotid artery (ICA) and should be followed during bone removal, thus reducing the risk of iatrogenic injury to the ICA. It also represents a key landmark to unlock the lateral aspect of the middle cranial fossa.

The lateral boundary of the sphenoid portion of the clivus is demarcated by the paraclival tracts of the intracavernous carotid arteries (Fig. 87). Nevertheless, one should bear in mind that particular attention must be paid when extending the bone removal laterally. As a matter of fact, the abducent nerve enters the cavernous sinus by traversing the basilar sinus in close proximity to the paraclival tract of the intracavernous carotid artery. Once the dura mater has been opened, the basilar artery and its branches, as well as the upper cranial nerves, are well visualized along their courses in the posterior cranial fossa (Figs. 88, 89).

The removal of the inferior part of the clival bone exposes the anterior surface of the craniovertebral junction. The lower third of the clivus can be removed up to the occipital condyles (Fig. 90).
The lateral boundaries of the bone removal at the level of the floor of the sphenoid sinus are defined by the foramina lacerata with the intrapetrous carotid artery, while at the level of the craniovertebral junction they are defined by the hypoglossal canals, which course into the occipital condyles between their anterior and middle third (Fig. 91). As a matter of fact, the articular surface of the condyles lies on its lateral portion. Therefore, removal of the inner surface of the anterior third of the condyles can be performed without affecting the functional integrity of the joints. Upon dural opening, the vertebral arteries can be explored up to the basilar artery (see Fig. 91). The posterior inferior cerebellar artery (PICA), the lower cranial nerves and the acoustic-facial bundle (VII–VIII) with the anterior inferior cerebellar artery (AICA) can be visualized as well.

6.2.2. Endoscopic Anatomy of the Craniovertebral Junction

Extending the clival bone opening downward, the anterior surface of the craniovertebral junction can be exposed as well. Once the mucosa of the rhinopharynx has been removed, the atlantooccipital membrane, the longus capitis and longus colli muscles, and the atlas and axis are exposed (Fig. 92). Dissection of the muscular structures together with removal of the anterior arch of the atlas are required to visualize the dens (Fig. 93). The dens is then thinned, separated from the apical and alar ligaments, dissected from the transverse ligament, and finally removed. Once the dura mater has been opened, all the neurovascular structures running through the anterior part of the foramen magnum can be visualized; particularly, the intradural tract of the vertebral artery and the C1 and C2 ventral rootlets should be clearly visible (Fig. 94).

6.3. Cavernous Sinus Approach – Endoscopic Anatomy

This approach involves removal of the bone that covers the intracavernous carotid artery (carotid protuberance) and allows both the medial and lateral compartments of the cavernous sinus to be exposed. Viewing the intracavernous carotid artery within the sphenoid sinus, resembling a shrimp, permits to identify the various segments by their topographical relationship to the surrounding structures. Therefore, we are able to distinguish a parasellar and a paraclival segment. The latter forms the shape of a “C” with medial concavity and can be subdivided into three segments: upper horizontal, vertical and inferior horizontal. The paraclival segment can be divided into an extracavernous lacerum portion, which is caudal, and an intracavernous trigeminal portion, which is cranial (Fig. 95).
By lateralizing the intracavernous carotid, it is possible to view, behind the latter and the pituitary gland, the meningoendothelial trunk and its branches, the dorsal meningeal, inferior hypophyseal and tentorial arteries (Fig. 96). On the other hand, passing laterally to the carotid artery, the inferolateral trunk, i.e. the artery of the inferior cavernous sinus, with its branches to the intracavernous cranial nerves, can be identified along the lateral wall of the cavernous sinus (Fig. 97). Furthermore, the oculomotor, abducent and maxillary nerves can be visualized lying on a closer plane as compared to that occupied by the trochlear and the ophthalmic nerves (Figs. 98, 99).

As visualized through the endoscope from below, the oculomotor nerve superiorly and the abducent inferiorly define a triangular area, the base of which is formed by the lateral loop of the carotid artery. The outer surface of this area contains the fourth cranial nerve and a portion of the V1 branch of the trigeminal nerve. The abducent nerve superiorly and V2 inferiorly enclose a quadrangular area, laterally demarcated by the bone surface of the lateral sphenoid sinus wall, extending from the superior orbital fissure to the foramen rotundum, and medially by the carotid artery. The ophthalmic branch of the trigeminal nerve and arteries to the inferior cavernous sinus pass through this area. Finally, particularly in the case of a well-pneumatized sinus, an inferior quadrangular area can be identified (Fig. 100). It is delineated superiorly by V2 and inferiorly by the vidian nerve. This quadrangular area is of great clinical relevance because it appears to be the safest entry to the lateral compartment of the cavernous sinus when it is involved by the lesion.
Extended Endoscopic Endonasal Approaches to the Skull Base

7.1. Operating Room Set-up

The use of some additional tools has been shown to make the endoscopic endonasal trans-sphenoidal procedures safer and more effective, particularly in case of extended approaches.

A detailed, complete preoperative planning – even with the integrated 3D reconstruction of MRI and/or CT scans, post-processed and displayed by use of open source software (e.g., OsiriX, MRICro) – is essential to assess the size and position of the skull base opening in relation to the 3D volume of the lesion.

Image-guided surgery systems (neuronavigation) are very useful for intraoperative identification of the boundaries of the lesion providing relevant information concerning the midline and trajectory, and offering enhanced precision in defining the bony delineations and neurovascular spatial relationships.

Finally, it is extremely important to use dedicated instruments, such as high-speed low-profile microdrills, micro-Doppler probes, and coagulating instruments, including a dedicated bipolar forceps with angled tips, either in sagittal and in coronal plane. The use of a low-profile ultrasonic aspirator can be very helpful in lesion debunking.

Nevertheless, as in the standard approach, the endoscopic equipment and neuronavigation system are positioned behind the head of the patient and in front of the surgeon. Both the screens of the neuronavigation and endoscopic equipment have to be positioned side by side in an ergonomic way. The surgeons are on the right side (the first) and on the left (the second), respectively. Again, the anesthesiologist is positioned with his/her equipment at the left side of the patient at the level of the head and the nurse is positioned at the level of the patient’s legs.

As with the standard transsphenoidal approach, rigid HOPKINS® 0°, 30°, and 45° telescopes (length 18 cm, diameter 4 mm) are the only optical devices used to visualize the surgical field during an extended transsphenoidal procedure. At times, it can be helpful, particularly during the intradural stage of the procedure, to additionally use a scope, 18 cm in length and 2.7 mm in diameter.

7.2. Patient Positioning

Depending on the surgical target area, the head is extended about 10–20 degrees to achieve a more anterior trajectory (as for planum sphenoidale or olfactory groove approach) or flexed (as for clival approach), to obtain a posterior trajectory. In both cases, impinging the thorax of the patient with either the scope and/or the surgical instruments must be avoided.

7.3. Approach to the Suprasellar Area

After the preliminary stage, to expose the suprasellar area using an endoscopic endonasal approach, additional bone removal from the cranial base is required, i.e. the tuberculum sellae and planum sphenoidale (trantuberculum-transplanum approach).

Bone removal begins with drilling (using a 2-mm burr) of the upper half of the sella and the tuberculum sellae, extending laterally up to both medial opto-carotid recesses, and ensuingly opening the planum sphenoidale with a Kerrison rongeur. Above the medial opto-carotid recesses, bone removal can be extended more laterally, so that the opening resembles an “upside down trapezoid” This particular shape is due to the fact that the inferior part of the osteodural opening is narrowed by the parasellar portion of both the intracavernous carotid arteries and the optic nerves at their entrance in the optic canals. In its superior half, bone removal can be extended laterally because the optic nerves diverge towards the orbits.
In order to better define the limits of bone removal, it is advisable to make use of a neuronavigation system. During bone removal, bleeding from the superior intercavernous sinus can occur. This can be controlled with different hemostatic agents, and with temporary gentle compression with cottonoids. Nevertheless, before opening the dura mater, the sinus should be coagulated with bipolar forceps.

The dura mater is incised horizontally a few millimeters above and below the superior intercavernous, so that the sinus can be coagulated between the two tips of the bipolar forceps (Figs. 101–104); it is then incised with microscissors, and the two resulting dural flaps are again coagulated, to obtain further retraction.

The strategy for dissection and removal of the lesion is tailored to each individual lesion following the same principles as in transcranial microsurgery.
Craniopharyngiomas

Suprasellar craniopharyngiomas are readily seen upon creation of the dural opening in the prechiasmatic space, anterior to the pituitary stalk, whereas intraventricular craniopharyngiomas, posterior to the stalk, must be approached by passing on each side of the stalk. The stalk and infundibular recess can be enlarged by the craniopharyngioma, thus allowing the removal of the lesion through it. Tumor removal can be performed observing the same principles as in microsurgery, i.e. internal debulking of the solid component and/or cystic evacuation and careful dissection of the tumor capsule from the major neurovascular structures (Figs. 105–108).

![Fig. 105 Preoperative MRI scans (a, b) showing a case of suprasellar, retrosellar and intraventricular craniopharyngioma.](image)

![Fig. 106 The lesion is removed through a corridor lateral to the pituitary stalk followed by piecemeal removal. Dura mater (dm); planum sphenoidale (PS); pituitary stalk (Ps); tumor (T); pituitary gland (Pg).](image)

![Fig. 107 Exploration of the suprasellar infrachiasmatic area with a 30°-scope (a, b). Internal carotid artery (⁎). Optic chiasm (Ch); pituitary stalk (Ps).](image)

![Fig. 108 Panoramic view after removal of the craniopharyngioma. The entire retrosellar area can be inspected (a, b). Basilar artery (BA); posterior communicating artery (PcoA); third cranial nerves (⁎); posterior cerebral artery (P1); pituitary stalk (Ps).](image)
Meningiomas of the Tuberculum Sellae and Planum Sphenoidale

The removal of such lesions is preceded by coagulation of the dural attachment so that early tumor devascularisation is achieved. The tumor is therefore debulked safely and its capsule finally dissected from the surrounding microvascular structures via the extra-arachnoidal route. In this particular case, the main advantage of the endoscopic endonasal technique comes from the early devascularization and from the dissection of the tumor with or without minimal manipulation of the optic pathways (Figs. 109–113).

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**Fig. 109** Preoperative MRI scan showing the case of a tuberculum sellae meningioma (a). Postoperative MRI scan demonstrating total removal of the lesion (b).

**Fig. 110** After early devascularization and internal debulking, the arachnoidal plane is delineated (a). The tumor is dissected off the left optic nerve (b). Pituitary stalk (Ps); optic nerve (ON); pre-communicating segment of the anterior cerebral artery (A1); post-communicating segment of the anterior cerebral artery (A2).

**Fig. 111** Note the neurovascular conflict between the left optic nerve and A1 (a). Panoramic view after tumor removal (b). Pituitary stalk (Ps); optic nerve (ON); pre-communicating segment of the anterior cerebral artery (A1); post-communicating segment of the anterior cerebral artery (A2); chiasm (Ch); neurovascular conflict (*); internal carotid artery (ICA).

**Fig. 112** Preoperative MRI scan showing the case of a meningioma of the sphenethmoidal planum (a, b). Postoperative MRI scan demonstrating total removal of the lesion and multilayer reconstruction over the osteodural defect (c, d).

**Fig. 113** During extracapsular dissection an artery is identified and preserved (white arrow) (a). Panoramic view after tumor removal (b). Olfactory groove (OG); orbit (O); sella (S).
7.4. Approach to the Olfactory Groove

Such an approach is currently used for the management of many different lesions such as CSF leaks, meningoencephaloceles and esthesioneuroblastomas arising from or involving this area. Therefore, bone removal and exposure of the target area can be tailored to each case according to lesion extension. In case of olfactory groove meningiomas, middle turbinectomy is performed bilaterally, followed by a radical anterior and posterior ethmoidectomy, and removal of the superior half of the nasal septum. The bone of the anterior skull base enclosed between the two orbits is removed, thus creating a wide surgical corridor, which can be extended laterally between the two medial orbital walls, and anteroposteriorly from the frontal sinus to the sella, according to tumor extension. Once the dura has been opened, the lesion can be removed following the steps described previously. The endoscopic approach again allows coagulation of the dural attachment and early devascularization of the tumor (Figs. 114–118).

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**Fig. 114** Preoperative MRI scans (a, b) showing the case of an olfactory groove meningioma.

**Fig. 115** Intracapsular debulking with an ultrasonic aspirator. Orbit (O); pledget interposed between the tumor and the brain (*); planum sphenoidale (PS).

**Fig. 116** Intracapsular debulking using an ultrasonic surgical aspirator.

**Fig. 117** Extracapsular dissection.

**Fig. 118** Operative field after complete tumor removal.
7.5. Approach to the Clivus

Access to the clivus takes a lower trajectory compared with the one used to reach the sellar and suprasellar region. After the preliminary steps common to the extended procedures, the nasal mucosa is detached from the vomer, along the inferior wall of the sphenoid sinus, and bilaterally up to identify the vidian nerves, that represent the lateral boundaries of the surgical corridor. Hence, staying medial to the vidian nerve, damage to the intrapetrous carotid artery can be avoided. The vomer and floor of the sphenoid sinus are completely removed, obtaining access to the junction between the sphenoidal and the rhinopharyngeal parts of the clivus. Depending on the extent of the lesion, the bone of the clivus is more or less extensively removed. The clivus contains the basilar plexus, which is the most extensive series of intercavernous venous connections across the midline, joined by the superior and inferior petrosal sinuses. The abducens nerve enters the cavernous sinus passing through the basilar sinus close to the paraclival tract of the intracavernous carotid artery. Therefore, particular attention must be paid during bone removal in this area. The most frequent lesions arising from this area are usually located extradurally, i.e. chordomas, which is why the dura is opened only upon its infiltration. Nevertheless, even intradural lesions such as clival and/or petroclival tumors may also be removed using this approach (Figs. 119–121).

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**Fig. 119** Preoperative (a) and postoperative (b) MRI scans showing a case of clivus chordoma.

**Fig. 120** Clival bone removal. Sellar floor (SF); clivus (C); paraclival segment of the internal carotid artery (CPc); parasellar segment of the internal carotid artery (CPs).

**Fig. 121** Tumor dissection (a). Piecemeal tumor removal (b). Close-up view of the tumor bed (c). Sellar floor (SF); tumor (T); paraclival segment of the internal carotid artery (CPc); parasellar segment of the internal carotid artery (CPs).
7.6. Approach to the Cavernous Sinus

Multiple endoscopic endonasal surgical corridors have been described to get into the cavernous sinus. The corridors can give access to the medial and lateral cavernous sinus compartments, with respect to the position of the intracavernous ICA. One of the approaches allows the cavernous sinus compartment to be entered medially to the ICA, and a second provides exposure of the lateral compartment. As a general rule, the surgical corridor to the medial compartment can be created more easily through the contralateral nostril, whereas the corridor to access the lateral compartment can be established through the ipsilateral nostril via a transthyroidal route. In order to facilitate and improve exposure of the lateral compartment, the anterior sphenoidotomy must be extended more laterally on the same side of tumor invasion. The superior and supreme turbinates together with the posterior ethmoidal cells must be removed and the medial pterygoid process has to be drilled out to identify the vidian canal, medially, and the foramen rotundum, laterally. In this way, a quadrangular area is created, bounded superiorly by V2, inferiorly by the vidian nerve, and posteriorly by the intrapetrous and paracloidal segment of the internal carotid artery. Through such a corridor, the tumor portion extending lateral to the carotid as well as toward the middle cranial fossa can be managed.

7.7. Reconstruction of the Skull Base in Extended Approaches

During an extended transsphenoidal approach, especially to the suprasellar area, a large osteodural opening has to be created, and the cisternal space is often widely dissected. A conspicuous intraoperative CSF leak should therefore be anticipated. An effective watertight closure, however, is mandatory to prevent postoperative CSF leaks.

In our department, we use the “sandwich technique”: in the first instance, the cistern is covered with a layer of collagen sponge coated with fibrinogen and thrombin, and the surgical cavity is filled with fat graft sutured to the inner layer of three layers of fascia lata or dural substitute. The first layer is then positioned intradurally, the second between the dura and the bone, and the third is applied to cover the bone. In order to support the materials used for reconstruction at the level of the skull base defect, a vascular flap of septal mucosa is created by cutting the septal mucosa along the inferior edge of the septum, from the choana to the cartilage portion of the septum, and superiorly to the level of the rostral portion of the middle turbinate. Following mucosal dissection from the septal bone, the flap is pedicled laterally around the sphenopalatine foramen and positioned in the choana during the operation. At the end of the procedure, the flap is used to cover the posterior wall of the sphenoid sinus. An inflated Foley balloon catheter, filled with 7 to 8 ml of saline solution, is then placed in the sphenoid sinus to support the reconstruction (Figs. 122–125).

![Fig. 122 Reconstruction technique. Dural substitute is placed intradurally.](image)

![Fig. 123 The dural substitute is encased in the extradural space and covered by fibrin glue (a, b). Tachosil® (⭐); fibrin glue (⭐⭐).](image)
It must be kept in mind, however, that an effective and watertight reconstruction requires the following goals to be met, ranked in order of relevance:

1. intradural sealing of the arachnoid;
2. watertight closure of the osteodural skull base defect;
3. packing of the sphenoid.

Finally, as adjunct postoperative measures, we also advise our patients to have:

- Bed rest for 3–5 days, depending also on the grade of pneumoencephalus. This can be relevant, particularly in case of third ventricle craniopharyngiomas
- Medical therapy with:
  - acetazolamide;
  - stool softeners;
  - broad-spectrum antibiotics.

**Fig. 124** Reconstruction technique. Multilayer technique (a, b). Schematic drawing of the multilayer reconstruction (c).

**Fig. 125** The naso-septal flap is used to cover the skull base defect. Naso-septal flap (NSF).
References


Recommended Set for
Endoscopic Pituitary and Skull Base Surgery
Endoscopic Pituitary and Skull Base Surgery

Recommended Sets acc. to CAPPABIANCA-de DIVITIIS
Endoscopic Pituitary and Skull Base Surgery

Recommended Sets acc. to CAPPABIANCA-de DIVITIIS

Endoscopic Visualization

1. 28132 AA HOPKINS® Straight Forward Telescope 0°, enlarged view, diameter 4 mm, length 18 cm, autoclavable
2. 7230 AS Irrigation Sheath, outer diameter 5 mm, working length 14 cm, for use with HOPKINS® Telescope 28132 AA and KARL STORZ lens irrigation system CLEARVISION® II
3. 28132 BA HOPKINS® Forward-Oblique Telescope 30°, enlarged view, diameter 4 mm, length 18 cm, autoclavable
4. 7230 BS Irrigation Sheath, outer diameter 5 mm, working length 14 cm, for use with HOPKINS® Telescope 28132 BA and KARL STORZ lens irrigation system CLEARVISION® II
5. 28164 AA HOPKINS® Straight Forward Telescope 0°, enlarged view, diameter 4 mm, length 30 cm, autoclavable
6. 28164 ASA Irrigation Sheath, outer diameter 5.0 mm, working length 16 cm, for use with HOPKINS® Telescopes 28164 AA
7. 28272 RKB Holding System, autoclavable optional
8. 72132 FA HOPKINS® Forward-Oblique Telescope 45°, enlarged view, diameter 4 mm, length 18 cm, autoclavable (not illustrated)
9. 7229 FS Irrigation Sheath, outer diameter 5 mm, working length 14 cm, for use with HOPKINS® Telescope 28164 AA/FVA and KARL STORZ lens irrigation system CLEARVISION® II (not illustrated)
10. 7229 AA HOPKINS® Straight Forward Telescope 0°, enlarged view, diameter 2.7 mm, length 18 cm, autoclavable (not illustrated)
11. 28164 CAA Irrigation Sheath, outer diameter 3.8 mm, working length 15 cm, for use with HOPKINS® Telescopes 7229 AA (not illustrated)

Nasal and Sphenoid Stage

12. 474001 FREER Suction Elevator, with stylet, length 21 cm
13. 628702 Antrum Curette, oblong small size, length 19 cm
14. 660500 Sickle Knife, length 18 cm
15. 459010 STAMMBERGER RHINOFORCE® II Antrum Punch, upside backward cutting, length 10 cm
16. 449211 RHINOFORCE® II Nasal Forceps, working length 13 cm, straight
17. 452501 B MACKAY-GRÜNWALD RHINOFORCE® II Nasal Forceps, through-cutting, tissue sparing, delicate, upturned 45°, size 1.8 x 3 mm, working length 13 cm
18. 452001 B MACKAY-GRÜNWALD RHINOFORCE® II Nasal Forceps, through-cutting, tissue sparing, delicate, straight, size 1.8 x 3 mm, working length 13 cm
19. 28164 MKB KERRISON Punch, upbiting 40° forward, size 2 mm, working length 17 cm
20. 28164 MKC KERRISON Punch, upbiting 40° forward, size 3 mm, working length 17 cm
21. 651050 STAMMBERGER Punch, circular cutting for sphenoid, ethmoid and choanal atresia, working length 18 cm, diameter 4.5 mm
22. 651055 STAMMBERGER Punch, circular cutting, for sphenoid, ethmoid and choanal atresia
23. 634824 STRÜMPEL Forceps, with oval, fenestrated cupped jaws, working length 12.5 cm
24. 634825 A STRÜMPEL Forceps, with oval, fenestrated, cupped jaws, 45° upturned, working length 12.5 cm
25. 839310 N Unipolar Suction-Coagulation Tube, insulated, with connector pin for unipolar coagulation, diameter 3 mm, working length 10 cm
26. 663231 Forceps, with round spoon, diameter 2.5 mm, straight, working length 18 cm
27. 663239 Forceps, with oval, fenestrated, cupped jaws, 2.5 mm wide, straight, working length 18 cm
28. 663301 Scissors, straight, delicate, working length 18 cm
29. 663304 Scissors, curved right, delicate, working length 18 cm
30. 663305 Scissors, curved left, delicate, working length 18 cm
31. 663307 Scissors, 45° upturned, delicate, working length 18 cm
32. 28164 SAD Scissors, curved up 45°, delicate, sheath 360° rotatable, working length 18 cm
33. 28164 KK de DIVITIIS-CAPPABIANCA Scalpel, with telescopic blade, including:
   - Handle
   - Outer Tube
   - Micro-Knife, sickle-shaped
34. 28164 M de DIVITIIS-CAPPABIANCA Scalpel, with telescopic blade, including:
   - Handle
   - Outer Tube
   - Micro Knife, pointed

It is recommended to check the suitability of the product for the intended procedure prior to use.
### Endoscopic Pituitary and Skull Base Surgery

**Recommended Sets acc. to CAPPABIANCA-de DIVITIS**

| 28164 DM | Elevator, sharp, slightly curved spatula, size 2 mm, with round handle, length 25 cm |
| 28164 DS | Elevator, sharp, slightly curved spatula, size 3 mm, with round handle, length 25 cm |
| 28164 DB | Dissector, sharp, round spatula, tip angled 45°, size 3 mm, with round handle, length 25 cm |
| 28164 H | CASTELNUOVO Hook, 90°, blunt, length 25 cm, with round handle |
| 28164 KB | Curette, round spoon, tip slightly angled, with round handle, length 25 cm |
| 28164 RN | CAPPABIANCA-de DIVITIS Ring Curette, round wire, inner diameter 3 mm, tip angled 45°, with round handle, length 25 cm |
| 28164 RE | Same, malleable |
| 28164 RO | CAPPABIANCA-de DIVITIS Ring Curette, round wire, inner diameter 5 mm, tip angled 45°, with round handle, length 25 cm |
| 28164 RJ | Same, malleable |
| 28164 RI | De DIVITIS-CAPPABIANCA Ring Curette, round wire, inner diameter 3 mm, tip angled 90°, with round handle, length 25 cm |
| 28164 RG | Same, inner diameter 5 mm |
| 28164 RA | Same, inner diameter 7 mm |
| 28164 RV | CAPPABIANCA-de DIVITIS Ring-Curette, round wire, inner diameter 3 mm, tip laterally angled 90°, with round handle, length 25 cm |
| 28164 RD | Same, inner diameter 5 mm |
| 28164 RW | Same, inner diameter 7 mm |
| 28164 RF | CAPPABIANCA-de DIVITIS Ring-Curette, round wire, vertical, inner diameter 5 mm, tip angled 45°, with round handle, length 25 cm |
| 28164 RSB | de DIVITIS-CAPPABIANCA Suction-Curette, with round wire, inner diameter 5 mm, tip angled 45°, LUER, length 25 cm |
| 28164 SCA | Same, inner diameter 7 mm |
| 28164 RT | CAPPABIANCA-de DIVITIS Suction Curette, with basket, round, size 5 mm, rotatable tube, LUER, length 25 cm |
| 28164 RU | Same, size 6.5 mm |
| 28164 BDB | TAKE-APART® Bipolar Forceps, short, rounded tip, width 2 mm, outer diameter 3.4 mm, working length 14 cm, including: |
| 28164 BDC | TAKE-APART® Bipolar Forceps, width 2 mm, outer diameter 3.4 mm, working length 14 cm, including: |
| 28164 BDL | TAKE-APART® Bipolar Forceps, width 1 mm, delicate jaws, distally angled 45°, vertical closing, outer diameter 3.4 mm, working length 20 cm, including: |
| 28164 BDM | TAKE-APART® Bipolar Forceps, width 1 mm, delicate jaws, distally angled 45°, horizontal closing, outer diameter 3.4 mm, working length 20 cm, including: |
| 28164 MI | Lesion Meter, to determine the size of transnasal lesions, with wheel handle and scale, width 2 mm, working length 19 cm (not illustrated) |
| 662882 | FRANK-PASQUINI Suction Tube, angular, outer diameter 2.4 mm, tip curved upwards, ball end, with grip plate and cut-off hole, LUER, working length 13 cm |
| 662885 | FRANK-PASQUINI Suction Tube, angular, outer diameter 3 mm, tip curved upwards, ball end, with grip plate and cut-off hole, LUER, working length 13 cm |
| 649183 | FERGUSON Suction Tube, with cut-off hole and stylet, LUER, 10 Fr., working length 15 cm |
| 649184 | Same, 12 Fr. |
| 649185 | Same, 15 Fr. |
| 649179 B | Suction Tube, malleable, with elongated cut-off hole and stylet, LUER, 4 Fr., working length 15 cm |
| 649180 B | Same, 6 Fr. |
| 649182 B | Same, 8 Fr. |
| 649183 B | Same, 10 Fr. |
| 28164 XA | Suction Tube, with cut-off hole, drop-shaped, with distance markings, LUER, conical distal end, 8 Fr., working length 15 cm |
| 28164 XB | Same, 6 Fr. |
HOPKINS® Telescopes – autoclavable
diameter 4 mm, length 18 cm

28132 AA/BA/FA

28132 AA  HOPKINS® Straight Forward Telescope 0°,
enlarged view, diameter 4 mm, length 18 cm,
autoclavable,
fiber optic light transmission incorporated,
color code: green

28132 BA  HOPKINS® Forward-Oblique Telescope 30°,
enlarged view, diameter 4 mm, length 18 cm,
autoclavable,
fiber optic light transmission incorporated,
color code: red

28132 FA  HOPKINS® Forward-Oblique Telescope 45°,
enlarged view, diameter 4 mm, length 18 cm,
autoclavable,
fiber optic light transmission incorporated,
color code: black

7230 AS/BS/FS

7230 AS  Irrigation Sheath, outer diameter 5 mm,
working length 14 cm, for use with
HOPKINS® Telescope 28132 AA and
KARL STORZ lens irrigation system CLEARVISION® II

7230 BS  Irrigation Sheath, outer diameter 5 mm,
working length 14 cm, for use with
HOPKINS® Telescope 28132 BA and
KARL STORZ lens irrigation system CLEARVISION® II

7230 FS  Irrigation Sheath, outer diameter 5 mm,
working length 14 cm, for use with
HOPKINS® Telescope 28132 FA/FVA and
KARL STORZ lens irrigation system CLEARVISION® II

723750 B

723750 B  Protection Tube,
for use with HOPKINS® Telescopes with length 18 cm
HOPKINS® Telescopes – autoclavable
diameter 4 mm, length 30 cm

HOPKINS® Straight Forward Telescope 0°,
enlarged view, diameter 4 mm, length 30 cm,
autoclavable,
fiber optic light transmission incorporated,
color code: green

Irrigation Sheath
for use with KARL STORZ CLEARVISION® II System

Irrigation Sheath, outer diameter 5 mm,
working length 24 cm, for use with
HOPKINS® Telescope 28164 AA and
KARL STORZ Lens Irrigation System CLEARVISION® II

Protection Tube,
for HOPKINS® telescope with length 30 cm
HOPKINS® Telescopes – autoclavable
diameter 2.7 mm, length 18 cm

7229 AA

HOPKINS® Straight Forward Telescope 0°,
enlarged view, diameter 2.7 mm, length 18 cm,
autoclavable,
fiber optic light transmission incorporated,
color code: green

7229 AA

28164 CAA

HOPKINS® Irrigation Sheath, outer diameter 3.8 mm,
working length 15 cm, for use with
HOPKINS® Telescope 7229 AA,
compatible to KARL STORZ
Lens Irrigation System CLEARVISION® II

28164 CAA

723750 B

HOPKINS® Protection Tube,
for use with HOPKINS® Telescopes with length 18 cm

723750 B
KARL STORZ CLEARVISION® II System
for intra-operative rinsing of the telescope lens

403341 01 CLEARVISION® II, irrigation pump
for irrigation of the front lens,
power supply 100 – 240 VAC, 50/60 Hz
including:
CLEARVISION® II
Mains Cord
One-Pedal Footswitch, two-stage
Silicone Tubing Set, for irrigation, sterilizable

*)Optional Accessories:
MTP 031229-10 Single-use tubing set.
For use with Karl Storz CLEARVISION® II. Sterile,
10 per pack

Submit your order to:
*mtp medical technical promotion gmbh,
Take-Off GewerbePark 46, 78579 Neuhausen ob Eck, Germany
KARL STORZ CLEARVISION® II System
Irrigation Sheath for use with CLEARVISION® II System

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<td>7230 AA 28132 AA</td>
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Holder
for use with rigid KARL STORZ telescopes attached to CLEARVISION® II irrigation sheaths

28272 RKB  **Holding System, autoclavable**, with fastener: KSLock, including:
- **Rotation Socket** to clamp on the operating table, for use with European and United States standard rails, with lateral clamping element for height and angle adjustment of the articulated stand
- **Articulated Stand**, reinforced version, L-shaped, with one mechanical central clamp for all five joint functions, height 48 cm, operating range 52 cm, with fastener: KSLock (female)
- **Clamping Jaw**, metal, with axial intake, for use with instrument and telescope sheaths, clamping range 4.8 up to 12.5 mm, with fastener: KSLock (male)
Nasal Stage
Basic Instrumentation

- **FREER Suction Elevator**, with stylet, length 19 cm
- **Antrum Curette**, oblong small size, length 19 cm
- **Sickle Knife**, slightly curved, pointed, length 18 cm

Nasal Stage
RHINOFORCE® II Nasal Scissors

- **RHINOFORCE® II, Nasal Scissors**, straight, small model, length of cut 10 mm, with cleaning connector, working length 13 cm
Nasal Stage

STAMMBERGER RHINOFORCE® Antrum Punch and
MACKAY-GRÜNWALD RHINOFORCE® II Nasal Forceps

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

452001 B MACKAY-GRÜNWALD RHINOFORCE® II
Nasal Forceps, through-cutting, straight,
delicate, tissue-sparing, 8 x 3 mm,
size 1, with cleaning connector,
working length 13 cm

452501 B MACKAY-GRÜNWALD RHINOFORCE® II
Nasal Forceps, 45° upturned,
through-cutting, tissue-sparing,
extra delicate, 8 x 3 mm, size 1,
with cleaning connector, working length 13 cm
Sphenoid Stage

STRÜMPEL Nasal Forceps

634824 STRÜMPEL Forceps, with oval, fenestrated cupped jaws, straight, width 2.5 mm, working length 12.5 cm

634825 A Same, 45° upturned

Nasal and Sphenoid Stages

Punches

28164 MKB Punch, upbiting 60° forward, size 2 mm, working length 17 cm

28164 MKC Same, size 3 mm
Sphenoid Stage

STAMMBERGER Circular Cutting Punches

651055

STAMMBERGER Punch, circular cutting, for sphenoid, ethmoid and choanal atresia, diameter 3.5 mm, with cleaning connector, working length 18 cm

651050

Same, diameter 4.5 mm

Sphenoid and Sellar Stages

Grasping Forceps

663231

Forceps, straight, with round cupped jaws, diameter 2.5 mm, working length 18 cm
Sphenoid and Sellar Stages
Delicate Dissectors

28164 DB
Dissector, sharp, tip angled 45°, round spatula, with round handle, size 3 mm, length 25 cm

28164 DS
Dissector, sharp, tip angled 15°, slightly curved spatula, with round handle, size 2 mm, length 25 cm

28164 DM
Dissector, sharp, straight tip, slightly curved spatula, with round handle, size 3 mm, length 25 cm

Sellar Stage
Scalpel, Very Delicate Scissors

28164 M
de DIVITIIS-CAPPABIANCA Scalpel, with retractable blade, including:
Handle
Outer Sheath
Micro Knife, pointed

28164 KK
Same, including:
Handle
Outer Sheath
Micro Knife, sickle-shaped

663301
Scissors, straight, delicate, working length 18 cm

663304
Same, curved to right

663305
Same, curved to left

663307
Same, 45° curved up

28164 SAD
Scissors, 45° upwards curve, delicate, shaft 360° rotatable, working length 18 cm
Sellar Stage

**Forceps**
- Forceps, straight, not through-cutting, with oval, fenestrated spoon, width 2.5 mm, working length 18 cm

Sellar Stage

**Hooks, Curettes, round spoon**

- **28164 H** CASTELNUOVO Hook, 90°, blunt, with round handle, length 25 cm
- **28164 KB** Curette, round spoon, tip slightly angled, size 2 mm, with round handle, length 25 cm
Sellar Stage

Curettes

28164 RO  CAPPABIANCA-de DIVITIIS Ring Curette, round wire, inner diameter 3 mm, tip angled 45°, with round handle, length 25 cm

28164 RE  Same, malleable

28164 RO  CAPPABIANCA-de DIVITIIS Ring Curette, round wire, inner diameter 5 mm, tip angled 45°, with round handle, length 25 cm

28164 RJ  Same, malleable

28164 RI  De DIVITIIS-CAPPABIANCA Ring Curette, round wire, inner diameter 3 mm, tip angled 90°, with round handle, length 25 cm

28164 RG  Same, inner diameter 5 mm

28164 RB  de DIVITIIS-CAPPABIANCA Ring Curette, round wire, inner diameter 3 mm, distally curved shaft, with round handle, length 25 cm

28164 RA  Same, inner diameter 5 mm

28164 RV  CAPPABIANCA-de DIVITIIS Ring-Curette, round wire, inner diameter 3 mm, tip laterally angled 90°, with round handle, length 25 cm

28164 RD  Same, inner diameter 5 mm

28164 RW  Same, inner diameter 7 mm

28164 RF  CAPPABIANCA-de DIVITIIS Ring Curette, round wire, vertical, inner diameter 5 mm, tip angled 45°, with round handle, length 25 cm
Sellar Stage
CAPPABIANCA-de DIVITIIS Suction Curettes, round wire – basket-shaped

- 28164 RSB de DIVITIIS-CAPPABIANCA Suction-Curette, with round wire, inner diameter 5 mm, tip angled 45°, LUER, length 25 cm
- 28164 RSC Same, inner diameter 7 mm
- 28164 RT CAPPABIANCA-de DIVITIIS Suction Curette, with basket, round, size 5 mm, rotatable tube, LUER, length 25 cm
- 28164 RU Same, size 6.5 mm

Lesion Meter

- 28164 MI Lesion Meter, to determine the size of transnasal lesions, with wheel handle and scale, width 2 mm, working length 19 cm

Suction Tubes

- 662882 FRANK-PASQUINI Suction Tube, knee bent, tip curved upwards, ball end, with grip plate and cut-off hole, LUER, diameter 2.4 mm, working length 13 cm
- 662885 FRANK-PASQUINI Suction Tube, knee bent, tip curved upwards, ball end, with grip plate and cut-off hole, LUER, diameter 3 mm, working length 13 cm
Suction Tubes

- 649183   FERGUSON Suction Tube, with cut-off hole and stylet, Luer, 10 Fr., working length 15 cm
- 649184   Same, 12 Fr.
- 649185   Same, 15 Fr.

- 649179 B   Suction Tube, malleable, with elongated cut-off hole and stylet, Luer, 4 Fr., working length 15 cm
- 649180 B   Same, 6 Fr.
- 649182 B   Same, 8 Fr.
- 649183 B   Same, 10 Fr.

- 28164 XB   Suction Tube, with cut-off hole, drop-shaped, with distance markings, Luer, conical distal end, 8 Fr., working length 15 cm
- 28164 XA   Same, 6 Fr.
Basic Instrumentation for Extended Approaches

**Micro Instruments**

- **28164 PBA** Micro Scissors, bayonet-shaped, 0.5 mm, smooth, working length 10 cm
- **28164 PBB** Micro Scissors, bayonet-shaped, spoon, 2 mm, working length 10 cm
- **28164 SBA** Micro Scissors, horizontal, bayonet-shaped, sharp/sharp, straight, working length 10 cm
- **28164 SBB** Micro Scissors, bayonet-shaped, sharp/sharp, left curved, working length 10 cm

- **28164 ZBA** Micro Applying Forceps, Yasargil-Clips, working length 10 cm
- **28164 ZBB** Micro Applying Forceps, Yasargil-Mini Clips, working length 10 cm
Instruments for Coagulation

28164 BDB TAKE-APART® Bipolar Forceps, short, rounded tip, width 2 mm, outer diameter 3.4 mm, working length 14 cm, including:
- Bipolar Ring Handle
- Outer Sheath
- Inner Sheath
- Forceps Insert

28164 BDC TAKE-APART® Bipolar Forceps, width 2 mm, outer diameter 3.4 mm, working length 14 cm, including:
- Handle
- Outer Sheath
- Inner Sheath
- Bipolar Insert
Instruments for Coagulation

28164 BDL  **TAKE-APART® Bipolar Forceps**, delicate jaws, width 1 mm, distally angled 45°, axial closing, size 3.4 mm, working length 20 cm, including:
- Handle
- Outer Tube
- Inner Tube
- Bipolar Insert

28164 BDM  **TAKE-APART® Bipolar Forceps**, delicate jaws, width 1 mm, distally angled 45°, axial closing, size 3.4 mm, working length 20 cm, including:
- Handle
- Outer Tube
- Inner Tube
- Bipolar Insert

839310 N  **Insulated Suction Cannula**, for nose, straight, outer diameter 3 mm, working length 10 cm

28164 ED  **Coagulation Ball Electrode**, diameter 2 mm, laterally curved, working length 13 cm

28164 EF  **Same**, diameter 4 mm
The ENDOCAMELEON® from KARL STORZ brings a new quality to endoscopy in the OR as it often enhances orientation during an operation without the time-consuming changeover of telescopes, thereby ensuring safe and smooth surgery. The ENDOCAMELEON® combines the user comfort of the proven HOPKINS® endoscopes with unprecedented versatility – in the proven KARL STORZ high quality.

**Special Features:**
- Variable direction of view (15° to 90°)
- Easy-to-use adjusting knob selects the desired direction of view
- Lightweight construction and modern design
- HOPKINS® telescope with unique rod-lens system
- Diameter 4 mm, length 18 cm
- Standard eyepiece fits all camera heads

The familiar ergonomics and handling of conventional telescopes is enhanced with the additional convenience of a variable direction of view.

The direction of view is adjusted by a mere turn of the adjusting knob at the proximal end of the ENDOCAMELEON®.
**Telescope**

28132 AE  **ENDOCAMELEON® HOPKINS® Telescope**, diameter 4 mm, length 18 cm, autoclavable, variable direction of view from 15° to 90°, adjustment knob for selecting the desired direction of view, fiber optic light transmission incorporated, color code: gold

7230 AES  **Irrigation and Suction Sheath**, outer diameter 4.8 x 6 mm, working length 14 cm, for use with ENDOCAMELEON® ENT HOPKINS® Telescope 7230 AE and KARL STORZ lens irrigation system CLEARVISION® II

**Accessories**

39501 A1  **Wire Tray for Cleaning, Sterilization and Storage** of one rigid endoscope, including holder for light post adaptors, silicone telescope holders and lid, external dimensions (w x d x h): 290 x 60 x 52 mm, for rigid endoscopes up to diameter 5 mm and working length 20 cm
UNIDRIVE® S III NEURO SCB

Special Features:

Straightforward function selection and optimized user control via touch screen

Choice of user languages

Operating elements are single and clear to read due to color display

One unit – six functions:
Neurosurgery:
– Craniotomes
– Perforators
– High-Speed Handpieces 100,000 rpm
– High-Speed Handpieces 60,000 rpm
ENT:
– Shaver system for surgery of the paranasal sinuses and anterior skull base
– INTRA Drills
– Sinus Shavers
– Micro Saws
– Dermatomes

Two motor outputs:
Two motor outputs enable two motors to be connected simultaneously: for example, a high-speed handpiece and a shaver handpiece may be connected in parallel

Safe work due to rapid blade when the pedal is released

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 variable revolution range

Maximum number of revolutions and motor torque:
Microprocessor-controlled revolutions per minute. Therefore the preselected parameters are maintained all the time during drilling

Maximum number of evolutions can be preset

With connection possibilities to the KARL STORZ Communication Bus (KARL STORZ-SCB)

Irrigator rod included
UNIDRIVE® S III NEURO SCB

Recommended Standard Set Configurations

40 7017 01-1

UNIDRIVE® S III NEURO SCB, motor control unit with color display, touch screen, two motor outputs, integrated irrigation pump and integrated SCB module, power supply 100 – 240 VAC, 50/60 Hz including:

- **Mains Cord**
- **Irrigator Rod**
- **Two-Pedal Footswitch**, two-stage, with proportional function
- **Clip Set**, for use with tubing set
- **SCB Connecting Cable**, length 100 cm
- **Single Use Tubing Set***, sterile, package of 3

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**Specifications:**

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<th>Feature</th>
<th>Specification</th>
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<td>Touch Screen</td>
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*mtp medical technical promotion gmbh, Take-Off GewerbePark 46, 78579 Neuhausen ob Eck, Germany
UNIDRIVE® S III NEURO SCB
High-Speed Micro Motor

Special Features:
- Self-cooling and brushless high-speed micro motor
- Smallest possible dimensions
- Autoclavable
- Can be processed in a cleaning machine
- Maximum torque 6 Ncm
- Number of revolutions can be continuously adjusted from 1000 – 60,000 rpm
- Possible to adjust the number of revolutions to 100,000 rpm with the appropriate handle

Accessories:

280053 Universal Spray, 6x 500 ml bottles – HAZARDOUS GOODS – UN 1950
including:
Spray Nozzle

031131-10* Tubing Set, for irrigation, for single use, sterile, package of 10

*mtp medical technical promotion gmbh,
Take-Off GewerbePark 46, 78579 Neuhausen ob Eck, Germany
UNIDRIVE® S III NEURO SCB
System Components

UNIT SIDE

PATIENT SIDE

Two-Pedal Footswitch

Single Use Tubing Set

High-Speed Micro Motor

High Performance EC Micro Motor II

DrillCut-X® II Shaver Handpiece

Perforator

INTRA Drill Handpiece, 80,000 rpm

High-Speed Handpieces, 100,000 rpm

Craniotome

INTRA Drill Handpiece, 40,000 rpm

Dermatomes

High-Speed Handpieces, 60,000 rpm

Micro Saw

INTRA Drill Handpiece

Dermatomes

High-Speed Handpieces

Micro Saw
UNIDRIVE® S III NEURO SCB
High-Speed Handpieces, angled, 100,000 rpm

For use with drills with shaft diameter 3.17 mm

252680
High-Speed Handpiece, short, angled, 100,000 rpm, for use with High-Speed Micro-Motor 20712033

252681
High-Speed Handpiece, medium, angled, 100,000 rpm, for use with High-Speed Micro-Motor 20712033

252682
High-Speed Handpiece, long, angled, 100,000 rpm, for use with High-Speed Micro-Motor 20712033
UNIDRIVE® S III NEURO SCB
High-Speed Handpieces, angled, 60,000 rpm

For use with drills with shaft diameter 2.35 mm

60,000 rpm

UNIDRIVE® S III NEURO SCB
High-Speed Handpieces, angled, 60,000 rpm

252660 High-Speed Handpiece, extra short, angled, 60,000 rpm, for use with High-Speed Micro-Motor 20 7120 33

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 NEURO SCB
High-Speed Handpieces, straight, 60,000 rpm

For use with drills with shaft diameter 2.35 mm

252690  High-Speed Handpiece, extra short, straight, 60,000 rpm, for use with High-Speed Micro-Motor 20 7120 33

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 NEURO SCB
High-Speed Handpieces, malleable, slim, angled, 60,000 rpm

For use with drills with shaft diameter 1 mm

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 NEURO SCB**  
For use with High-Speed Handpieces, 100,000 rpm

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

100,000 rpm  
diameter 7.5 mm

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<td>350270 S</td>
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**UNIDRIVE® S III NEURO SCB**

High-Speed Coarse Diamond Burrs, High-Speed Acorns, High-Speed Barrel Burrs, High-Speed Neuro Fluted Burrs

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

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<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>short</td>
<td>350330 S</td>
<td>350340 S</td>
<td>350350 S</td>
<td>350360 S</td>
<td>350370 S</td>
</tr>
<tr>
<td>medium</td>
<td>350330 M</td>
<td>350340 M</td>
<td>350350 M</td>
<td>350360 M</td>
<td>350370 M</td>
</tr>
<tr>
<td>long</td>
<td>350330 L</td>
<td>350340 L</td>
<td>350350 L</td>
<td>350360 L</td>
<td>350370 L</td>
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<table>
<thead>
<tr>
<th>Diameter in mm</th>
<th>7.5</th>
<th>9</th>
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<tr>
<td>short</td>
<td>350675 S</td>
<td>350690 S</td>
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<tr>
<td>medium</td>
<td>350675 M</td>
<td>350690 M</td>
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<th>Diameter in mm</th>
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<tr>
<td>short</td>
<td>350960 S</td>
<td>350991 S</td>
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<tr>
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<td>350960 M</td>
<td>350991 M</td>
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<tr>
<th>Diameter in mm</th>
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<tr>
<td>short</td>
<td>350718 S</td>
<td>350730 S</td>
</tr>
<tr>
<td>medium</td>
<td>350718 M</td>
<td>350730 M</td>
</tr>
<tr>
<td>long</td>
<td>350718 L</td>
<td>350730 L</td>
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**UNIDRIVE® S III NEURO SCB**

High-Speed Standard Burrs, High-Speed Diamond Burrs

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

<table>
<thead>
<tr>
<th>Diameter in mm</th>
<th>extra short</th>
<th>short</th>
<th>medium</th>
<th>long</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>330110 ES</td>
<td>330110 S</td>
<td>330110 M</td>
<td>–</td>
</tr>
<tr>
<td>2</td>
<td>330120 ES</td>
<td>330120 S</td>
<td>330120 M</td>
<td>330120 L</td>
</tr>
<tr>
<td>3</td>
<td>330130 ES</td>
<td>330130 S</td>
<td>330130 M</td>
<td>330130 L</td>
</tr>
<tr>
<td>4</td>
<td>330140 ES</td>
<td>330140 S</td>
<td>330140 M</td>
<td>330140 L</td>
</tr>
<tr>
<td>5</td>
<td>330150 ES</td>
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<tr>
<td>6</td>
<td>330160 ES</td>
<td>330160 S</td>
<td>330160 M</td>
<td>330160 L</td>
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<tr>
<td>7</td>
<td>330170 ES</td>
<td>330170 S</td>
<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>
<tr>
<th>Diameter in mm</th>
<th>extra short</th>
<th>short</th>
<th>medium</th>
<th>long</th>
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</thead>
<tbody>
<tr>
<td>0.6</td>
<td>330206 ES</td>
<td>330206 S</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>1</td>
<td>330210 ES</td>
<td>330210 S</td>
<td>330210 M</td>
<td>–</td>
</tr>
<tr>
<td>1.5</td>
<td>330215 ES</td>
<td>330215 S</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>2</td>
<td>330220 ES</td>
<td>330220 S</td>
<td>330220 M</td>
<td>330220 L</td>
</tr>
<tr>
<td>3</td>
<td>330230 ES</td>
<td>330230 S</td>
<td>330230 M</td>
<td>330230 L</td>
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<td>330250 S</td>
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<td>330260 S</td>
<td>330260 M</td>
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<td>7</td>
<td>330270 ES</td>
<td>330270 S</td>
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</table>
**UNIDRIVE® S III NEURO SCB**

High-Speed Diamond Burrs, High-Speed Barrel Burrs,
LINDEMANN High-Speed Fluted Burrs

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

<table>
<thead>
<tr>
<th>Diameter in mm</th>
<th>extra short</th>
<th>short</th>
<th>medium</th>
<th>long</th>
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</thead>
<tbody>
<tr>
<td>3</td>
<td>330330 ES</td>
<td>330330 S</td>
<td>330330 M</td>
<td>330330 L</td>
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<tr>
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<td>330340 S</td>
<td>330340 M</td>
<td>330340 L</td>
</tr>
<tr>
<td>5</td>
<td>330350 ES</td>
<td>330350 S</td>
<td>330350 M</td>
<td>330350 L</td>
</tr>
<tr>
<td>6</td>
<td>330360 ES</td>
<td>330360 S</td>
<td>330360 M</td>
<td>330360 L</td>
</tr>
<tr>
<td>7</td>
<td>330370 ES</td>
<td>330370 S</td>
<td>330370 M</td>
<td>330370 L</td>
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<table>
<thead>
<tr>
<th>Diameter in mm</th>
<th>extra short</th>
<th>short</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
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<td>330440 S</td>
</tr>
<tr>
<td>6</td>
<td>330460 ES</td>
<td>330460 S</td>
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LINDEMANN High-Speed Fluted Burrs, 60,000 rpm, for single use, sterile, package of 5

<table>
<thead>
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<th>Diameter in mm (diameter x length)</th>
<th>extra short</th>
<th>short</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diameter 2.1/11</td>
<td>330511 ES</td>
<td>330511 S</td>
</tr>
<tr>
<td>Diameter 2.3/26</td>
<td>330526 ES</td>
<td>330526 S</td>
</tr>
</tbody>
</table>
UNIDRIVE® S III NEURO SCB
High-Speed Diamond Burrs

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

<table>
<thead>
<tr>
<th></th>
<th>Diameter in mm</th>
<th>extra long</th>
<th>super long</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>320220 EL</td>
<td>320220 SL</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>320230 EL</td>
<td>320230 SL</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>320240 EL</td>
<td>320240 SL</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Diameter in mm</th>
<th>extra long</th>
<th>super long</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2</td>
<td>320320 EL</td>
<td>320320 SL</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>320330 EL</td>
<td>320330 SL</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>320340 EL</td>
<td>320340 SL</td>
</tr>
</tbody>
</table>
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.
**IMAGE1 S Camera System**

**NEW**

**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**
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*

SPECTRA B**

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

**NEW**

![IMAGE1 S Camera System](image)

**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:**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>HD video outputs</td>
<td>- 2x DVI-D</td>
</tr>
<tr>
<td></td>
<td>- 1x 3G-SDI</td>
</tr>
<tr>
<td>Format signal outputs</td>
<td>1920 x 1080p, 50/60 Hz</td>
</tr>
<tr>
<td>LINK video inputs</td>
<td>3x</td>
</tr>
<tr>
<td>USB interface</td>
<td>4x USB, (2x front, 2x rear)</td>
</tr>
<tr>
<td></td>
<td>2x 6-pin mini-DIN</td>
</tr>
<tr>
<td>Power supply</td>
<td>100–120 VAC/200–240 VAC</td>
</tr>
<tr>
<td>Power frequency</td>
<td>50/60 Hz</td>
</tr>
<tr>
<td>Protection class</td>
<td>I, CF-Defib</td>
</tr>
<tr>
<td>Dimensions w x h x d</td>
<td>305 x 54 x 320 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>2.1 kg</td>
</tr>
</tbody>
</table>

**For use with IMAGE1 S

**IMAGE1 S CONNECT Module TC 200EN**

![TC 300](image)

**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>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Camera System</td>
<td>TC 300 (H3-Link)</td>
</tr>
<tr>
<td>Supported camera heads/video endoscopes</td>
<td>TH 100, TH 101, TH 102, TH 103, TH 104, TH 106 (fully compatible with IMAGE1 S) 22220056-3, 22220056-3, 22220053-3, 22220060-3, 22220061-3, 22220054-3, 22220065-3 (compatible without IMAGE1 S technologies CLARA, CHROMA, SPECTRA*)</td>
</tr>
<tr>
<td>LINK video outputs</td>
<td>1x</td>
</tr>
<tr>
<td>Power supply</td>
<td>100–120 VAC/200–240 VAC</td>
</tr>
<tr>
<td>Power frequency</td>
<td>50/60 Hz</td>
</tr>
<tr>
<td>Protection class</td>
<td>I, CF-Defib</td>
</tr>
<tr>
<td>Dimensions w x h x d</td>
<td>305 x 54 x 320 mm</td>
</tr>
<tr>
<td>Weight</td>
<td>1.86 kg</td>
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</tbody>
</table>

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

**NEW**

For use with IMAGE1 S Camera System

**IMAGE1 S CONNECT Module TC 200EN, IMAGE1 S H3-LINK Module TC 300**

and with all IMAGE1 HUB™ HD Camera Control Units

#### Image 1

**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 \( f = 15\text{–}31 \text{ mm} (2x) \), 2 freely programmable camera head buttons, for use with IMAGE1 S and IMAGE1 HUB™ HD/HD

<table>
<thead>
<tr>
<th>Specifications</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IMAGE1 FULL HD Camera Heads</strong></td>
<td><strong>IMAGE1 S H3-Z</strong></td>
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<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\text{–}31 \text{ 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>

#### Image 2

**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 \( f = 15\text{–}31 \text{ mm} (2x) \), 2 freely programmable camera head buttons, for use with IMAGE1 S and IMAGE1 HUB™ HD/HD

<table>
<thead>
<tr>
<th>Specifications</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>IMAGE1 FULL HD Camera Heads</strong></td>
<td><strong>IMAGE1 S H3-ZA</strong></td>
</tr>
<tr>
<td>Product no.</td>
<td>TH 104</td>
</tr>
<tr>
<td>Image sensor</td>
<td>3x 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\text{–}31 \text{ mm} (2x) )</td>
</tr>
<tr>
<td>Min. sensitivity</td>
<td>F 1.4/1.17 Lux</td>
</tr>
<tr>
<td>Grip mechanism</td>
<td>standard eyepiece adaptor</td>
</tr>
<tr>
<td>Cable</td>
<td>non-detachable</td>
</tr>
<tr>
<td>Cable length</td>
<td>300 cm</td>
</tr>
</tbody>
</table>
Monitors

9619 NB

19" HD Monitor, 
color systems PAL/NTSC, max. screen resolution 1280 x 1024, image format 4:3, power supply 100–240 VAC, 50/60 Hz, wall-mounted with VESA 100 adaption, including:
External 24 VDC Power Supply
Mains Cord

9826 NB

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

<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>Wall-mounted with VESA 100 adaption</td>
<td>9619 NB</td>
<td>9826 NB</td>
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<tr>
<td>Inputs:</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>
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<tr>
<td>Composite/FBAS</td>
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<td>●</td>
</tr>
<tr>
<td>Outputs:</td>
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<td></td>
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<tr>
<td>DVI-D</td>
<td>●</td>
<td>●</td>
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<tr>
<td>S-Video</td>
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<td>●</td>
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<tr>
<td>Composite/FBAS</td>
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<tr>
<td>RGBS (VGA)</td>
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<td>4:3</td>
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<td>●</td>
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<tr>
<td>5:4</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>16:9</td>
<td>●</td>
<td>●</td>
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<tr>
<td>Picture-in-Picture</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>PAL/NTSC compatible</td>
<td>●</td>
<td>●</td>
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</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>
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<tr>
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<td>optional</td>
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<tr>
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<td>9826 NB</td>
</tr>
<tr>
<td>Brightness</td>
<td>200 cd/m² (type)</td>
<td>500 cd/m² (type)</td>
</tr>
<tr>
<td>Max. viewing angle</td>
<td>178° vertical</td>
<td>178° vertical</td>
</tr>
<tr>
<td>Pixel distance</td>
<td>0.29 mm</td>
<td>0.3 mm</td>
</tr>
<tr>
<td>Reaction time</td>
<td>5 ms</td>
<td>8 ms</td>
</tr>
<tr>
<td>Contrast ratio</td>
<td>700:1</td>
<td>1400:1</td>
</tr>
<tr>
<td>Mount</td>
<td>100 mm VESA</td>
<td>100 mm VESA</td>
</tr>
<tr>
<td>Weight</td>
<td>7.6 kg</td>
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</tr>
<tr>
<td>Rated power</td>
<td>28 W</td>
<td>72 W</td>
</tr>
<tr>
<td>Operating conditions</td>
<td>0–40°C</td>
<td>5–35°C</td>
</tr>
<tr>
<td>Storage</td>
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<tr>
<td>Rel. humidity</td>
<td>max. 85%</td>
<td>max. 85%</td>
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<tr>
<td>Dimensions w x h x d</td>
<td>469.5 x 416 x 75.5 mm</td>
<td>643 x 396 x 87 mm</td>
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<tr>
<td>Power supply</td>
<td>100–240 VAC</td>
<td>100–240 VAC</td>
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<tr>
<td>Certified to</td>
<td>EN 60601-1, protection class IPX0</td>
<td>EN 60601-1, UL 60601-1, MDD93/42/EEC, protection class IPX2</td>
</tr>
</tbody>
</table>
Accessories for Video Documentation

495 NL Fiber Optic Light Cable,
with straight connector, diameter 3.5 mm, length 180 cm

495 NA Same, length 230 cm

Cold Light Fountain XENON NOVA® 175

201315 01 Cold Light Fountain XENON NOVA® 175,
power supply: 100–125 VAC/220–240 VAC, 50/60 Hz including:
Mains Cord

201320 26 XENON Spare Lamp, only,
175 watt, 15 volt

Cold Light Fountain XENON NOVA® 300

201340 01 Cold Light Fountain XENON NOVA® 300,
Lamp type: 300 W XENON
power supply: 100–125 VAC/220–240 VAC, 50/60 Hz including:
Mains Cord

201330 28 XENON Spare Lamp, only,
300 watt, 15 volt

Cold Light Fountain XENON 300 SCB

20133101-1 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
SCB Connecting Cable, length 100 cm

201330 27 Spare Lamp Module XENON
with heat sink, 300 watt, 15 volt

201330 28 XENON Spare Lamp, only,
300 watt, 15 volt
Data Management and Documentation
KARL STORZ AIDA® – Exceptional documentation

The name AIDA stands for the comprehensive implementation of all documentation requirements arising in surgical procedures: A tailored solution that flexibly adapts to the needs of every specialty and thereby allows for the greatest degree of customization.

This customization is achieved in accordance with existing clinical standards to guarantee a reliable and safe solution. Proven functionalities merge with the latest trends and developments in medicine to create a fully new documentation experience – AIDA.

AIDA seamlessly integrates into existing infrastructures and exchanges data with other systems using common standard interfaces.

WD 200-XX*  AIDA Documentation System, for recording still images and videos, dual channel up to FULL HD, 2D/3D, power supply 100-240 VAC, 50/60 Hz including:
USB Silicone Keyboard, with touchpad
ACC Connecting Cable
DVI Connecting Cable, length 200 cm
HDMI-DVI Cable, length 200 cm
Mains Cord, length 300 cm

WD 250-XX*  AIDA Documentation System, for recording still images and videos, dual channel up to FULL HD, 2D/3D, including SMARTSCREEN® (touch screen), power supply 100-240 VAC, 50/60 Hz including:
USB Silicone Keyboard, with touchpad
ACC Connecting Cable
DVI Connecting Cable, length 200 cm
HDMI-DVI Cable, length 200 cm
Mains Cord, length 300 cm

*XX Please indicate the relevant country code (DE, EN, ES, FR, IT, PT, RU) when placing your order.
Workflow-oriented use

**Patient**
Entering patient data has never been this easy. AIDA seamlessly integrates into the existing infrastructure such as HIS and PACS. Data can be entered manually or via a DICOM worklist. All important patient information is just a click away.

**Checklist**
Central administration and documentation of time-out. The checklist simplifies the documentation of all critical steps in accordance with clinical standards. All checklists can be adapted to individual needs for sustainably increasing patient safety.

**Record**
High-quality documentation, with still images and videos being recorded in FULL HD and 3D. The Dual Capture function allows for the parallel (synchronous or independent) recording of two sources. All recorded media can be marked for further processing with just one click.

**Edit**
With the Edit module, simple adjustments to recorded still images and videos can be very rapidly completed. Recordings can be quickly optimized and then directly placed in the report. In addition, freeze frames can be cut out of videos and edited and saved. Existing markings from the Record module can be used for quick selection.

**Complete**
Completing a procedure has never been easier. AIDA offers a large selection of storage locations. The data exported to each storage location can be defined. The Intelligent Export Manager (IEM) then carries out the export in the background. To prevent data loss, the system keeps the data until they have been successfully exported.

**Reference**
All important patient information is always available and easy to access. Completed procedures including all information, still images, videos, and the checklist report can be easily retrieved from the Reference module.
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

**UG 310  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

**UG 410  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

**UG 510  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